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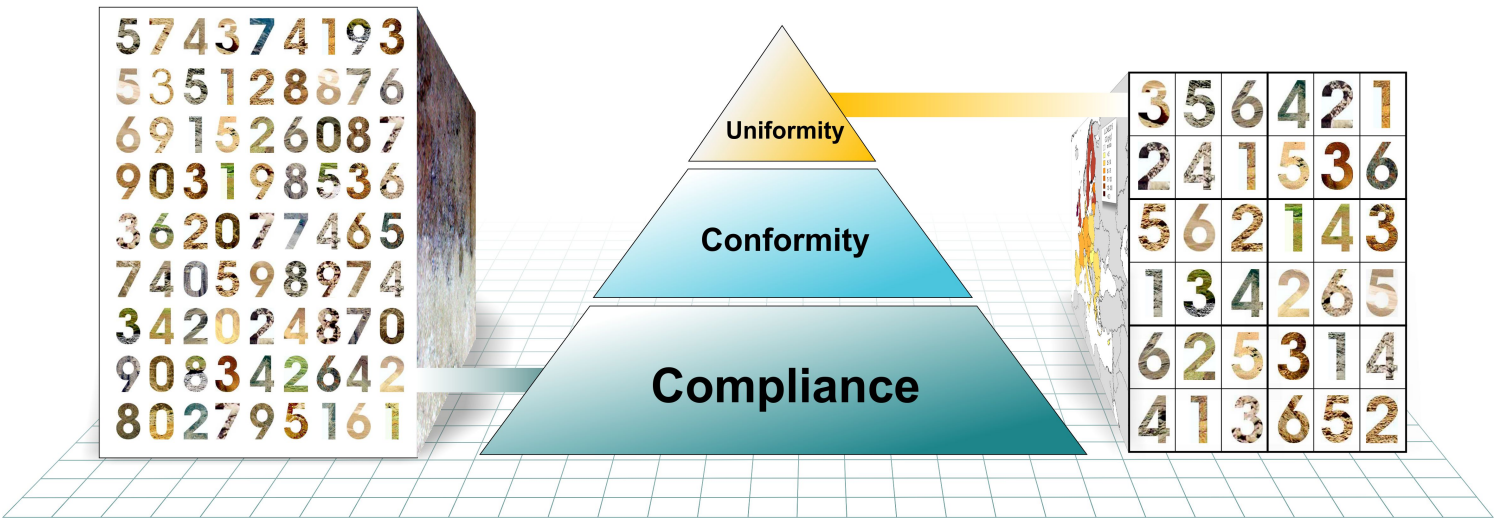
Data Evaluation of LUCAS Soil Survey Laboratory Data

Survey 2009, 2012 and 2015

Hiederer, R.

2020



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Abstract

In 2015 topsoil samples were collected in all 28 Member States of the European Union under the Soil module of the LUCAS survey. Previous surveys were performed in 2009 and 2012, but with restricted coverage. All soil samples were analysed by a central laboratory using standard methods. The results of the laboratory analysis were evaluated for their practicality to characterise the status and changes of European topsoil physical and chemical conditions. The evaluation covers aspects of data compliance to specifications, conformity to data structures and value ranges, consistency between parameters and surveys. The parameters evaluated were: coarse fragments, clay silt and sand content, pH in $CaCl_2$ and H_2O, organic carbon, calcium carbonate, total nitrogen, soluble phosphor, extractable potassium and cation exchange capacity.

Despite general common characteristics the reported laboratory results from the various soil surveys also display some notable differences. For laboratory methods and delivery of results from the 2009 and 2015 survey detailed specifications were available. No such specifications were available for the methods and delivery of the 2012 laboratory results. The data largely comply to the specifications for file format and content. Low adherence to the specifications was noted for parameter position in the file. This is potentially problematic when parameters with a similar range of values are interchanged, as for silt and sand or pH($CaCl_2$) and pH(H_2O). For the 2012 survey the values for total nitrogen were reported in the wrong unit, which in the absence of specifications for the data may not be obvious.

The checks of conformity found incompatible data types and duplicates for the key field containing the sample identifier. This reduces the number of samples that can be unambiguously assigned to LUCAS points for a geographic location by up to 10% (2009). The codes indicating measurements below the limit of detection and the values used differed between documents and years. In data for the 2012 and 2015 results numeric entries were used, which is a potential source of error when analysing the data. The evaluation of consistency between parameters of a survey showed few cases outside the expected range. However, the temporal consistency of a parameter with repeated samples shows a degree of variability that is several times higher than for the repeated laboratory analysis of a sample and viable unfeasible for 15% of the samples from soils high in organic material. This indicates a sizable variability in soil conditions between repeated samples. Uncertainties in the data were identified for $CaCO_3$ and soluble phosphor at low concentrations. The values for cation exchange capacity would appear to be highly variable and to be used with particular caution, if at all.

The evaluation found that the results from the laboratory analysis of the LUCAS Soil survey are valuable to characterise European topsoil conditions. A change in data delivery format would ease some of the format issues found. Including the analysis of texture parameters in revisited sample locations would help in the identification of problems in the stability of repeated samples.

1 Introduction

Since 2006 the *Land Use and Coverage Area frame Survey* (LUCAS) is carried out at 3-year intervals in the Member States of the European Union (EU) to collect statistical information on land use and land cover over the territory of the EU[1]. The survey follows a stratified sample design where data are collected by direct observations of about 340,000 points (2015 LUCAS survey) made by surveyors on the ground information (*in situ*).

