AFFINITY WATER UK LABORATORY
Guidance Document: Commercial
Title: Automated Commercial Invoices
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Guidance Document: Commercial

Automated Commercial Invoices

Contents

1.0 Overview

1.1 The Commercial Team requires invoices to be produced for each customer on the 15th of each month. All orders received between the 15th of the current and previous months must be billed to generate revenue for the department.

1.2 This business process improvement project aims to address the delays associated with the generation, transformation, and delivery of commercial invoices. The benefits of which are the savings of 30 hours of manual processing time per month, reducing the time spent issuing commercial invoices by 96.8%.

1.3 The requirements for an invoice were as follows:

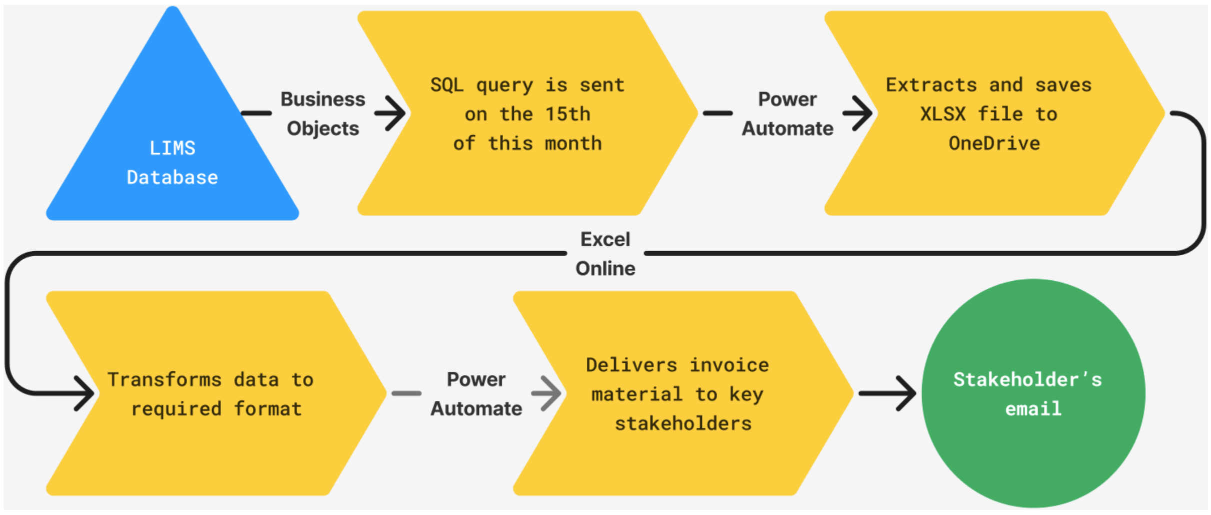
- A raw data spreadsheet of all received orders within the last billing cycle
- An invoice sheet where expenses were billed either by the unit or suite costs

1.4 This was achieved using 2 flows capturing 5 precise SQL reports. The results of which were delivered to Enquiries.Commercial inbox where the material can be reviewed before issuing to customers.

1.5 Data from LIMS relating to commercial customers was extracted using Business Objects and received in David.Golacis' inbox on the 15th of each month.

Keywords from the email's title activated a Power Automate flow, allowing the attached XLSX file to be saved to OneDrive. The files were processed and transformed in the cloud using 2 TypeScript programmes per flow through Excel Online API calls.

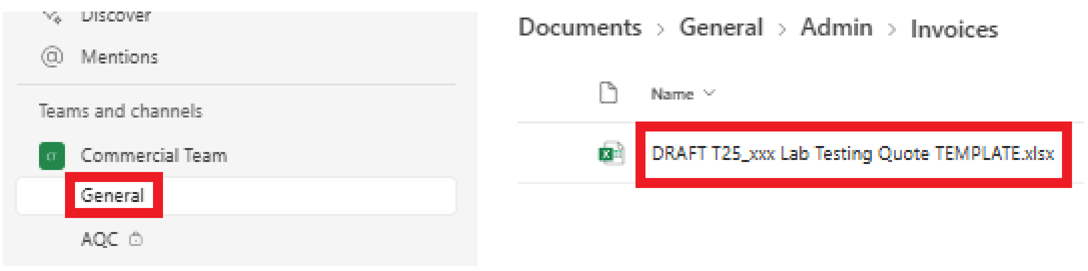
1.6 Process map for the order of operations:


LIMS Database
Business Objects
SQL query is sent on the 15th of this month
Power Automate
Extracts and saves XLSX file to OneDrive
Excel Online
Transforms data to required format
Power Automate
Delivers invoice material to key stakeholders
Stakeholder's email

2.0 Maintenance

2.1 A yearly template of the relevant customer's quote sheet must be updated upon contract renewal. The location of this spreadsheet:

Teams: Commercial Team/ Documents/ General/ Admin/ Invoices



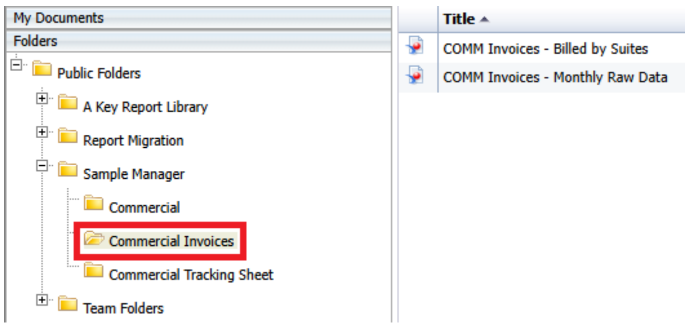
DRAFT T25_xxx Lab Testing Quote TEMPLATE.xlsx

2.2 As of present, this quote is only used to calculate the sum of analytical costs for 2 customers. These customers were Eden Springs and ELGA 2030.

3.0 Data Governance

3.1 All Business Objects files (SQL reports) are stored online at [Affinity's BO Portal] within this location:

Public Folders/ Sample Manager/ Commercial Invoices



COMM Invoices - Billed by Suites
COMM Invoices - Monthly Raw Data

3.2 Queries, flows, and Office scripts are provided in the appendix.

4.0 Detailed Design

4.1 Design of reports

4.1.1 Business Objects generated and delivered scheduled queries from an Oracle database.

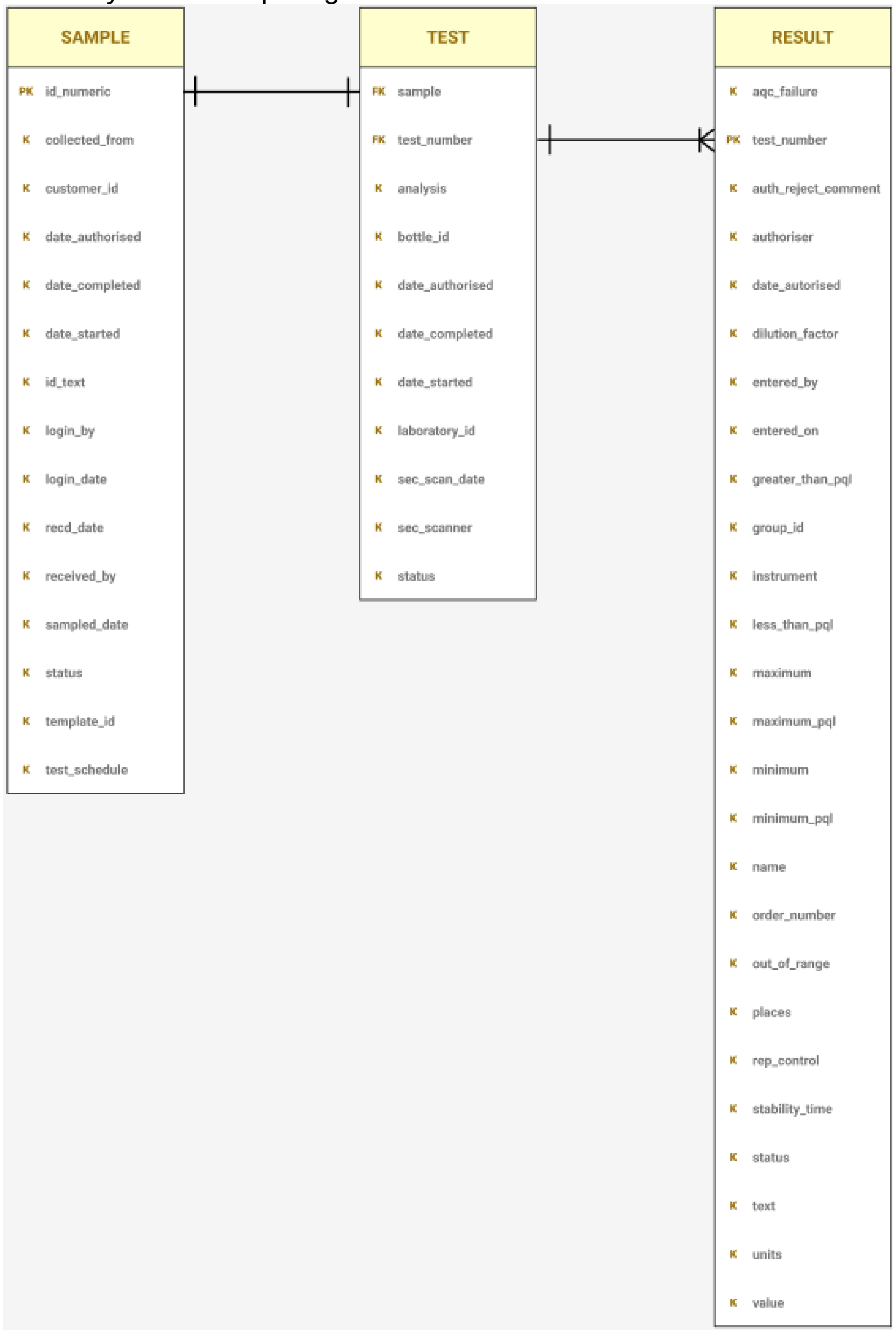
4.1.2 From the database the following 3 tables were used: sample, test, and result.

These were inner joined together to minimise the chance of anomalous records from being included. Records which did not comply with all constraints were eliminated without requiring additional lines of SQL.

The following database features were used throughout this project:

Table	Property	Description	Type
Sample	id_numeric	Foreign key to join with test.sample; one-to-one relationship	Number
	recd_date	Date of when the order was received	Date-time
	customer_id	Which customer does this work belong to	String
	status	The progression of job status	String
Result	test_number	Foreign key to join with test.test_number; one-or-many-to-one	Number
	name	Name of the parameter	String
	rep_control	Boolean to show the parameter on the final certificate	Date-time
Test	test_number	Foreign key to join with result.test_number; one-to-one-or-many relationship	Number
	sample	Foreign key to join with sample.id_numeric; one-to-one relationship	Number
	analysis	Name of the test	String

Logical entity-relationship diagram:



4.1.3 These queries shared safety features that restricted the data pulled from the cloud, reducing the server's memory usage and improving processing speed.

Techniques used to hone searches were:

- Limiting the date range used:

```
WHERE
   ( sample.recd_date BETWEEN
      TRUNC ( ADD_MONTHS ( SYSDATE, -1 ), 'MM' ) + 14
      AND TRUNC ( SYSDATE, 'MM' ) + 14 )
```

- Fetching samples with an associated customer ID:

```
WHERE
```

```
    TRIM ( sample.customer_id ) IS NOT NULL
```

- Filtering out results which are not reported:

```
WHERE
    ( result.rep_control <> 'N' OR test.analysis = 'MATRIX' )
```

- Specifying which sample status was required:

```
WHERE
    sample.status IN ( 'X' )
```

4.1.4 An example selection is shown below of a count of suites table:

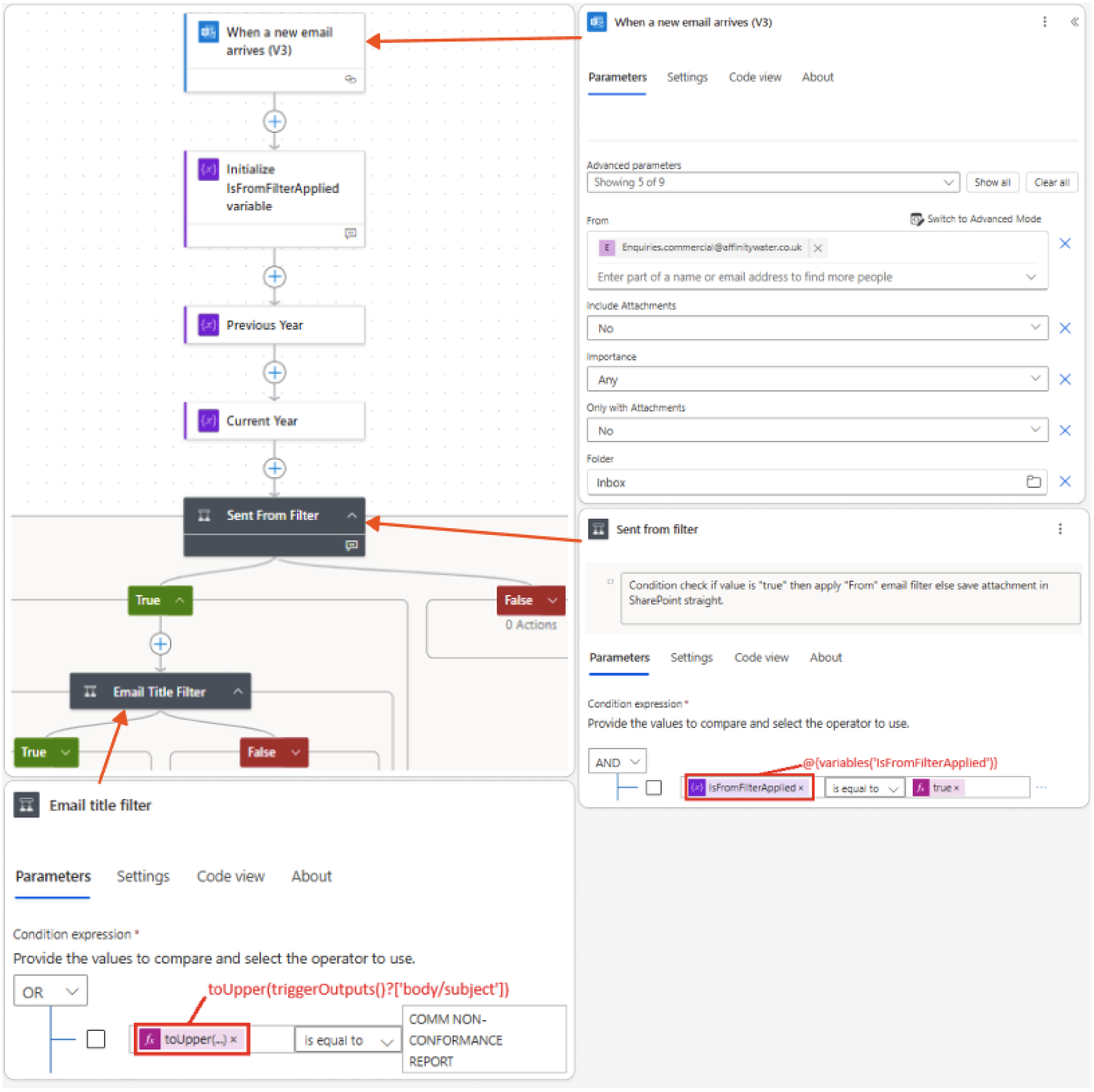
Customer ID	Template ID	Count of Samples
EDEN_SPR	RE_EDEN1	3
EDEN_SPR	RE_EDEN10	5
EDEN_SPR	RE_EDEN12	15

4.2 Design of flows

4.2.1 Once an email containing a report has been received, a Power Automate flow attempts to match the email's title to keywords. If a match is found, a series of steps take place to save the attached XLSX file for processing.

To ensure reliability, conditional filters were used to eliminate potential problems that could occur during an action. Considerations included were:

- Confirmation of email requirements:



When a new email arrives (V3)

Parameters | Settings | Code view | About

Advanced parameters: Showing 5 of 9 | Show all | Clear all

From (Switch to Advanced Mode): Enquiries.commercial@affinitywater.co.uk
Enter part of a name or email address to find more people

Include Attachments: No

Importance: Any

Only with Attachments: No

Folder: Inbox

Sent from filter

Condition check if value is "true" then apply "From" email filter else save attachment in SharePoint straight.

Parameters | Settings | Code view | About

Condition expression *
Provide the values to compare and select the operator to use.

@{variables('IsFromFilterApplied')}

AND	IsFromFilterApplied	is equal to	true

Email title filter

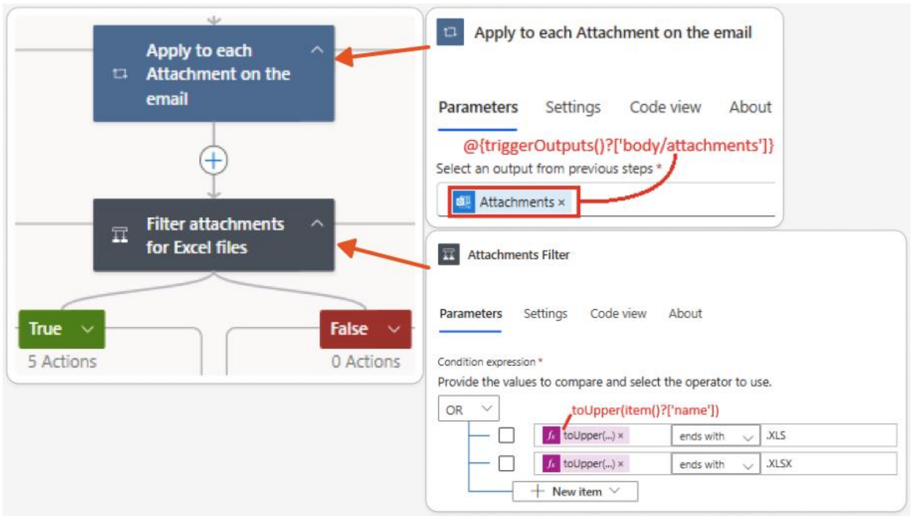
Parameters | Settings | Code view | About

Condition expression *
Provide the values to compare and select the operator to use.

toUpper(triggerOutputs()?['body/subject'])

OR	toUpper(...)	is equal to	COMM NON-CONFORMANCE REPORT

- Check for attachment(s):


Apply to each Attachment on the email
Filter attachments for Excel files
True
5 Actions
False
0 Actions

Apply to each Attachment on the email

Parameters | Settings | Code view | About

@{triggerOutputs()?['body/attachments']}

Select an output from previous steps *: Attachments

Attachments Filter

Parameters | Settings | Code view | About

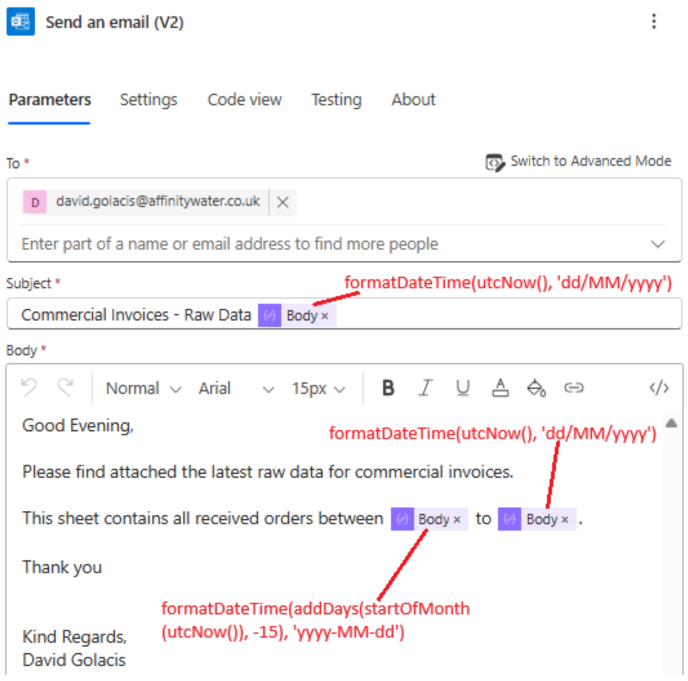
Condition expression *
Provide the values to compare and select the operator to use.

toUpper(item()?['name'])

OR			
	toUpper(...)	ends with	.XLS
	toUpper(...)	ends with	.XLSX

New item

The transformed invoice material was then sent to Enquiries.Commercial inbox stating the limits within the email:


Send an email (V2)

Parameters | Settings | Code view | Testing | About

To *
Switch to Advanced Mode
david.golacis@affinitywater.co.uk
Enter part of a name or email address to find more people

Subject *
Commercial Invoices - Raw Data Body ×
formatDateTime(utcNow(), 'dd/MM/yyyy')

Body *
Normal | Arial | 15px

Good Evening,

Please find attached the latest raw data for commercial invoices.

This sheet contains all received orders between Body × to Body × .

Thank you

Kind Regards,
David Golacis

formatDateTime(utcNow(), 'dd/MM/yyyy')

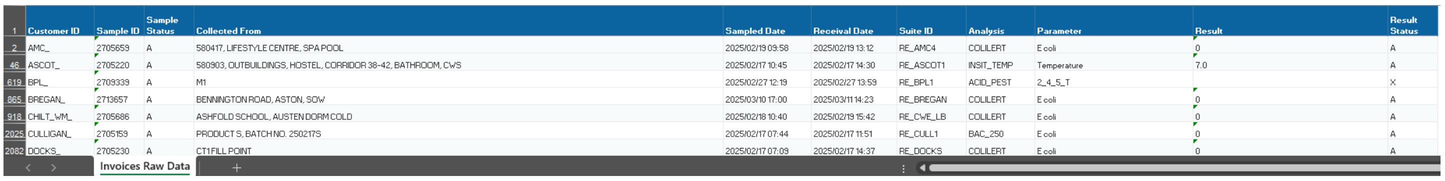
formatDateTime(addDays(startOfMonth(utcNow()), -15), 'yyyy-MM-dd')

4.3 Design of scripts

4.3.1 Power Automate provides access to Excel Online for the use of Office Scripts, enabling functions to be written and executed on queries.

4.3.2 Monthly raw data

First, the initial query required the customers to be separated into their own, unique worksheets.