In 2009 a *LUCAS Soil Component* (LUCAS Soil) was added to the survey on land use/cover (LUCAS LUC). The initial motive for the LUCAS Soil survey was to collect data on *soil organic carbon* (SOC), with emphasis on agricultural soils. The aim of the survey was to provide the basis for an assessment of SOC content and, with repeated surveys, an appraisal of soils acting as sources or sinks of atmospheric CO_2, which stems from changes in SOC. Over time the scope of the LUCAS Soil survey was broadened and additional parameters were collected and analysed[2].

The 2009 LUCAS Soil survey includes data from 23 EU Member States[3]. In addition, soil data were collected in Cyprus for LUCAS points, but without collection land use / cover data. The 2009 soil survey in Malta was financed by national funds and includes basic observations on land cover and use. The LUCAS Soil survey of 2012 covers Bulgaria and Romania. In 2015 the LUCAS Soil survey was repeated for EU28, with Croatia included for the first time. The 2015 LUCAS Soil survey probably provides the most exhaustive data on topsoil (0 - 20 cm) properties collected under standard conditions at European level (Orgiazzi, et al., 2017).

With the availability of the 2015 LUCAS Soil laboratory data the status of topsoils can be appraised from *in-situ* data for all 28 Member States of the European Union and, based on repeatedly collected soil samples, changes in soil properties deducted. The appraisal of the topsoil status and temporal changes in a parameter require that data for a survey be reliable and consistent between surveys. To this purpose the results of the sample analysis reported by the central laboratory LUCAS soil samples was evaluated for all surveys. Due to the significance of assessing soil organic carbon the soil property was evaluated first and in relation to land use and land use changes (Hiederer, 2018). The method used, the processing performed and the results obtained for a general evaluation of the LUCAS Soil Component laboratory data are presented in this report.

[1] URL: http://ec.europa.eu/eurostat/web/lucas

[2] URL: https://esdac.jrc.ec.europa.eu/projects/lucas

[3] URL: https://ec.europa.eu/eurostat/web/lucas/data/primary-data/2009

2 Data Evaluation

A data evaluation is the first step in an assessment of data quality. The data evaluation was applied to the results delivered by the central laboratory for all LUCAS Soil surveys and the exclusive soil survey for Malta in 2009. The data delivered were examined according to a set of rules and a indicator of the result of the check is assigned to each item evaluated.

2.1 Evaluation Principle

The evaluation is based on the principle that the data on the results of the laboratory analysis cannot be verified and checked for correctness. Such an exercise requires a comparison to a reference data set with accurately-defined properties for all aspects of the sample collected[4]. Instead, it is possible to assess the likelihood that data are not incorrect and whether data are within a credible range of values. Hence, the evaluation uses a process of rating data for being excluded from analysis, not included. This process is implemented as a series of checks, which have to be performed in sequential order. The starting point is set by checks that objectively mark a data value or property as invalid. These are cases where data are outside the range of the reporting units, such as percentages > 100% or pH > 14. Subsequent checks increase in complexity of the rules applied and decrease in the distinctness of the results obtained.

The method for data evaluation follows the steps developed and applied as part of the quality checks of the soil data from other pan-European soil data sets, such as *ForestFocus* (Hiederer, et al., 2008) and the *BioSoil Demonstration Project* (Hiederer, et al., 2011). A comparable method was adapted for the quality assurance and control in laboratories for data sampled under *ICP Forests* (UNECE, 2016)[5].

The evaluation is divided into three distinct steps of data compliance, conformity and uniformity that address different aspects of the results obtained from the laboratory analysis of the soil samples and links to the main LUCAS survey. These steps are performed in sequence, as graphically presented in Figure 1.

[4] Soil reference material is used by the central laboratory to verify the methods.

[5] URL: http://www.icp-forests.org/pdf/manual/2016/ICP_Manual_2016_01_part16.pdf

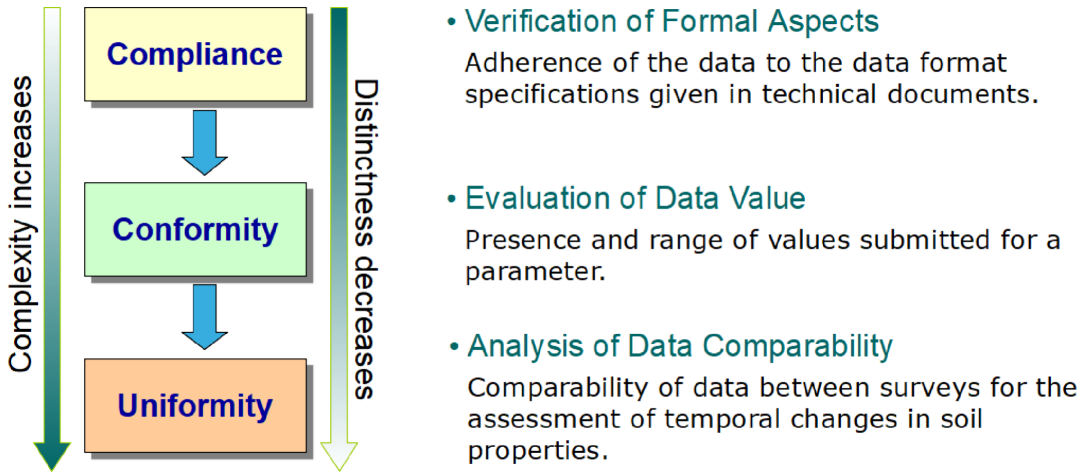


Figure 1: Evaluation Steps of Compliance, Conformity and Uniformity Checks

The steps concern data formats, range of values and consistency, either as part of repeated surveys or compared to results from other surveys. With the evaluation the complexity of the checks increases and the distinctness of the results become more dependent on the context and, therefore, less distinct.