1	Customer ID	Sample ID	Sample Status	Collected From	Sampled Date	Receival Date	Suite ID	Analysis	Parameter	Result	Result Status
2	AMC_	2705659	A	580417, LIFESTYLE CENTRE, SPA POOL	2025/02/19 09:58	2025/02/19 13:12	RE_AMC4	COLILERT	E coli	0	A
46	ASCOT_	2705220	A	580903, OUTBUILDINGS, HOSTEL, CORRIDOR 38-42, BATHROOM, CWS	2025/02/17 10:45	2025/02/17 14:30	RE_ASCOT1	INSIT_TEMP	Temperature	7.0	A
619	BPL_	2709339	A	M1	2025/02/27 12:19	2025/02/27 13:59	RE_BPL1	ACID_PEST	2_4_5_T		X
865	BREGAN_	2713657	A	BENNINGTON ROAD, ASTON, SOW	2025/03/10 17:00	2025/03/11 14:23	RE_BREGAN	COLILERT	E coli	0	A
918	CHILT_WM_	2705686	A	ASHFOLD SCHOOL, AUSTEN DORM COLD	2025/02/18 10:40	2025/02/19 15:42	RE_CWE_LB	COLILERT	E coli	0	A
2025	CULLIGAN_	2705159	A	PRODUCT S, BATCH NO. 250217S	2025/02/17 07:44	2025/02/17 11:51	RE_CULL1	BAC_250	E coli	0	A
2082	DOCKS_	2705230	A	CT1 FILL POINT	2025/02/17 07:09	2025/02/17 14:37	RE_DOCKS	COLILERT	E coli	0	A

The processing of the monthly raw data query began by looping through all the present customers in the table and separating each customer's data into an array.

```
for (let customer of splitCustomers) {
   let tempArray: string[][] = [];
```

This was achieved by filtering the data by matching the Customer ID property of a record to the search string in the loop, resulting in positive matches being inserted into an empty array.

```
if (nestedObjects[a]['Customer ID'] === customer) {
   let values = Object.values(nestedObjects[a]);
   tempArray.push(values);
}
```

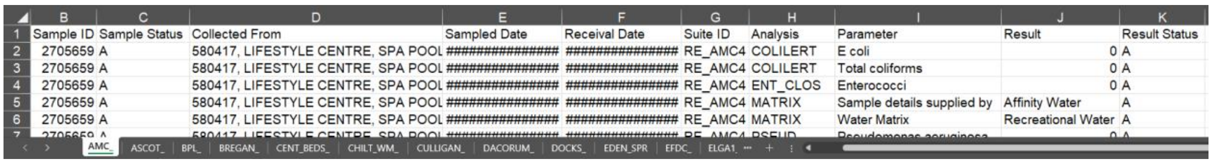
If there was data in the array, then a new worksheet was generated and the array contents was pasted in place.

```
if (tempArray.length > 0) {
   let lastRow = tempArray.length;
   let lastColumn = columnToLetter(tempArray[0].length);

   let createSheet = workbook.addWorksheet(customer);
   let selectSheet = workbook.getWorksheet(customer);

   selectSheet.getRange(`A1:${lastColumn}${lastRow}`).setValues(tempArray);
}
```

During this step, a bug was also fixed by converting the date format from a number to a long date.

```
selectSheet.getRange('E:F').setNumberFormatLocal('[$-en-GB]dd mmm yyyy  hh:mm');
```

Upon completion of all customers, the original sheet was deleted, leaving only individual customer sheets. This produced the following sheet:



	B	C	D	E	F	G	H	I	J	K
1	Sample ID	Sample Status	Collected From	Sampled Date	Receival Date	Suite ID	Analysis	Parameter	Result	Result Status
2	2705659	A	580417, LIFESTYLE CENTRE, SPA POOL	################	################	RE_AMC4	COLILERT	E coli	0	A
3	2705659	A	580417, LIFESTYLE CENTRE, SPA POOL	################	################	RE_AMC4	COLILERT	Total coliforms	0	A
4	2705659	A	580417, LIFESTYLE CENTRE, SPA POOL	################	################	RE_AMC4	ENT_CLOS	Enterococci	0	A
5	2705659	A	580417, LIFESTYLE CENTRE, SPA POOL	################	################	RE_AMC4	MATRIX	Sample details supplied by	Affinity Water	A
6	2705659	A	580417, LIFESTYLE CENTRE, SPA POOL	################	################	RE_AMC4	MATRIX	Water Matrix	Recreational Water	A
7	2705659	A	580417, LIFESTYLE CENTRE, SPA POOL	################	################	RE_AMC4	PSEUD	Pseudomonas aeruginosa	0	A

Next, the sheets were looped through to pivot the results into a wide format allowing for simple counting of each analysis.

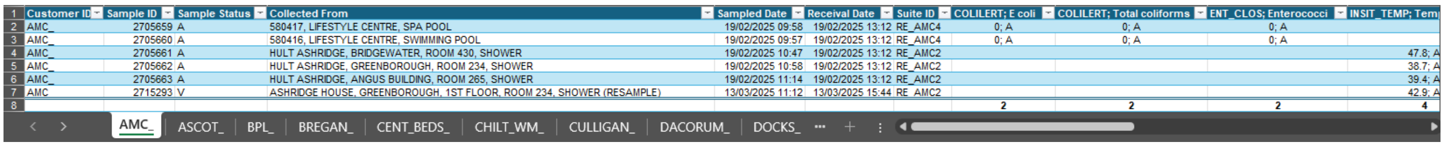
For the pivot function, the parameter, result value, and result status columns were extracted and used for pivoting, producing this result:

Customer ID	Sample ID	COLILERT; E coli	COLILERT; Total coliforms
AMC_	2705659	0; A	0; A
AMC_	2705660	0; A	0; A

By pairing the value with the status of the result, one can easily see if the result was valid, i.e. wasn't QC rejected, nulling the value of the test for the customer. To help with the visibility of this problem, a conditional filter was added to highlight these issues for the end users, where results in status 'R', 'X', or 'U' appeared prominently in red colouring.

Customer ID	Sample ID	LEGIONELLA; L pneumophila gp 2-14
AMC_	2705663	0; A
AMC_	2715293	🟥 ; U

A formula to count the range between the header and last row was placed below the table for immediate insight of each parameter's quantities, achieving this result:



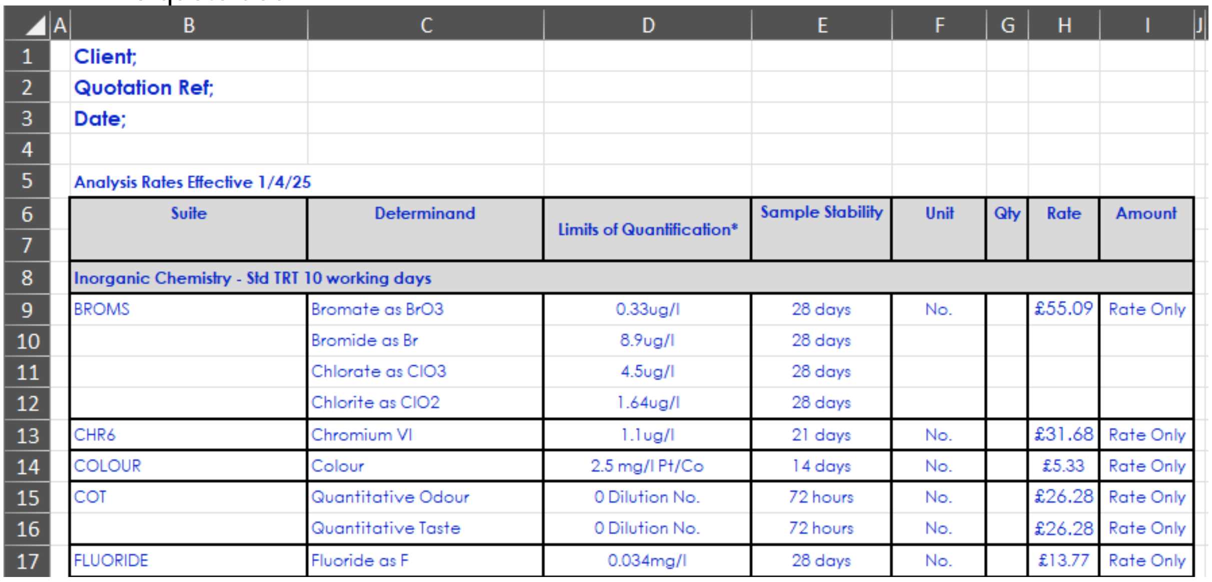
	Customer ID	Sample ID	Sample Status	Collected From	Sampled Date	Receival Date	Suite ID	COLILERT; E coli	COLILERT; Total coliforms	ENT_CLOS; Enterococci	INSIT_TEMP; Tem
2	AMC_	2705659	A	580417, LIFESTYLE CENTRE, SPA POOL	19/02/2025 09:58	19/02/2025 13:12	RE_AMC4	0; A	0; A	0; A	
3	AMC_	2705660	A	580416, LIFESTYLE CENTRE, SWIMMING POOL	19/02/2025 09:57	19/02/2025 13:12	RE_AMC4	0; A	0; A	0; A	
4	AMC_	2705661	A	HULT ASHRIDGE, BRIDGEWATER, ROOM 430, SHOWER	19/02/2025 10:47	19/02/2025 13:12	RE_AMC2				47.8; A
5	AMC_	2705662	A	HULT ASHRIDGE, GREENBOROUGH, ROOM 234, SHOWER	19/02/2025 10:58	19/02/2025 13:12	RE_AMC2				38.7; A
6	AMC_	2705663	A	HULT ASHRIDGE, ANGUS BUILDING, ROOM 265, SHOWER	19/02/2025 11:14	19/02/2025 13:12	RE_AMC2				39.4; A
7	AMC	2715293	V	ASHRIDGE HOUSE, GREENBOROUGH, 1ST FLOOR, ROOM 234, SHOWER (RESAMPLE)	13/03/2025 11:12	13/03/2025 15:44	RE_AMC2				42.9; A
8								2	2	2	4

A tally was placed below the last row to be validated by a responsible person before transferring outputs to an invoice sheet for billing.

4.3.4 Suite-based billing

A template quote document containing prices was stored on Teams for extraction of prices for this task. A dirty approach was used to achieve this, which could break this function if the main columns were misaligned.