2.2 Scope of Data Evaluation

The evaluation checks query data, but data are not modified. Rather, the results of the checks are treated as attributes of the data or item evaluated and stored as such in the database. Based on the results data may be excluded from being evaluated in a subsequent check when. Such restrictions may apply when evaluating aspects of consistency, such as the use of a common value for the limit of detection or limiting the comparison of repeated samples to a specific distance between locations.

In line with the concept of retaining the data in the original state any aspects of data cleaning are limited. Potential items considered for data cleaning are:

- Missing data: identified, but no estimates are introduced.
- Outliers: identified and highlighted, but not removed.
- Inconsistencies: identified and highlighted, but not removed.

No measures are taken to directly reduce noise in the data. Other aspects of a data quality, such as timeliness, believability or interpretability, are not considered relevant to the aim of the task.

As a separate step and at the end of the evaluation process a data set is generated, where some data are modified or removed to compile with standard codes and a consistent structure.

2.3 Data Sources

The data used in the evaluation are the results reported by the laboratory analysing the soil samples from LUCAS Soil surveys of 2009, 2012 and 2015.

2.3.1 LUCAS Soil Survey 2009

The data for the 2009 LUCAS Soil survey comes from three separate surveys:

- LUCAS Soil survey for EU23: 19,910 samples
- LUCAS Soil survey for Cyprus: 90 samples

  Laboratory results combined to LUCAS Soil data for 2009: 20,000 samples
  additional samples analysed: 897 samples
- Exclusive Soil survey for Malta: 19 samples

The results of the analysis of the soil samples collected in EU23 and those from Cyprus are recorded in one file containing a total of 20,000 samples, while the results of the analysis from 19 samples collected on Malta are stored in a separate file. The results of the analysis of an additional 897 samples of the EU23 survey are stored in a separate file. The surveys and the soil parameters analysed in the laboratory have some distinct characteristics.

LUCAS Soil Survey for EU23

The main data of the LUCAS Soil 2009 survey is the file *5.6.LUCAS_Results of 20,000 soil samples.xls*. This would appear to be the original data submitted by the central laboratory. There are derivate versions of the data, such as the data available from the *European Soil Data Centre* (ESDAC) (*LUCAS_TOPSOIL_v1.xls*)[6]. However, the data available from ESDAC do not represent the original data and were not used for the evaluation (Hiederer, 2018).

The data are arranged as a flat table by country, where a record (row) consists of the soil sample identifier (ID) and each parameter is stored as a field (column). The individual country data are added and stored in a single table. The resulting table cannot be used as a flat data table without modification, because the data headers are repeated for each country. As a consequence, no meaningful data structure for records or fields can be established from the arrangement. A suitable flat data table was generated from the workbook by exporting the data to an ASCII format and importing the data into the database format with all values defined as alpha-numeric data type.

An additional 897 soil samples were analysed under the EU23 survey. The results of the analysis was reported in a separate file named *LUCAS_RECORD_2011-09-27_Results_897_extra samples.xls*.

[6] URL: https://esdac.jrc.ec.europa.eu/content/lucas-2009-topsoil-data

The parameter code does not correspond completely with the codes used in the file containing the final results of the main submission, but corresponds to the order of parameters.

LUCAS Soil Survey for Cyprus

The 2009 soil survey of Cyprus was organised without a concurrent LUCAS main survey of that year. However, in contrast to data from Malta, the results from the analysis of the 90 soil samples from Cyprus were included in the data provided by the central laboratory. Hence, the soil property data for Cyprus was taken from the file *5.6.LUCAS_Results of 20,000 soil samples.xls*.

Exclusive Soil Survey for Malta

The soil survey of Malta was organised and performed outside the LUCAS main survey and the LUCAS Soil survey of 2009. The data reported covers the analysis of the soil samples collected as part of the soil survey and observations from a basic land cover/use survey. No information were available relative to the survey details or any specifications concerning the sample analysis and data formats. It was assumed that the specifications for the 2009 analysis were applicable.

It was further not possible to retrieve all files submitted by the survey contractor or the laboratory. Data from the analysis of the 19 soil samples were taken from the ESDAC LUCAS Soil 2009 data file (*LUCAS_TOPSOIL_v1.xls*). The ESDAC data do not contain a country code for the samples from Malta and the country samples were identified by the soil sample ID and the site coordinates. The ESDAC data uses a numeric value when the property is below the detection limit of the analysis used. Another observation is that the ESDAC data inverts the order of the results for pH($CaCl_2$) with pH(H_2O) relative to the specifications for the 2009 EU23 survey.

The data used was the attribute table of an Esri® Shapefile[7]. of 08.11.2011. A file named "*Malta_Lucas.xlsx*" contained the basic information on geographic position and land use observations, but not the soil data.

2.3.2 LUCAS Soil Survey 2012

For Bulgaria and Romania a LUCAS Soil component survey was organised as part of the main LUCAS survey in 2012. The results of the soil analysis were submitted as separate files for each country. The specifications for the analysis and data submission could not be retrieved. Therefore, and because the same central laboratory performed the analysis, it was assumed that they would correspond to those of the 2009 analysis.

- LUCAS Soil survey for Bulgaria: 661 samples
- LUCAS soil survey for Romania: 1,373 samples

[7] Environmental Systems Research Institute, Inc., 380 New York Street, Redlands, CA 92373-8100 USA

The data files used for the evaluation were *Bulgaria.csv* and *Romania.csv*. Files with an XLSX suffix also exist with an earlier date. However, these files seem to have been generated from other data for the surveys and are not suitable for evaluation.

2.3.3 LUCAS Soil Survey 2015

The LUCAS Soil Component survey of 2015 covers EU28 in a single survey. The method for taking soil samples was basically unchanged as far as the parameters evaluated are concerned. The laboratory analysis added a measurement for electric conductivity to the soil parameters reported. Other than this, the methods used to analyse the samples by the laboratory have remained unchanged.

A modification to previous surveys was the distinction of four groups of soil samples that affect the scope of the laboratory analysis:

- *Group 1: 1,334 samples*
  Results from repeated soil sampling locations of soils rich in organic material, as found in 2009 and 2012 surveys. For these samples the analysis of *CF* and particle size distribution were not assessed.
- *Group 2: 16,019 samples*
  Results from repeated soil sampling locations of mineral soils identified as mineral during the 2009 and 2012 survey.
- *Group 3: 5,656 samples*
  Results from soil samples not located at previous sample sites, covering mineral and organic soil types.
- *Group 4: 381 samples*
  Results of the analysis of clay mineral and/or multi-spectral analysis.

The evaluation covers data from Group 1, 2, and 3 for all checks and Group 4 for a consistent data structure, excluding the results of the multi-spectral analysis.

2.4 Implementation: Evaluation Database

The data evaluation is implemented as a *relational database* (RDB). An RDB would appear to be particularly suited to the task, because the data are uniformly structured and recorded in some tabulated format. Compared to an implementation of interrogating data in a non-structured environment this approach reduces data redundancy and improves integrity.

The information defining the data or values, such as units or limits of detection(LOD), were only available in text documents. These were transferred to dictionaries and added to the database. Any parameters specifying a check are stored in the database rather than the procedures to avoid inconsistencies in the values used and improve transparency.

The checks carried out under the steps and any parameters used are recorded in tables of the evaluation database and documented for reference. When a check highlights a particular condition the information on the check and a

corresponding message is written to results table. The set of result tables then become part of the evaluation database. The results of the checks can be summarised, categorised or linked to each item evaluated to provide a high degree of flexibility and transparency.

The evaluation RDB covers the tasks of importing the source data, running the evaluation checks and compiling a practical set of LUCAS Soil component data. To facilitate these tasks dedicated graphical user interfaces have been created.

2.4.1 Data Import Form

An example of the import form, set to importing data from the 2009 surveys, is given in Figure 2.

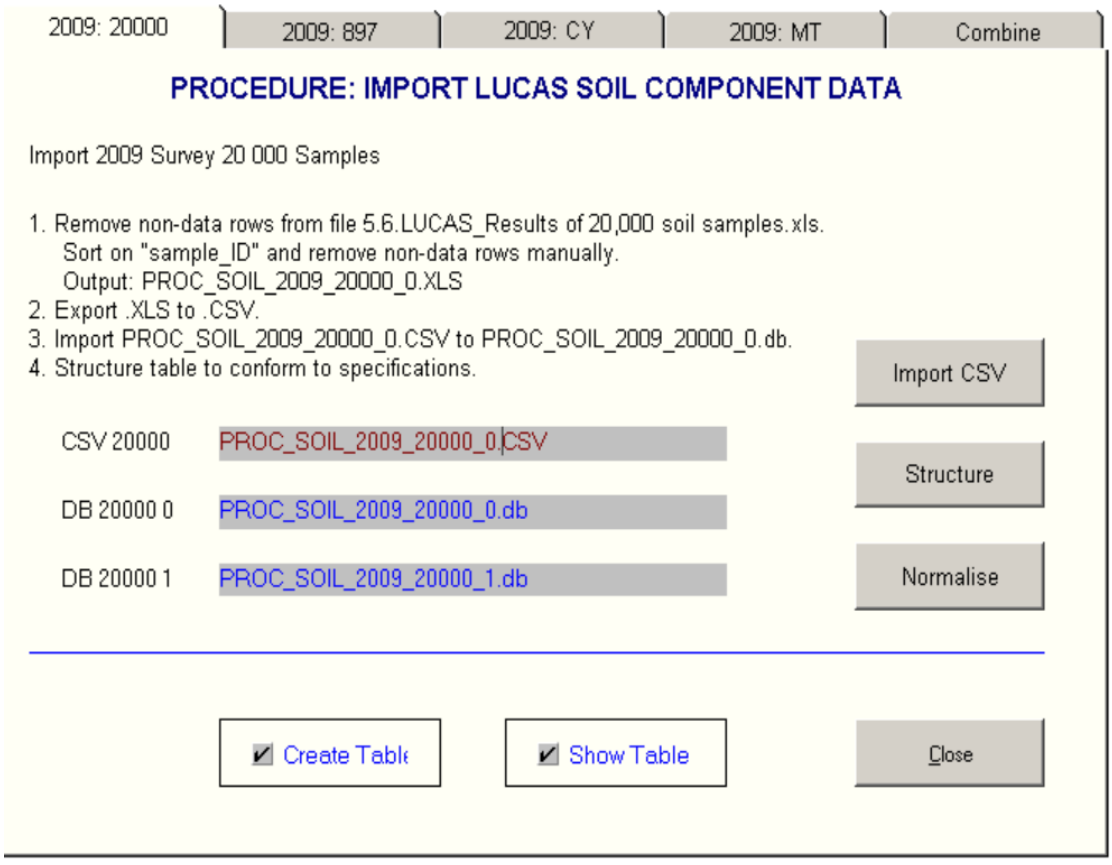


Figure 2: Form to Import LUCAS Soil Laboratory Results (Example: 2009 Data)