The quote doc:



	A	B	C	D	E	F	G	H	I	J
1		**Client;**								
2		**Quotation Ref;**								
3		**Date;**								
4										
5		**Analysis Rates Effective 1/4/25**								
6		**Suite**	**Determinand**	**Limits of Quantification***	**Sample Stability**	**Unit**	**Qty**	**Rate**	**Amount**	
7										
8		**Inorganic Chemistry - Std TRT 10 working days**								
9		BROMS	Bromate as BrO3	0.33ug/l	28 days	No.		£55.09	Rate Only	
10			Bromide as Br	8.9ug/l	28 days					
11			Chlorate as ClO3	4.5ug/l	28 days					
12			Chlorite as ClO2	1.64ug/l	28 days					
13		CHR6	Chromium VI	1.1ug/l	21 days	No.		£31.68	Rate Only	
14		COLOUR	Colour	2.5 mg/l Pt/Co	14 days	No.		£5.33	Rate Only	
15		COT	Quantitative Odour	0 Dilution No.	72 hours	No.		£26.28	Rate Only	
16			Quantitative Taste	0 Dilution No.	72 hours	No.		£26.28	Rate Only	
17		FLUORIDE	Fluoride as F	0.034mg/l	28 days	No.		£13.77	Rate Only	

The range was looped until 3 columns returned blank results, indicating the end of the list.

```
if (position > 8 && rangeText[position][0] === ''
   && rangeText[position][1] === '' && rangeText[position][3] === ''
   && rangeText[position][6] === '') {
      break;
}
```

Elements at each index were validated to confirm if data was present. These were added to a new list for easier manipulation.

```
// Loop to capture all analytical rates
for (let position = 5; position < length2; position++) {
   //console.log(rangeText[b]);

   // If parameter and cost columns are not blank, add it to analysis list
   if (rangeText[position][1] !== '' && rangeText[position][6] !== '') {
      analyses.push(rangeText[position]);
      continue;
   }

   // If parameter and limits columns are not blank, add it to the analysis list
   if (rangeText[position][1] !== '' && rangeText[position][3] !== '') {
      analyses.push(rangeText[position]);
      continue;
   }

   // If suite and limits columns are not blank, add it to the analysis list
   if (rangeText[position][0] !== '' && rangeText[position][3] !== '') {
      analyses.push(rangeText[position]);
      continue;
```

```
    }
}
```

Items which didn't have a cost property were appended the result which did previously, assuming this grouping to be a suite of tests under a fixed cost, enabling this pricing method for a series of parameters.

```
// Loop through costs data...
while (analysesLength--) {
   // If cost is blank, append to the following parameter
   if (analyses[analysesLength][2] === '') {

      analyses[analysesLength - 1][1] = analyses[analysesLength - 1][1]
                                          .concat(`, ${analyses[analysesLength][1]}`);
      // Remove final line
      analyses.splice(analysesLength, 1);
   }
}
```

The extracted result was a string of nested JSON objects containing information about the suite, parameter, and cost:

Suite	Determinand	Rate
BROMS	Bromate as BrO3, Bromide as Br, Chlorate as ClO3, Chlorite as ClO2	55.09
COLOUR	Colour	5.33
COT	Quantitative Odour	26.28

A similar approach was used to draw the counts and parameters tables from the initialising query.

Counts table:

Customer ID	Template ID	Count of Samples
EDEN_SPR	RE_EDEN1	3
EDEN_SPR	RE_EDEN10	5
EDEN_SPR	RE_EDEN12	15
EDEN_SPR	RE_EDEN13	30

Parameters table:

Customer ID	Template ID	Analysis	Parameter
EDEN_SPR	RE_EDEN1	BAC_250	E coli
EDEN_SPR	RE_EDEN1	BAC_250	Total coliforms
EDEN_SPR	RE_EDEN1	ENTCLO_250	Enterococci
EDEN_SPR	RE_EDEN1	PS_AER_250	Pseudomonas aeruginosa

The parameter's names were modified to match the quote document for precise selection. The reason the parameters were chosen over the quote document was because the SQL query will always produce consistent outputs, while the costs documents could gain transcription errors with each iteration, making string amendment errors challenging to spot.

```
if (rangeText[a][3].includes('Total Coliforms') === true) {
   rangeText[a][3] = 'Total coliforms';
}
```

Two loops were used to identify which parameters were in each template. The parameter was then checked against a loop of the cost's objects. Positive matches between the parameter's name and cost's name were used to identify the parameter's rate, adding the value to a running total for this template's expenses.

Suites of tests were identified by the comma in the string, which was used to loop through the items.

```
// Apply suite cost if multiple parameters
if (splitSuite.length > 1) {
   for (let d = 0; d < splitSuite.length; d++) {
      if (splitAnalysis[0] === costsData[c]['Suite']
         && splitAnalysis[1] === splitSuite[d]) {

            suiteCheck = true;
            multipleAnalyses.push(splitAnalysis[0]);

            //console.log(`Adding ${costsData[c]['Rate']} of
               ${splitAnalysis[1]}, suite and parameter matched (${splitSuite[d]})`);
            suiteCost += Number(costsData[c]['Rate']);
            break;
      }
   }
}
```

The name of the suite was appended to a list outside this costs loop to compare to the next item in the parameter's list; if this suite was identified in the next iteration, the parameter will be rejected and not accounted for.

```
// Check if current parameter is part of a processed suite
for (let e = 0; e < multipleAnalyses.length; e++) {
   if (splitAnalysis[0] === multipleAnalyses[e]) {
      alreadyProcessedSuite = true;
   }
}
```

The template's costs were totalled and reported per unit price along with the total price for all templates of this kind. Any missed parameters from the bill were entered adjacent.

The resulting table for the customer:

Customer ID	Template ID	Count of Samples	Unit Price (£)	Total Cost (£)	Exceptions
EDEN_SPR	RE_EDEN1	3	52.70	158.10	
EDEN_SPR	RE_EDEN10	5	20.92	104.60	
EDEN_SPR	RE_EDEN12	15	23.52	352.80	
EDEN_SPR	RE_EDEN13	30	39.21	1176.30	
EDEN_SPR	RE_EDEN2	114	114.55	13058.70	
EDEN_SPR	RE_EDEN3	1	1164.33	1164.33	KONE; Nitrite Nitrate Formula,SUB_BPA; Bisphenol A

5.0 Appendix

5.1 Business Objects material

5.1.1 Monthly raw data

SQL query:

```
SELECT
   TRIM ( sample.customer_id ),
   TRIM ( sample.id_numeric ),
   TRIM ( sample.status ),
   TRIM ( sample.collected_from ),
   sample.sampled_date,
   sample.recd_date,
   TRIM ( sample.template_id ),
   TRIM ( test.analysis ),
   TRIM ( result.name ),
   TRIM ( result.text ),
   TRIM ( result.status )


FROM
   sample

INNER JOIN test
   ON test.sample = sample.id_numeric

INNER JOIN result
   ON result.test_number = test.test_number


WHERE
   ( sample.recd_date BETWEEN
      TRUNC ( ADD_MONTHS ( SYSDATE, -1 ), 'MM' ) + 14
      AND TRUNC ( SYSDATE, 'MM' ) + 14 )

   AND TRIM ( sample.customer_id ) IS NOT NULL
   AND ( result.rep_control <> 'N' OR test.analysis = 'MATRIX' )
   AND sample.status NOT IN ( 'X' )
```

Report:

Customer ID	Sample ID	Sample Status	Collected From	Sampled Date	Receival Date	Suite ID	Analysis	Parameter	Result	Result Status
AMC_	2705659	A	580417, LIFESTYLE CENTRE, SPA POOL	2025/02/19 09:58	2025/02/19 13:12	RE_AMC4	COLILERT	E coli	0	A
AMC_	2705659	A	580417, LIFESTYLE CENTRE, SPA POOL	2025/02/19 09:58	2025/02/19 13:12	RE_AMC4	COLILERT	Total coliforms	0	A
AMC_	2705659	A	580417, LIFESTYLE CENTRE, SPA POOL	2025/02/19 09:58	2025/02/19 13:12	RE_AMC4	ENT_CLOS	Enterococci	0	A
AMC_	2705659	A	580417, LIFESTYLE CENTRE, SPA POOL	2025/02/19 09:58	2025/02/19 13:12	RE_AMC4	MATRIX	Sample details supplied by	Affinity Water	A
AMC_	2705659	A	580417, LIFESTYLE CENTRE, SPA POOL	2025/02/19 09:58	2025/02/19 13:12	RE_AMC4	MATRIX	Water Matrix	Recreational Water	A

5.1.2 Suites-based billing

Customer 1 suites SQL query:

```
SELECT
   sample.customer_id,
   sample.template_id,
   COUNT ( sample.id_numeric )

FROM sample

WHERE
   ( sample.recd_date BETWEEN
      TRUNC ( ADD_MONTHS ( SYSDATE, -1 ), 'MM' ) + 14
      AND TRUNC ( SYSDATE, 'MM' ) + 14 )

   AND sample.customer_id = 'EDEN_SPR'
   AND sample.status NOT IN ( 'X', 'R' )

GROUP BY sample.customer_id, sample.template_id
```

Report:

Customer ID	Template ID	Count of Samples
EDEN_SPR	RE_EDEN1	3
EDEN_SPR	RE_EDEN10	5
EDEN_SPR	RE_EDEN12	15
EDEN_SPR	RE_EDEN13	30
EDEN_SPR	RE_EDEN2	114
EDEN_SPR	RE_EDEN3	1

Customer 1 suite breakdown SQL query:

```
SELECT
   sample.customer_id,
   sample.template_id,
   test.analysis,

   CASE TRIM ( test.analysis )
      WHEN 'ACID_PEST'
      THEN 'ACID Suite'
      WHEN 'OCPP'
      THEN 'OCP Suite'
      WHEN 'ONP_PEST'
      THEN 'ONS Suite'
      WHEN 'PAH'
      THEN 'PAH Suite'
      WHEN 'TRZ_URON'
      THEN 'TRZ_URON Suite'
      WHEN 'VOC'
      THEN 'VOC Suite'
      ELSE result.name
      END AS name


FROM sample

INNER JOIN test
   ON test.sample = sample.id_numeric

INNER JOIN result
   ON result.test_number = test.test_number


WHERE
   ( sample.recd_date BETWEEN
      TRUNC ( ADD_MONTHS ( SYSDATE, -1 ), 'MM' ) + 14
      AND TRUNC ( SYSDATE, 'MM' ) + 14 )

   AND sample.customer_id = 'EDEN_SPR'
   AND sample.status NOT IN ('X', 'R')
   AND result.rep_control <> 'N'
   AND test.analysis NOT IN ( 'NON_CONF_S' )
```

Report:

Customer ID	Template ID	Analysis	Parameter
EDEN_SPR	RE_EDEN2	BAC_250	E coli
EDEN_SPR	RE_EDEN2	BAC_250	Total coliforms
EDEN_SPR	RE_EDEN2	BROMS	Bromate as BrO3
EDEN_SPR	RE_EDEN2	ENTCLO_250	Enterococci
EDEN_SPR	RE_EDEN2	PS_AER_250	Pseudomonas aeruginosa
EDEN_SPR	RE_EDEN2	TVC	1 day plate count 37C

Customer 2 suites SQL query:

```
SELECT
   sample.customer_id,
   sample.template_id,
   COUNT ( sample.id_numeric )

FROM sample

WHERE
   ( sample.recd_date BETWEEN
      TRUNC ( ADD_MONTHS ( SYSDATE, -1 ), 'MM' ) + 14
      AND TRUNC ( SYSDATE, 'MM' ) + 14 )

   AND sample.customer_id = 'ELGA_2030'
   AND sample.status NOT IN ( 'X', 'R' )

GROUP BY sample.customer_id, sample.template_id
```

Report:

Customer ID	Template ID	Count of Samples
ELGA_2030	RE_DENTAL	6
ELGA_2030	RE_ENDO	58
ELGA_2030	RE_ENT	2
ELGA_2030	RE_RENAL	4
ELGA_2030	RE_SSD	10
ELGA_2030	RE_SSDMYCO	11

Customer 2 suite breakdown SQL query:

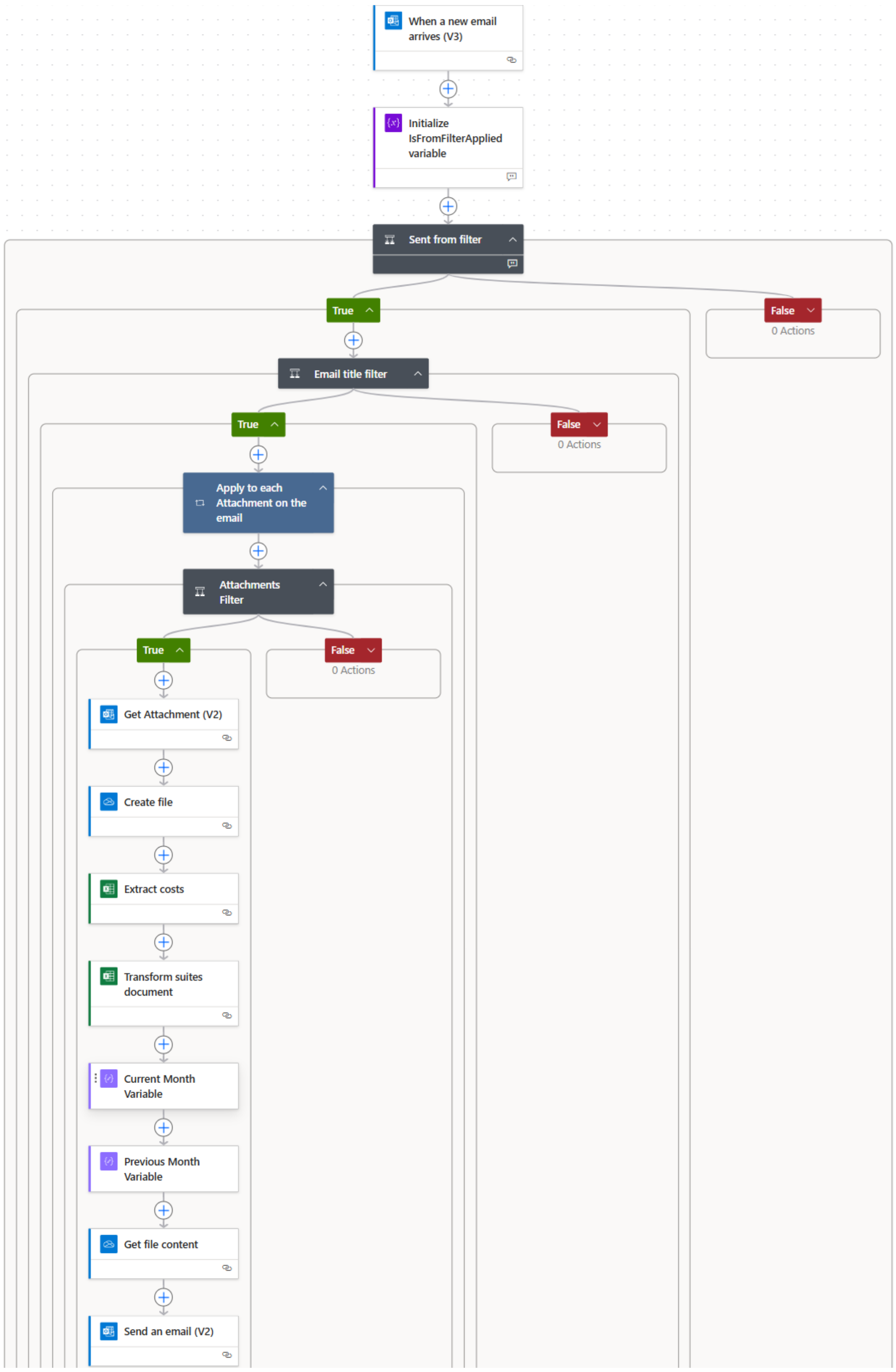
```
SELECT
   sample.customer_id,
   sample.template_id,
   test.analysis,

   CASE TRIM ( test.analysis )
      WHEN 'ACID_PEST'
      THEN 'ACID Suite'
      WHEN 'OCPP'
      THEN 'OCP Suite'
      WHEN 'ONP_PEST'
      THEN 'ONS Suite'
      WHEN 'PAH'
      THEN 'PAH Suite'
      WHEN 'TRZ_URON'
      THEN 'TRZ_URON Suite'
      WHEN 'VOC'
      THEN 'VOC Suite'
      ELSE result.name
      END AS name


FROM sample

INNER JOIN test
   ON test.sample = sample.id_numeric

INNER JOIN result
   ON result.test_number = test.test_number


WHERE
   ( sample.recd_date BETWEEN
      TRUNC ( ADD_MONTHS ( SYSDATE, -1 ), 'MM' ) + 14
      AND TRUNC ( SYSDATE, 'MM' ) + 14 )

   AND sample.customer_id = 'ELGA_2030'
   AND sample.status NOT IN ('X', 'R')
   AND result.rep_control <> 'N'
   AND test.analysis NOT IN ( 'NON_CONF_S' )
```

Report:

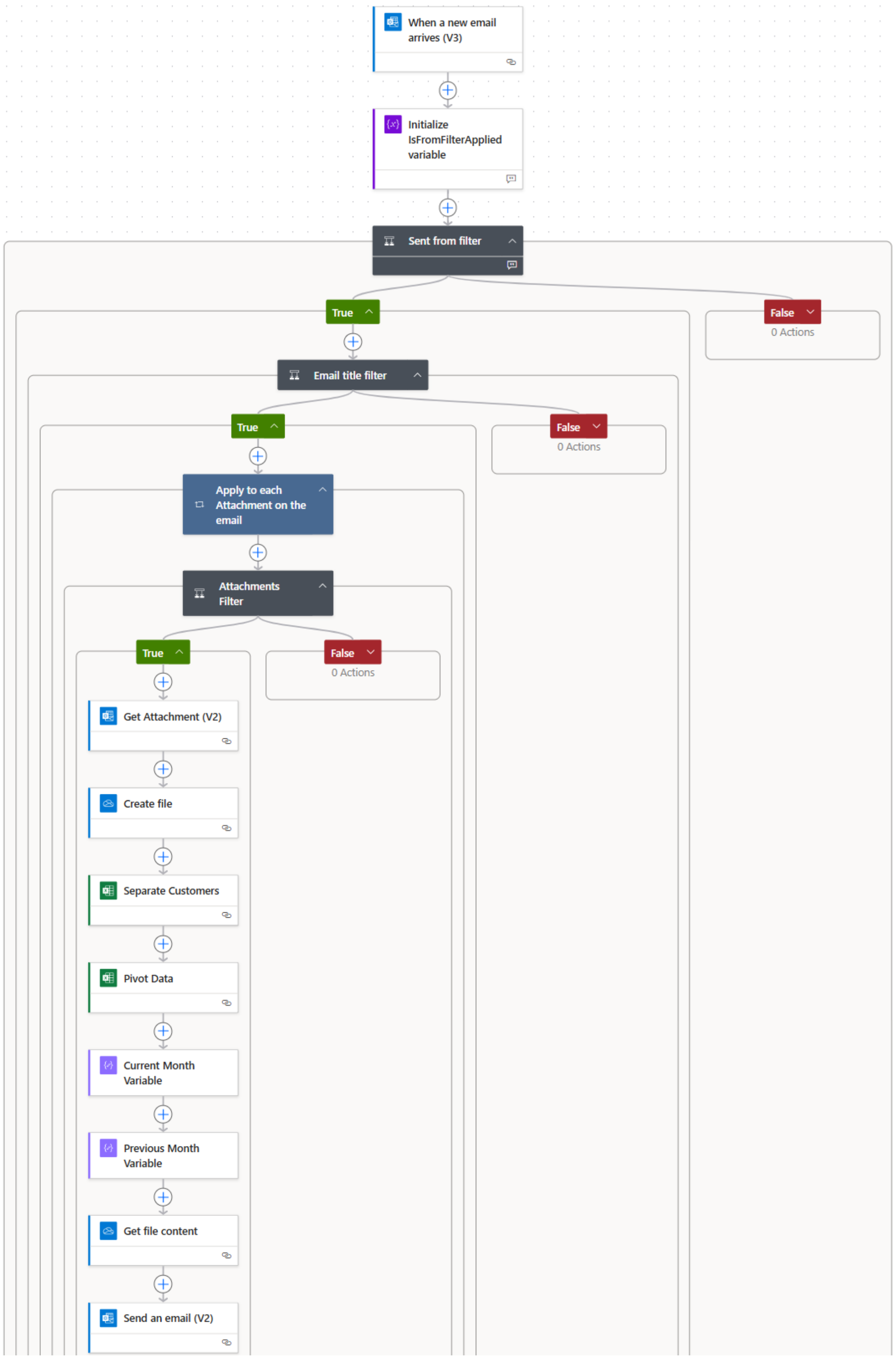
Customer ID	Template ID	Analysis	Parameter
ELGA_2030	RE_DENTAL	HEAVY_MET	Heavy Metals
ELGA_2030	RE_DENTAL	ICP	Cadmium as Cd
ELGA_2030	RE_DENTAL	ICP	Cobalt as Co
ELGA_2030	RE_DENTAL	ICP	Iron as Fe
ELGA_2030	RE_DENTAL	ICP	Sodium as Na
ELGA_2030	RE_DENTAL	KONE	Chloride as Cl
ELGA_2030	RE_DENTAL	KONE	Silica as SiO2