The import form reads the source data, which is always in an ASCII format (CSV). Although the original spreadsheet format could be imported it was found that each submission had a different arrangement with rows or columns hidden, set to 0 width and a fair spectrum of field names. Because of this variety the source data was converted to a common ASCII format, where the first line contains the name of the parameter as found in the source data and all other

rows are treated as records. All data are imported as alpha-numeric. This approach is needed to evaluate the data content. Otherwise the parser routine would remove any entries that do not comply to the field format. Similar to a spreadsheet file the RDB allows to set a field format to store any type of data yet this is not applicable for the evaluation purpose.

2.4.2 Data Evaluation Form

The imported data are then structured by converting the parameter names to standard field names based on a dictionary. Not modified is the order of the parameters in the source data, which is assessed as one of the checks of compliance. The structured data are then normalised to allow setting the rules of the evaluation RDB model. All data of the 2009 surveys are finally combined to a single table.

All evaluation checks are accessible from a single form, as shown in Figure 3.

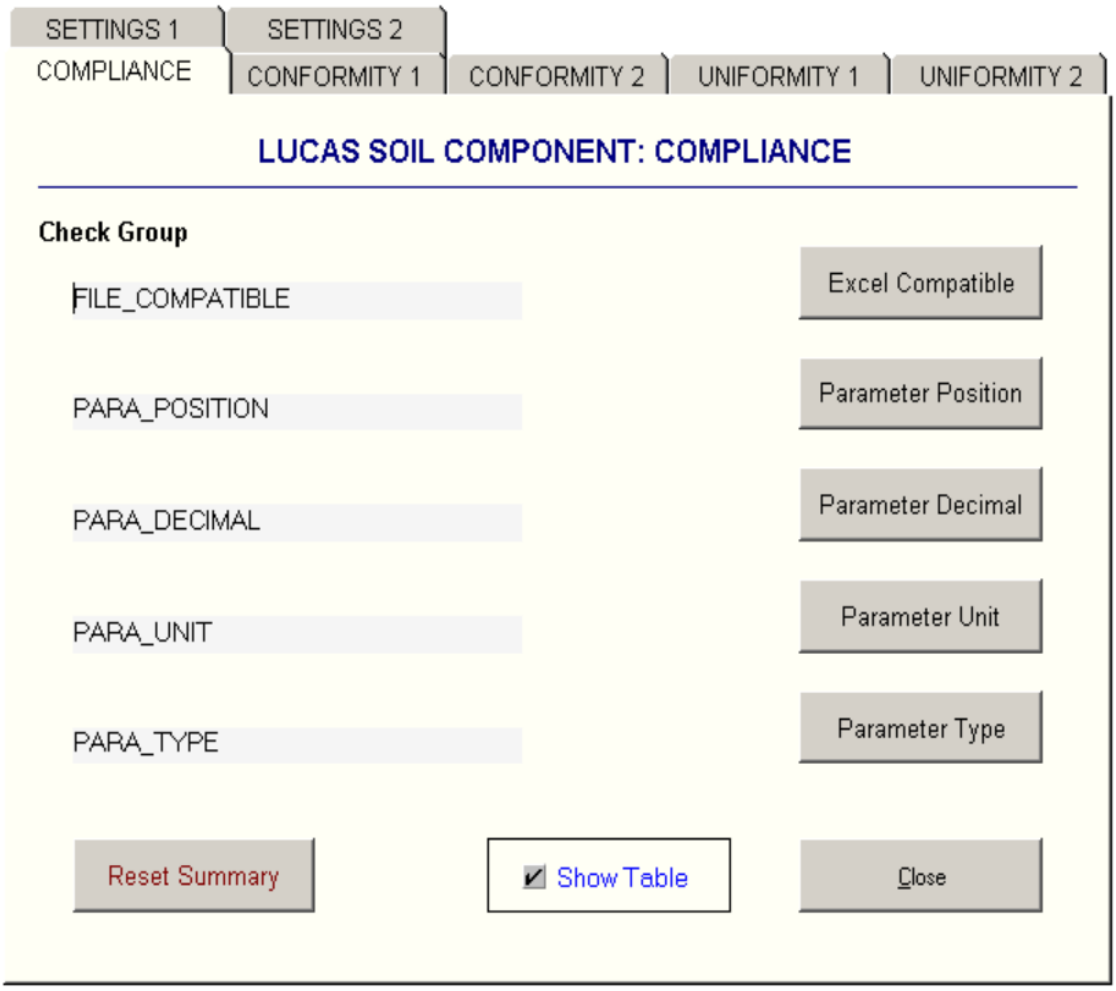


Figure 3: Form to run Evaluation Checks of LUCAS Soil Laboratory Results (all years)

The evaluation checks are independent of the year assessed. The survey years subjected to the checks are defined in the evaluation check list. The checks of each evaluation step are arranged in groups. The names of the groups as used in the evaluation check list are displayed on the form. For each group of checks the output is written to a results table. A summary of the check is also appended to a summary table. While the detailed results of the checks are attributes to the item or data assessed, the summary tables provide an overview of the findings and are mainly used in this report. As on other forms the "Settings" pages specify the processing environment, not the evaluation checks.

2.4.3 Data Standardisation Form

Somewhat beyond the scope of the evaluation task is provision of a the LUCAS Soil data in a standard format. This task involves modifying the data submitted and in some cases also removing data. The form to perform the task is presented in Figure 4.

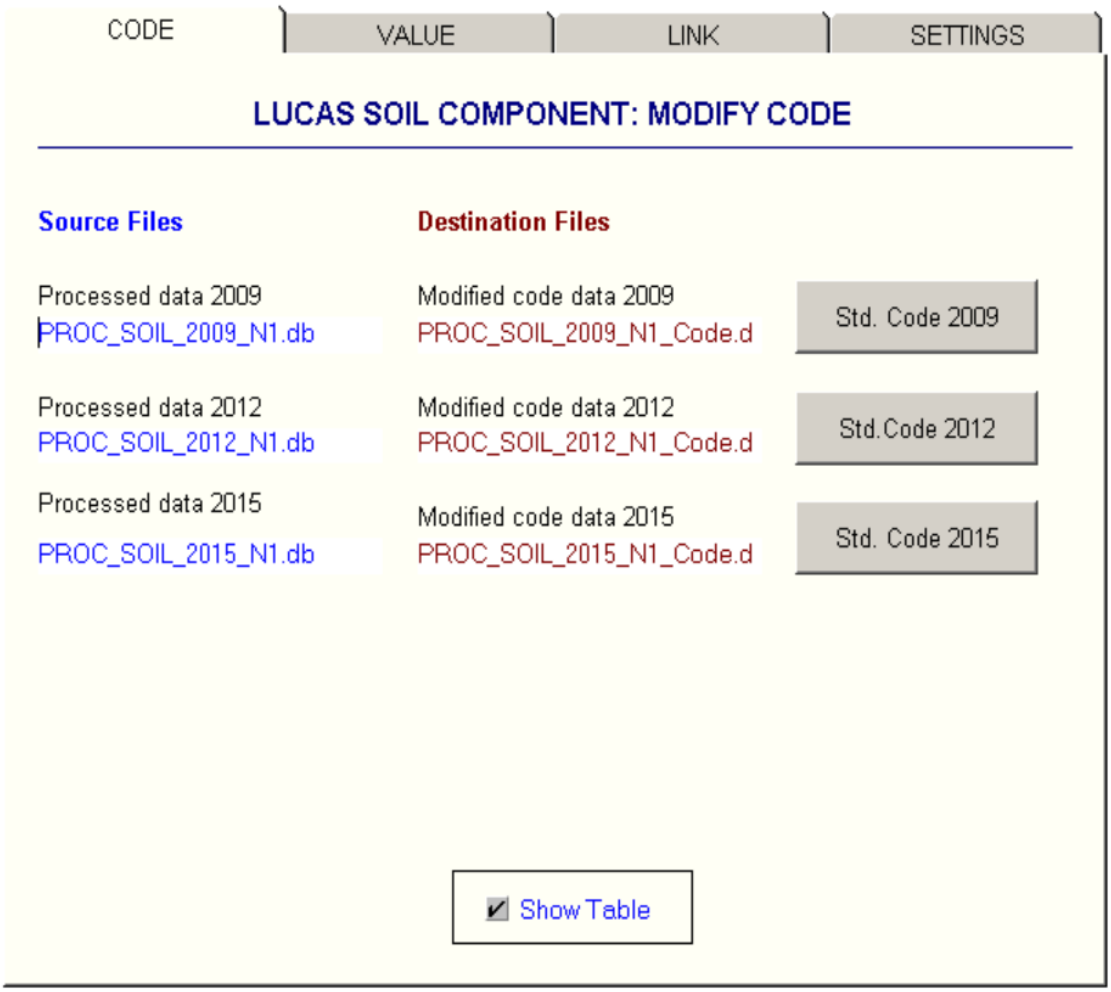


Figure 4: Form to Generate Standard Data of LUCAS Soil Laboratory Results (All Years)

The task is ordered into processing first codes, then values and finally links. The codes concern the application of a standard form of codes, mainly to indicate laboratory results below the limit of detection. The values indicated in the codes are not changed, only the way they are presented in the tables. The values of results submitted can be changed from options available from the corresponding page on the form. One such change is the adjustment of the results reported for *total nitrogen* for the 2012 surveys or converting all values to a common decimal separator. The standard data are then linked to data from the LUCAS main survey to provide spatial reference and information on land cover and use.

3 Evaluation Checks

In this chapter details on the checks applied to evaluate LUCAS Soil component data are presented by step and group. Although the checks are independent of the survey year, different specifications apply to each year.

3.1 Compliance Checks

Data format specifications for Compliance Checks for the LUCAS Soil laboratory data are taken from tender and meeting documents. The soil properties analysed in the laboratory did not follow a specific naming convention. Each delivery used a different naming convention, which makes identifying the data and transferring the values to a more structured form more difficult. A standard naming convention for the results of the parameters reported by the laboratory was defined.

Mandatory parameters specified in the tender documents were (with standard label and used as field names) are given in Table 1.