5.2 Power Automate flows

5.2.1 Monthly raws flow:



5.2.2 Suites flow:



5.3 Office Scripts

5.3.1 Raw data splitting programme

```
// Function to extract and separate customers by worksheet
function main(workbook: ExcelScript.Workbook): void {
    // Extract range from 1st sheet
    let inputData = tableToString(workbook);
    //console.log(inputData);

    // Convert range to nested objects
    const nestedObjects = stringToObjects(inputData);
    //console.log(JSON.stringify(outputData));

    // Find unique customers as a string, and split them into an array
    let customers = uniqueCustomers(nestedObjects);
    let splitCustomers: string[] = customers.split(', ');
    //console.log(splitCustomers);

    // Keys for nested arrays
    let keys = Object.keys(nestedObjects[0]);
    //console.log(keys);

    // Loop by unique customers...
    for (let customer of splitCustomers) {
        // Create temporary nested array for new sheets
        let tempArray: string[][] = [];
        tempArray.push(keys);

        // Populate nested array
        for (let a = 0; a < nestedObjects.length; a++) {
            //console.log(outputData[a]['Customer ID']);

            if (nestedObjects[a]['Customer ID'] === customer) {
                let values = Object.values(nestedObjects[a]);
                tempArray.push(values);
            }
        }
        //console.log(tempArray);

        // If there's data, create new sheet
        if (tempArray.length > 0) {
            let lastRow = tempArray.length;
            let lastColumn = columnToLetter(tempArray[0].length);
            //console.log(`A1:${lastColumn}${lastRow}`);

            let createSheet = workbook.addWorksheet(customer);
            let selectSheet = workbook.getWorksheet(customer);

            selectSheet.getRange(`A1:${lastColumn}${lastRow}`).setValues(tempArray);

            // Set format for range E:F on selectedSheet
            selectSheet.getRange('E:F').setNumberFormatLocal('[$-en-GB]dd mmm yyyy  hh:mm');
        } else {
            continue;
        }
    }
    workbook.getWorksheets()[0].delete();
}

// Function to convert any number to equivalent alphabetical letter
function columnToLetter(column: number) {
    var temp: number, letter = '';
    while (column > 0) {
        temp = (column - 1) % 26;
        letter = String.fromCharCode(temp + 65) + letter;
        column = (column - temp - 1) / 26;
    }
    return letter;
```

```
}

// Function to separate customers from nested objects
function filterCustomers(inputObjects: string[]): string {
    // Finding unique dates's from inputObjects
    const uniqueObjs: string[] = inputObjects.reduce((newArr, element) => {
        // Before element: x-1, and empty array
        //console.log(newArr);
        // Current element: x
        //console.log(element);

        // If the the current object's customer ID is not in newArr, add it
        if (newArr.some(item => item['Customer ID'] === element['Customer ID'])) {
            // Add missing object to array
            newArr.push(element);
            //console.log(element);
        }
        // Return nested objects
        return newArr;
    }, []);
    //console.log(uniqueObjs);
}

// Function to extract unique customers from nested objects
function uniqueCustomers(inputObjects: string[]): string {
    // Finding unique dates's from inputObjects
    const uniqueObjs: string[] = inputObjects.reduce((newArr, element) => {
        // Before element: x-1, and empty array
        //console.log(newArr);
        // Current element: x
        //console.log(element);

        // If the the current object's customer ID is not in newArr, add it
        if (!newArr.some(item => item['Customer ID'] === element['Customer ID'])) {
            // Add missing object to array
            newArr.push(element);
            //console.log(element);
        }
        // Return nested objects
        return newArr;
    }, []);
    //console.log(uniqueObjs);

    // Extracting the parameter values into array
    let uniqueIDs = '';
    for (let index = 0; index < uniqueObjs.length; index++) {
        //console.log(uniqueObjs[index]);

        // If uniqueIDs is blank, no comma
        if (uniqueIDs === '') {
            uniqueIDs = String(uniqueObjs[index]['Customer ID']);
        }

        // Otherwise, add comma
        else {
            uniqueIDs = uniqueIDs.concat(`, ${String(uniqueObjs[index]['Customer ID'])}`);
        }
    }
    //console.log(uniqueIDs);
    return uniqueIDs;
}

// Function to extract table as JSON string
function tableToString(workbook: ExcelScript.Workbook): string[][] {
    // Select 1st sheet in workbook containing all data
    const selectedSheet = workbook.getWorksheets()[0];
    // Get the working range as string
    const rangeText = selectedSheet.getUsedRange().getTexts();
    //console.log(rangeText);
    // Cleaning string
    let length = rangeText.length;

    while (length--) {
        // Remove blank rows
        if (rangeText[length][0] === '') {
            rangeText.splice(length, 1);
            continue;
        }

        // Remove blank columns
        if (rangeText[length][-1] === '') {
            rangeText[length].splice(-1, 1);
            continue;
        }
    }
    //console.log(rangeText);
    return rangeText;
}

// Function to convert a 2D array string to nested objects
function stringToObjects(tableString: string[][]): string[][] {
    // Key: Value pairs
    var objectKeys: string[] = [];
    // Result
    var outputArray: string[][] = [];

    // for each element in array...
    for (var index = 0; index < tableString.length; index++) {
        // Use the 1st element of array as keys
        if (index === 0) {
            objectKeys = tableString[index];
            continue;
        }

        // Empty object to store key and values
        var tempObject: Object = {};

        // For the length of an array within nest...
        for (var element = 0; element < tableString[index].length; element++) {
            //console.log(objectKeys[element]);

            // Set the value of newObject with objectKeys at position (element);
            // Using values of tableString at position (index) at key (element)
            tempObject[objectKeys[element]] = tableString[index][element];
        }

        // Push object into output array
        outputArray.push(tempObject);
        continue;
    }
    return outputArray;
}
```

5.3.2 Raw data pivoting programme

```
// Function to extract and clean test results to invoicing standards
function main(workbook: ExcelScript.Workbook): void {
    // Number of worksheets
    let sheets = workbook.getWorksheets().length;
    //console.log(sheets);

    // Loop through sheets...
    for (let sheetID = 0; sheetID < sheets; sheetID++) {
        // Select sheet at position
        let selectedSheet = workbook.getWorksheets()[sheetID];
        // Extract used range from sheet as string
        let rangeText = tableToString(selectedSheet, workbook);
        //console.log(rangeText);

        // Loop through range...
        if (rangeText.length > 1) {
            // Splice of sample ID, parameter, and result value
            const analyses = parameterFilter(rangeText);
            //console.log(analyses);

            // Pivoted parameters
            let transposed = getPivotArray(analyses, 0, 1, 2);
            //console.log(transposed);

            // Keeping a line per unique ID only
            const uniqueIDs = separateIDs(rangeText);
            //console.log(uniqueIDs);

            // Appending pivoted results to uniqueIDs
            for (let a = 0; a < uniqueIDs.length; a++) {
                //console.log(uniqueIDs[a]);

                // Remove old analysis and results column
                uniqueIDs[a].splice(7, 2);
                //console.log(uniqueIDs[a][1]);
                //console.log(transposed[a][0]);

                // If record IDs match in both lists...
                if (uniqueIDs[a][1] === transposed[a][0]) {
                    // Remove Sample ID before appending
                    const results = transposed[a].splice(1, transposed[a].length);
                    //console.log(results);
                    //console.log(uniqueIDs[a]);
                    uniqueIDs[a] = uniqueIDs[a].concat(results);
                }
            }
            //console.log(uniqueIDs);

            // Convert nested array to nested objects
            const newObjects = stringToObjects(uniqueIDs);
            //console.log(newObjects);

            // Output array
            let nestedArray: string[][] = [];

            // Convert nested objects to array
            for (let a = 0; a < newObjects.length; a++) {
                //console.log(newObjects[a]);

                if (a === 0) {
                    //
                    const keys = Object.keys(newObjects[a]);
                    //console.log(keys);
                    nestedArray.push(keys);

                    //
                    const values = Object.values(newObjects[a]);
                    //console.log(values);
                    nestedArray.push(values);
                } else {
                    const values = Object.values(newObjects[a]);
                    //console.log(values);
                    nestedArray.push(values);
                }
            }
            //console.log(nestedArray[0]);

            // Loop across the table...
            if (nestedArray[0].length > 0) {
                // Converting entry length to column letter
                const columnLetters = columnToLetter(nestedArray[0].length);

                // Extract range from sheet
                let usedRange = selectedSheet.getUsedRange();
                usedRange.clear();

                // Select new range to enter data
                const range =
selectedSheet.getRange(`A1:${columnLetters}${nestedArray.length}`);
                //console.log(range.getAddress());

                // Set values from nested array
                range.setValues(nestedArray);

                // Convert range to a table
                const table = selectedSheet.addTable(range, true);

                // Format area
                selectedSheet.getRange(`A:${columnLetters}`).getFormat().autofitColumns();

                // Draw table to loop through
                let tableText = selectedSheet.getTables()[0].getRange().getTexts();
                //console.log(tableText);

                // Loop by rows...
                for (let b = 0; b < tableText.length; b++) {
                    //console.log(tableText[b]);

                    // Variables to select an entire row
                    let endColumn = columnToLetter(tableText[b].length);
                    let lineIndex = b + 1;

                    // Skip headers
                    if (b === 0) {
                        selectedSheet.getRange(`H2:${endColumn}${tableText.length}`).getFormat()
.setHorizontalAlignment(ExcelScript.HorizontalAlignment.center);
                        continue;
                    }

                    // If sample status isn't authorised or complete, colour the record line
                    if (tableText[b][2] !== 'V' && tableText[b][2] !== 'A') {
                        selectedSheet.getRange(`A${lineIndex}:${endColumn}${lineIndex}`).getForm
at().getFill().setColor('#FF9393');
                    }

                    // If parameters were built in lieu of a suite, colour the record line
                    if (tableText[b][6] === 'RE') {
                        selectedSheet.getRange(`A${lineIndex}:${endColumn}${lineIndex}`).getForm
at().getFill().setColor('#FFC000');
                    }

                    // Tally up the results
                    for (let c = 7; c < tableText[b].length; c++) {
                        // Skip null values
                        if (tableText[b][c] === '') {
                            continue;
                        }

                        // Parameters to select current cell
                        let rowNumber = tableText.length;
                        let column = columnToLetter(c + 1);

                        // Split cell values to identify result status
                        let splitResults = tableText[b][c].split('; ');
                        //console.log(splitResults);

                        // If result status isn't reportable, apply conditional colouring
                        if (splitResults[1] === 'X') {
                            let activeCell = selectedSheet.getCell(b, c);
                            activeCell.getFormat().getFill().setColor('#ff0000');
                            continue;
                        } else if (splitResults[1] === 'U') {
                            let activeCell = selectedSheet.getCell(b, c);
                            activeCell.getFormat().getFill().setColor('#ff0000');
                            continue;
                        } else if (splitResults[1] === 'E') {
                            let activeCell = selectedSheet.getCell(b, c);
                            activeCell.getFormat().getFill().setColor('#ff0000');
                            continue;
                        } else if (splitResults[1] === 'R') {
                            let activeCell = selectedSheet.getCell(b, c);
                            activeCell.getFormat().getFill().setColor('#ff0000');
                            continue;
                        }

                        // Enter counta formula
                        let formulaCell = selectedSheet.getCell(rowNumber, c);
                        let formulaString = `=COUNTA(${column}2:${column}${tableText.length})`;
                        formulaCell.setValue(formulaString);
                    }
                }
            }
        }
    }
}

// Function to convert a number to an alphabetical letter
function columnToLetter(column: number) {
    // Variables
    var temp: number, letter = '';
    // Loop through all letters in alphabetical order
    while (column > 0) {
        temp = (column - 1) % 26;
        letter = String.fromCharCode(temp + 65) + letter;
        column = (column - temp - 1) / 26;
    }
    return letter;
}

// Function to add unique record dates to array
function separateIDs(inputObjects: string[][]): string[][] {
    // Finding unique dates's from inputObjects
    const uniqueObjs = inputObjects.reduce((newArr, element) => {
        // Before element: x-1, and empty array
        //console.log(newArr);
        // Current element: x
        //console.log(element);

        // If the the current object's year is not in newArr, add it
        if (!newArr.some(item => item[1] === element[1])) {
            // Add missing object to array
            newArr.push(element);
            //console.log(element);
        };
        // Return nested objects
        return newArr;
    }, []);
    //console.log(uniqueObjs);

    return uniqueObjs;
}

// Function to pivot nested array
function getPivotArray(dataArray: string[][], rowIndex: number, colIndex: number, dataIndex:
number): string[][] {

    // Loop variables
    var result: Object = {};
    var ret: string[][] = [];
    var newCols: string[] = [];
    // Loop through nested array...
    for (var index = 0; index < dataArray.length; index++) {
        if (!result[dataArray[index][rowIndex]]) {
            result[dataArray[index][rowIndex]] = {};
        }
        result[dataArray[index][rowIndex]][dataArray[index][colIndex]] =
dataArray[index][dataIndex];

        //To get column names
        if (newCols.indexOf(dataArray[index][colIndex]) == -1) {
            newCols.push(dataArray[index][colIndex]);
        }
    }
    newCols.sort();
    var item: string[] = [];

    // Add Header Row
    item.push('Sample ID');
    item.push.apply(item, newCols);
    ret.push(item);

    // Add content
    for (var key in result) {
        item = [];
        item.push(key);
        for (var i = 0; i < newCols.length; i++) {
            item.push(result[key][newCols[i]] || "");
        }
        ret.push(item);
        //console.log(ret);
    }
    return ret;
}

// Function to trim excess columns, allowing the analyses to be transposed
function parameterFilter(nestedArray: string[][]): string[][] {
    // Make a copy of nested array
    let transposing = [...nestedArray];
    //console.log(transposing);

    // Transposing analyses for wide format
    for (let a = 0; a < transposing.length; a++) {
        //console.log(transposing[a]);

        // Array of analysis and parameter pairs
        let analysisName = transposing[a].splice(7, 2);
        //console.log(analysisName);
        //console.log(transposing[a]);

        // String of analysis and parameter pairs
        let analysisString = analysisName.join('; ');
        //console.log(analysisString);

        // Array of result and status pairs
        let resultName = transposing[a].splice(7, 2);
        //console.log(resultName);
        //console.log(transposing[a]);

        // String of result and status pairs
        let resultString = resultName.join('; ');
        //console.log(resultString);

        // Addinding analysisString and resultString back to array
        transposing[a].splice(7, 0, analysisString);
        transposing[a].splice(8, 0, resultString);
        //console.log(transposing[a]);
    }
    //console.log(transposing);
    // Remove headers
    transposing.shift();

    // Keep only relevant columns; IDs, tests, and values
    var x = transposing.map((array) => {
        return array.slice(1, 2).concat(array.slice(7, 9));
    });
    //console.log(x);
    return x;
}

// Function to extract table as JSON string
function tableToString(selectedSheet: ExcelScript.Worksheet): string[][] {
    const rangeText = selectedSheet.getUsedRange().getTexts();
    //console.log(rangeText);

    // Cleaning string
    let length = rangeText.length;

    while (length--) {
        // Remove blank rows
        if (rangeText[length][0] === '') {
            rangeText.splice(length, 1);
            continue;
        }

        // Remove blank columns
        if (rangeText[length][-1] === '') {
            rangeText[length].splice(-1, 1);
            continue;
        }

        // Remove null result/ cancelled values
        if (rangeText[length][9] === '' && rangeText[length][10] === 'X') {
            rangeText.splice(length, 1);
            continue;
        }
    }
    //console.log(rangeText);
    return rangeText;
}

// Function to convert a 2D array string to nested objects
function stringToObjects(tableString: string[][]): string[][] {
    // Key: Value pairs
    var objectKeys: string[] = [];
    // Result
    var outputArray: string[][] = [];

    // for each element in array...
    for (var index = 0; index < tableString.length; index++) {
        // Use the 1st element of array as keys
        if (index === 0) {
            objectKeys = tableString[index];
            continue;
        }
        // Empty object to store key and values
        var tempObject: Object = {};

        // For the length of an array within nest...
        for (var element = 0; element < tableString[index].length; element++) {
            //console.log(objectKeys[element]);

            // Set the value of newObject with objectKeys at position (element);
            // Using values of tableString at position (index) at key (element)
            tempObject[objectKeys[element]] = tableString[index][element];
        }
        // Push object into output array
        outputArray.push(tempObject);
        continue;
    }
    return outputArray;
}
```