Table 1: Mandatory and Supplementary Soil Parameters to be Reported by the Central Laboratory

Parameter Name	Label
Mandatory parameters:	
Coarse fragments	*CF*
Clay content	*CLAY*
Silt content	*SILT*
Sand content	*SAND*
pH($CaCl_2$)	*PH_CACL2*
pH(H_2O)	*PH_H2O*
Organic carbon	*OC*
Supplementary parameters:	
Carbonate content	*CACO3*
Total Nitrogen content	*N*
Soluble Phosphor content	*P*
Extractable potassium	*K*
Cation Exchange Capacity	*CEC*

For the laboratory analysis of the 2015 data the parameter *Electric conductivity* (*EC*) was added. The method used to determine the mandatory parameter *OC* (indirect method, ISO 10694) requires the analysis for the supplementary parameter Carbonates as a fundamental part. The measured *total carbon* is generally not supplied by the laboratory. Also included should be a column on

comments and remarks. The contents of the data were not evaluated. Not evaluated at all were the results from the multi-spectral analysis.

The checks of data Compliance are divided into 5 groups:

- File delivery format;
- Position of parameters in file;
- Decimals reported for parameter;
- Reporting unit;
- Parameter value type.

The specifications that define the parameters for the Compliance checks are taken from project documents. All relevant attributes are transferred to dictionary tables and conditions are stored in the evaluation list table.

Specifications for Conditional Coding

Not included in the specifications are any details related to the coding of analysis results below the *Limit of Detection* (LOD), missing data or data formats[8]. Missing data occur frequently for data on the particle size distribution for organic soils. Some checks concerning the prospect of linking the soil analysis to the main LUCAS survey are defined, but were not specified for the deliverables of the soil analysis results.

3.1.1 Specifications of Compliance Checks of 2009 Data

Formal specifications of data deliverables for the 2009 laboratory data were taken from the following documents;

- The contract documents contain specifications on data layouts and delivery formats (JRC, 2009).
  File: *SGS_contract_385355_including_tender_and_offer.pdf*
- Preliminary Test Plan 2009
  File: *LUCAS_soil_Preliminary_Test_Plan .pdf*
- Final Test Plan 2009
  File: *5.8.2.LUCAS_Final_Test_Plan.pdf*
- Kick-off Meeting minutes, 08.01.2010
  File: *LUCAS_Kick-off_meeting_minutes.pdf*
- Final Project Report15.06.2011
  File: *5.10.LUCAS_Final Report_15June2011.PDF*

During the Kick-off Meeting on 08.01.2010, Ispra, some additional specifications were set for 2009 (SGS, 2010). Relevant to OC is that for samples for organic soils ("very high organic matter") a texture analysis was not needed.

[8] The file *Contents-LUCAS-primary-data-2009-20140618-0.xls* specifies the data format for the field [SOIL_LABEL] as "Number". Yet, not all identifiers of samples for results from the analysis of soil samples comply with a numeric format in column "sample ID".
http://ec.europa.eu/eurostat/documents/205002/208938/Contents-LUCAS-primary-data-2009-20140618-0.xls/27fe0910-4150-4299-9e89-8cc0adf73d83

File Delivery Format

Where specifications were given for the delivery file format they state "*100% Excel-compatible*" in all documents.

Position of Parameters in Files

A consistent position of the values reported in the file submitted may seem trivial, but is of consequence when the position of a parameter in a table changes between submissions. This may be obvious in some cases, where the range of data is significantly different, but less so where the ranges overlap, such as soil particle size or pH.

To avoid changes in a position in the source file data are imported into the evaluation database by name, not position. In the normalised form this aspect becomes irrelevant.

The specifications relative to the position of reporting a parameter in the files is given in Table 2.

Table 2: Position of Soil Parameters in Submitted File (2009)

Parameter	**Document**				**Check**
Label	*Contract*	*Preliminary Test Plan*	*Final Test Plan*	*Final Report*	
SOIL_ID	1				1
CF	*				2
CLAY	2				3
SILT	3				4
SAND	4				5
PH_CACL2	5				6
PH_H2O	6				7
OC	7				8
CACO3	8				9
N	9				10
P	10				11
K	11				12
CEC	12				13

* 2009: The order of parameters specified under Section 4.1 of the contract was later modified to allow for the parameter "coarse fragments" to be included, which is reported in column 2.
2015: The order of the parameters specified was altered during the Kick-off Meeting of 07.12.2016 to include the parameter LAB_ID.

The tender documents omitted to include the parameter CF in the specifications. When CF was reported as the second column, all subsequent parameters were shifted to a position outside the specifications.

Decimals Reported for Parameter

The number of decimals for the values reported in the submitted file were specified in the tender and contract documents, but also the Final Report. The specifications for decimals of the parameters reported are given in Table 3.

Table 3: Decimals for Soil Parameters in Submitted File (2009)

Parameter	**Document**				**Check**
Label	*Contract*	*Preliminary Test Plan*	*Final Test Plan*	*Final Report*	
CF	0			0	0
CLAY	0			0	0
SILT	0			0	0
SAND	0			0	0
PH_CACL2	1			**2**	1
PH_H2O	2			2	2
OC	1			1	1
CACO3	0			0	0
N	**0**			1	1
P	1			1	1
K	1			1	1
CEC	1			1	1

The changes made to the decimals of the values reported from the Tender Specifications to the specifications given in the *Final Report* are reasonable. There is no basis for reporting pH($CaCl_2$) and pH(H_2O) with different decimals or *total nitrogen* without a decimal, given the reporting unit. Not evident is why $CaCO_3$ should be reported without decimal, but OC with one decimal. OC is derived from $CaCO_3$, so can never have more significant decimals than the parameter it is derived from when the same reporting units are used.