5.3.3 Extracting quote document programme

```
// Function to extract costs and output as nested objects
function main(workbook: ExcelScript.Workbook): string {
    // Select 1st sheet in workbook
    const selectedSheet = workbook.getWorksheets()[0];
    // Get the working range as string
    const usedRange = selectedSheet.getUsedRange();
    let rangeText = usedRange.getTexts();
    //console.log(rangeText);

    // Loop conditions
    let length2 = rangeText.length;
    let analyses: string[][] = [];

    // Loop to capture all analytical rates
    for (let position = 5; position < length2; position++) {
        //console.log(rangeText[b]);

        // Stops at the first blank line past headers
        if (position > 8 && rangeText[position][0] === '' && rangeText[position][1] === '' &&
rangeText[position][3] === '' && rangeText[position][6] === '') {
            break;
        }

        // If parameter and cost columns are not blank, add it to analysis list
        if (rangeText[position][1] !== '' && rangeText[position][6] !== '') {
            analyses.push(rangeText[position]);
            continue;
        }

        // If parameter and limits columns are not blank, add it to the analysis list
        if (rangeText[position][1] !== '' && rangeText[position][3] !== '') {
            analyses.push(rangeText[position]);
            continue;
        }

        // If suite and limits columns are not blank, add it to the analysis list
        if (rangeText[position][0] !== '' && rangeText[position][3] !== '') {
            analyses.push(rangeText[position]);
            continue;
        }
    }
    //console.log(analyses);

    // Remove unnecessary properties
    for (let a = 0; a < analyses.length; a++) {
        //analyses[a].splice(0, 1);
        analyses[a].splice(-1, 1);
        analyses[a].splice(2, 4);
        //console.log(analyses[a]);

        // If suite is blank, copy previous suite name
        if (analyses[a][0] === '') {
            analyses[a][0] = analyses[a - 1][0];
        }

        // To distinguish: KONE (Nitrogen Suite)
        if (a > 1 && a + 2 < analyses.length && analyses[a - 1][0] === analyses[a + 1][0]) {
            // Append (Nitrogen Suite) to previous value
            analyses[a + 1][0] = analyses[a + 1][0].concat(` ${analyses[a + 2][0]}`);

            // Delete (Nitrogen Suite) so 'KONE (Nitrogen Suite)' is copied down
            analyses[a + 2][0] = '';
        }

        // Remove currency sign from rates for simple addition
        if (analyses[a][2].includes('£') === true) {
            analyses[a][2] = analyses[a][2].replace('£', '');
        }

        // If no parameter is given, use suite name
        if (analyses[a][1] === '') {
            analyses[a][1] = analyses[a][0];
        }
    }

    // Grouping analyses into suites for bulk pricing
    let analysesLength = analyses.length;

    // Loop through costs data...
    while (analysesLength--) {

        // If cost is blank, append to the following parameter
        if (analyses[analysesLength][2] === '') {

            analyses[analysesLength - 1][1] = analyses[analysesLength - 1][1].concat(`, 
${analyses[analysesLength][1]}`);
            // Remove final line
            analyses.splice(analysesLength, 1);
        }
    }
    //console.log(analyses);

    // Convert range to nested objects
    let outputData = stringToObjects(analyses);
    console.log(JSON.stringify(outputData));
    return JSON.stringify(outputData);
}

// Function to convert a 2D array string to nested objects
function stringToObjects(tableString: string[][]): string[][] {
    // Key: Value pairs
    var objectKeys: string[] = [];
    // Result
    var outputArray: string[][] = [];

    // for each element in array...
    for (var index = 0; index < tableString.length; index++) {
        // Use the 1st element of array as keys
        if (index === 0) {
            objectKeys = tableString[index];
            continue;
        }

        // Empty object to store key and values
        var tempObject: Object = {};

        // For the length of an array within nest...
        for (var element = 0; element < tableString[index].length; element++) {
            //console.log(objectKeys[element]);

            // Set the value of newObject with objectKeys at position (element);
            // Using values of tableString at position (index) at key (element)
            tempObject[objectKeys[element]] = tableString[index][element];
        }
        // Push object into output array
        outputArray.push(tempObject);
        continue;
    }
    return outputArray;
}
```

5.3.4 Transforming suites sheet with costs and missed parameters

```
// Function to extract data and output nested objects
function main(workbook: ExcelScript.Workbook, costs: string): void {
    // Costs table
    let costsData: string[][] = JSON.parse(costs);
    //console.log(costsData);

    // Number of worksheets
    let sheets = workbook.getWorksheets().length;
    //console.log(sheets);

    // Loop through sheets...
    for (let sheetID = 0; sheetID < sheets; sheetID++) {
        // Final array to enter on page
        let outputArray: string[][] = [];

        // Suite cost headers
        let priceTitles: string[] = [];
        priceTitles.push('Unit Price (£)');
        priceTitles.push('Total Cost (£)');
        priceTitles.push('Exceptions');
        outputArray.push(priceTitles);

        // Select 1st sheet in workbook
        const selectedSheet = workbook.getWorksheets()[sheetID];

        // Parameters in suites table
        let parametersText = parametersToString(selectedSheet);
        //console.log(parametersText);

        // Count of suites table
        let countsText = countsToString(selectedSheet);
        //console.log(countsText);

        // Loop through through count of suites...
        for (let a = 1; a < countsText.length; a++) {
            //console.log(countsText[a][1]);

            // Not accounted for parameters catch
            let notAdded: string[] = [];

            // Which suites have been billed once already
            let suiteParameters: string[] = [];

            // Loop through suite parameters...
            for (let b = 1; b < parametersText.length; b++) {
                // If current suite from counts and parameters table matched...
                if (countsText[a][1] === parametersText[b][1]) {

                    // Append suite name and parameter, insert into array
                    let tempString = parametersText[b][2].concat('; ' +
parametersText[b][3]);
                    suiteParameters.push(tempString);
                }
            }
            //console.log(suiteParameters);

            // Temp cost of analysis
            let suiteCost = 0;

            // Catch to account for suites once
            let multipleAnalyses: string[] = [];

            // Loop through parameters array...
            for (let analysis of suiteParameters) {
                //console.log(analysis);
                //console.log(multipleAnalyses);
                let splitAnalysis = analysis.split('; ');
                //console.log(splitAnalysis);

                // Boolean to skip completed suites
                let alreadyProcessedSuite = false;

                // Check if current parameter is part of a processed suite
                for (let e = 0; e < multipleAnalyses.length; e++) {
                    if (splitAnalysis[0] === multipleAnalyses[e]) {
                        alreadyProcessedSuite = true;
                    }
                }

                // Skip if suite has been accounted for already
                if (alreadyProcessedSuite === true) {
                    continue;
                }

                // Check to charge by suite or individual rates
                let suiteCheck = false;
                let unitCheck = false;

                // Loop through costs data
                for (let c = 0; c < costsData.length; c++) {
                    // If suite, i.e. more than 1 item in list
                    let splitSuite: string[] = [];
                    if (costsData[c]['Determinand'].includes(', ') === true) {
                        splitSuite = costsData[c]['Determinand'].split(', ');
                        //console.log(splitSuite);
                    }
                    //console.log(splitSuite.length);

                    // Apply suite cost if multiple parameters
                    if (splitSuite.length > 1) {
                        for (let d = 0; d < splitSuite.length; d++) {
                            if (splitAnalysis[0] === costsData[c]['Suite'] && splitAnalysis[1]
=== splitSuite[d]) {

                                suiteCheck = true;
                                multipleAnalyses.push(splitAnalysis[0]);

                                //console.log(`Adding ${costsData[c]['Rate']} of
${splitAnalysis[1]}, suite and parameter matched (${splitSuite[d]})`);
                                suiteCost += Number(costsData[c]['Rate']);
                                break;
                            }
                        }
                    }

                    // Otherwise, charge individual rate
                    if (splitAnalysis[0] === costsData[c]['Suite'] && splitAnalysis[1] ===
costsData[c]['Determinand']) {

                        unitCheck = true;
                        //console.log(`Adding ${costsData[c]['Rate']} of ${splitAnalysis[1]},
suite and parameter matched`);

                        suiteCost += Number(costsData[c]['Rate']);
                        break;
                    }
                    //console.log(costsData.length - c);
                }

                // Append non-chargeables
                if (suiteCheck === false && unitCheck === false) {
                    notAdded.push(analysis);
                }
            }
            //console.log(suiteCost);
            //console.log(notAdded);
            // Array to enter on sheet
            let totalSuiteCost: string[] = [];

            // Rounding unit cost
            suiteCost = Math.round(suiteCost * 100) / 100;
            // Multiplying unit cost by quantity
            let tempSuiteCost = suiteCost * Number(countsText[a][2]);

            // Adding suite prices to each row
            totalSuiteCost.push(String(suiteCost));
            totalSuiteCost.push(String(tempSuiteCost));
            totalSuiteCost.push(String(notAdded));
            //console.log(totalSuiteCost);
            outputArray.push(totalSuiteCost);
        }
        // Add 3 columns next to count of suites
        //selectedSheet.getRange('D:F').insert(ExcelScript.InsertShiftDirection.right);

        // Insert processed data
        //selectedSheet.getRange(`D1:F${countsText.length}`).setValues(outputArray);
        //selectedSheet.getRange('D:F').getFormat().autofitColumns();
    }
}

// Function to extract table as JSON string
function countsToString(selectedSheet: ExcelScript.Worksheet): string[][] {
    const rangeText = selectedSheet.getUsedRange().getTexts();
    //console.log(rangeText);

    // Cleaning string
    let length = rangeText.length;

    while (length--) {
        // Remove blank rows
        if (rangeText[length][0] === '') {
            rangeText.splice(length, 1);
            continue;
        }

        // Remove blank columns
        if (rangeText[length][3] === '') {
            rangeText[length].splice(3, rangeText[length].length);
            continue;
        }
    }
    //console.log(rangeText);

    return rangeText;
}

// Function to extract table as JSON string
function parametersToString(selectedSheet: ExcelScript.Worksheet): string[][] {
    const rangeText = selectedSheet.getUsedRange().getTexts();
    //console.log(rangeText);

    // Cleaning string
    let length = rangeText.length;

    while (length--) {
        // Remove blank rows
        if (rangeText[length][4] === '') {
            rangeText.splice(length, 1);
            continue;
        }

        // Remove blank columns
        if (rangeText[length][-1] === '') {
            rangeText[length].splice(-1, 1);
            continue;
        }

        // Remove spaces between tables
        if (rangeText[length][3] === '') {
            rangeText[length].splice(0, 4);
            continue;
        }
    }
    //console.log(rangeText);

    // Amending parameter names to match quotes
    for (let a = 1; a < rangeText.length; a++) {
        //console.log(rangeText[a]);

        if (rangeText[a][3].includes('Total Coliforms') === true) {
            rangeText[a][3] = 'Total coliforms';
        }

        if (rangeText[a][3].includes('E coli') === true) {
            rangeText[a][2] = 'COLILERT';
        }

        if (rangeText[a][3].includes('Total coliforms') === true) {
            rangeText[a][2] = 'COLILERT';
        }

        if (rangeText[a][2].includes('BAC_CAPS') === true && rangeText[a][3].includes('3 day
plate count 22C') === true) {

            rangeText[a][2] = 'TVC';
            rangeText[a][3] = '3 day plate count @22c';
        }

        if (rangeText[a][2].includes('EDEN_EXP') === true && rangeText[a][3].includes('3 day
plate count plate') === true) {

            rangeText[a][2] = 'TVC';
            rangeText[a][3] = '3 day plate count @22c';
        }

        if (rangeText[a][2].includes('COLIF_RINS') === true && rangeText[a][3].includes('3 day
plate count 22C') === true) {

            rangeText[a][2] = 'TVC';
            rangeText[a][3] = '3 day plate count @22c';
        }

        if (rangeText[a][2].includes('BAC_250') === true) {
            rangeText[a][2] = 'COLILERT';
        }

        if (rangeText[a][2].includes('STD_BAC') === true) {
            rangeText[a][2] = 'COLILERT';
        }

        if (rangeText[a][2].includes('ENTCLO_250') === true) {
            rangeText[a][2] = 'ENT_CLOS';
        }

        if (rangeText[a][2].includes('CRYPTO_BUL') === true) {
            rangeText[a][2] = 'CRYPTO';
        }

        if (rangeText[a][3].includes('Oocysts') === true) {
            rangeText[a][3] = 'Crypto Bulk Bag ';
        }

        if (rangeText[a][2].includes('EDEN_EXP') === true &&
rangeText[a][3].includes('Pseudomonas aeruginosa') === true) {
```

```
            rangeText[a][2] = 'PSEUD';
        }

        if (rangeText[a][3].includes('Pseudomonas aeruginosa') === true) {
            rangeText[a][3] = 'Pseudomonas Aeruginosa';
        }

        if (rangeText[a][2].includes('PS_AER_250') === true) {
            rangeText[a][2] = 'PSEUD';
        }

        if (rangeText[a][3].includes('7 day plate count 22C') === true) {
            rangeText[a][3] = '7 day plate count @ 37c';
        }

        if (rangeText[a][2].includes('TVC_100_SC') === true) {
            rangeText[a][2] = 'TVC_100ii';
        }

        if (rangeText[a][2].includes('TVC_REN_SC') === true) {
            rangeText[a][2] = 'TVC_RENALii';
        }

        if (rangeText[a][3].includes('2 day plate count 22C') === true) {
            rangeText[a][3] = '2 day plate count @ 37c';
        }

        if (rangeText[a][2].includes('TVC_CFPPSC') === true) {
            rangeText[a][2] = 'TVC_CFPPii';
        }

        if (rangeText[a][2].includes('MYCOBAC') === true) {
            rangeText[a][2] = 'MYCOBACii';
            rangeText[a][3] = 'Mycobacteria';
        }

        if (rangeText[a][2].includes('SC_ENDOTOX') === true) {
            rangeText[a][2] = 'ENDOTOXii';
        }

        if (rangeText[a][3].includes('Nitrate as NO3') === true) {
            rangeText[a][3] = 'Nitrate as NO3 (by calculation)';
        }

        if (rangeText[a][2].includes('CHROMIUMVI') === true) {
            rangeText[a][2] = 'CHR6';
        }

        if (rangeText[a][2].includes('MISC_PHYS') === true) {
            rangeText[a][2] = 'MISC PHYS i';
        }

        if (rangeText[a][2].includes('SUB_ACRYL') === true) {
            rangeText[a][2] = 'ACRYL i';
        }

        if (rangeText[a][2].includes('ACID_PEST') === true) {
            rangeText[a][2] = 'ACID Suite';
        }

        if (rangeText[a][2].includes('OCPP') === true) {
            rangeText[a][2] = 'OCP Suite';
        }

        if (rangeText[a][2].includes('ONP_PEST') === true) {
            rangeText[a][2] = 'ONS Suite';
        }

        if (rangeText[a][2].includes('PAH') === true) {
            rangeText[a][2] = 'PAH Suite';
        }

        if (rangeText[a][2].includes('TRZ_URON') === true) {
            rangeText[a][2] = 'TRZ_URON Suite';
        }

        if (rangeText[a][2].includes('VOC') === true) {
            rangeText[a][2] = 'VOC Suite';
        }

        if (rangeText[a][3].includes('Beryllium as Be') === true) {
            rangeText[a][3] = 'Beryllium';
        }

        if (rangeText[a][3].includes('Chromium VI as CrVI') === true) {
            rangeText[a][3] = 'Chromium VI';
        }

        if (rangeText[a][3].includes('Total Dissolved Solids') === true) {
            rangeText[a][3] = 'Dissolved Organic Carbon ii';
        }

        if (rangeText[a][2].includes('EPICHLOR') === true) {
            rangeText[a][2] = 'EPICHLOR ii';
            rangeText[a][3] = 'Epichlorohydrin';
        }

        if (rangeText[a][3].includes('L pneumophila gp 2-14') === true) {
            rangeText[a][3] = 'Legionella';
        }

        if (rangeText[a][3].includes('Soluble Reactive Phosphate as P') === true) {
            rangeText[a][3] = 'Soluble Reactive Phosphate';
        }

        if (rangeText[a][3].includes('Thallium as Tl') === true) {
            rangeText[a][3] = 'Thallium';
        }

        if (rangeText[a][2].includes('VINYL_CHLO') === true) {
            rangeText[a][2] = 'VINYL_CHLii';
            rangeText[a][3] = 'Vinyl chloride';
        }

        if (rangeText[a][2].includes('TRITIUM') === true) {
            rangeText[a][2] = 'TRITIUM ii';
        }

        if (rangeText[a][2].includes('TDS_DRYR') === true) {
            rangeText[a][2] = 'TOC';
        }

        if (rangeText[a][2].includes('A_B_RADIO') === true) {
            rangeText[a][2] = 'RADIO ii';
        }

        if (rangeText[a][2].includes('KONE') === true) {

            if (rangeText[a][3].includes('Nitrite as NO2') === true) {
                rangeText[a][2] = 'KONE (Nitrogen Suite)';
            }

            if (rangeText[a][3].includes('Total Oxidised Nitrogen as NO3') === true) {
                rangeText[a][2] = 'KONE (Nitrogen Suite)';
            }

            if (rangeText[a][3].includes('Nitrate as NO3 (by calculation)') === true) {
                rangeText[a][2] = 'KONE (Nitrogen Suite)';
            }
        }
        if (rangeText[a][3].includes('37C') === true) {
            rangeText[a][3] = rangeText[a][3].replace('37C', '@ 37c');
        }

        if (rangeText[a][3].includes('22C') === true) {
            rangeText[a][3] = rangeText[a][3].replace('22C', '@22c');
        }

        if (rangeText[a][3].includes('30C') === true) {
            rangeText[a][3] = rangeText[a][3].replace('30C', '@ 30c');
        }
    }
    //console.log(rangeText);
    return rangeText;
}

// Function to convert a 2D array string to nested objects
function stringToObjects(tableString: string[][]): string[][] {
    // Key: Value pairs
    var objectKeys: string[] = [];
    // Result
    var outputArray: string[][] = [];

    // for each element in array...
    for (var index = 0; index < tableString.length; index++) {
        // Use the 1st element of array as keys
        if (index === 0) {
            objectKeys = tableString[index];
            continue;
        }
        // Empty object to store key and values
        var tempObject: Object = {};

        // For the length of an array within nest...
        for (var element = 0; element < tableString[index].length; element++) {
            //console.log(objectKeys[element]);

            // Set the value of newObject with objectKeys at position (element);
            // Using values of tableString at position (index) at key (element)
            tempObject[objectKeys[element]] = tableString[index][element];
        }

        // Push object into output array
        outputArray.push(tempObject);
        continue;
    }
    return outputArray;
}
```