Reporting Unit

The units for reporting the results of the laboratory analysis were specified in the tender and contract documents, and repeated in the *Final Report*. On overview of the reporting units specified in the documents is given in Table 4.

Table 4: Units for Soil Parameters in Submitted File (2009)

Parameter	**Document**				**Check**
Label	*Contract*	*Preliminary Test Plan*	*Final Test Plan*	*Final Report*	
CF	%			%	%
CLAY	%			%	%
SILT	%			%	%
SAND	%			%	%
PH_CACL2					
PH_H2O					
OC	g kg^{-1}			g kg^{-1}	g kg^{-1}
CACO3	g kg^{-1}			g kg^{-1}	g kg^{-1}
N	g kg^{-1}			g kg^{-1}	g kg^{-1}
P	mg kg^{-1}			mg kg^{-1}	mg kg^{-1}
K	mg kg^{-1}			mg kg^{-1}	mg kg^{-1}
CEC	cmol(+) kg^{-1}			cmol(+) kg^{-1}	cmol(+) kg^{-1}

The units for all parameters are consistently presented in the documents. The units used for the checks were set accordingly.

Parameter Data Type

For the values submitted no specifications were defined for the data type. Specifying a data type or a dimension for a parameter would seem unwarranted for the file format. The spreadsheet format can store data of type 'any-type' in a cell and the dimension of a numeric value is given by the decimals. Other than storing a value the cell content can also be formatted. The value visible is thus not necessarily the value stored, but may the the value when exporting data from the spreadsheet to an ASCII format, such as CSV.

The results reported are mainly numeric, but specific conditions, such as values below the limit of detection, are recorded as alpha-numeric codes. These codes are neither specified, nor are they standardised or consistently documented. Depending on the software package used and the local configuration, the presence of these alpha-numerics in an otherwise numeric field can lead to abnormal results.

3.1.2 Formal Data Specifications 2012

For the results of the laboratory analysis of the 2012 LUCAS Soil surveys (Bulgaria and Romania) no further details on data formats specifications could be found. It seemed reasonable to apply the same criteria as for the 2009 data.

3.1.3 Formal Data Specifications 2015

The specifications for the 2015 data defining the checks of data compliance were taken from the following documents:

- Annex I to Service Contract 930131
  File: Contract 930131 LUCAS Vol II.pdf (JRC, 2016).

- Preliminary Test Plan 07.12.2016
  File: Preliminary Test Plan 07.12.2016..pdf

- Template Specimen 07.12.2016
  File: 5_Template_specimen.pdf

- Final Technical Report
  File: 5.12_LUCAS_2015_Final_Technical_Report.pdf

For the parameters to be analysed of the 2015 LUCAS Soil samples the mandatory and supplementary parameters of 2009 were assembled into one group of core parameters. The parameter of *Electric Conductivity* (standard label: *EC*) was added. The need to link the [Soil-ID] code to the LUCAS database is explicitly stated.

File Delivery Format

As for the results of the 2009 laboratory analysis, the specifications for the delivery file format state "*100% Excel-compatible*" in all documents.

Position of Parameters in File

The order of the results reported by the laboratory was more explicitly indicated in the Technical Specifications to the Tender for the 2015 survey data than 2009 (p. 13 of Annex I of contract 930131).

The specifications for the position of the parameters the file are summarised in Table 5.

Table 5: Position of Soil Parameters in Submitted File (2015)

Parameter	**Document**				**Check**
Label	*Contract*	*Preliminary Test Plan*	*Template Specimen*	*Final Report*	
SOIL_ID	1		2		2
CF	2		3		3
CLAY	3		4		4
SILT	4		5		5
SAND	5		6		6
PH_CACL2	6		7		7
PH_H2O	7		8		8
EC	8		9		9
OC	9		10		10
CACO3	10		11		11
N	12		13		13
P	11		12		12
K	13		14		14
CEC	14		15		15

Compared to the 2009 specifications the parameter *CF* was included, a position for *EC* was inserted and a last field for comments and remarks was also specified for column 15.

A notable deviation from the order of reporting parameters in 2015 to 2009 is the inversion of *N* and *P*. In the document "*5_Template_specimen.pdf*" the first column contains a laboratory ID.

The change to the order of parameters was presented during the Kick-off Meeting on 07.12.2016. As a result, the positions of the parameters reported is shifted by one position from the tender specifications. The rules for the check were defined as specified in the contractual document.

Decimals Reported for Parameter

The decimals to be used to report the results of the laboratory analysis for the "*Template Specimen*" document were taken from the decimals of the model values given in the table. The specifications for the decimals in which results are to be reported are given in Table 6.

Table 6: Decimals for Soil Parameters in Submitted File (2015)

Parameter	**Document**				**Check**
Label	*Contract*	*Preliminary Test Plan*	*Template Specimen*	*Final Report*	
CF	0		0	0	0
CLAY	0		0	0	0
SILT	0		0	0	0
SAND	0		0	0	0
PH_CACL2	1		1	1	1
PH_H2O	2		2	2	2
EC	2		2	2	2
OC	1		1	1	1
CACO3	0		0	0	0
N	0		0	1	1
P	1		1	1	1
K	1		1	1	1
CEC	1		1	1	1

For the number of decimals the *Final Report* states that the results for N should be reported with one decimal (p. 70), rather than without decimal as defined in the *Technical Specifications* and the *Template Specimen* documents. This rule was used for the checks of the data.

Reporting Unit

The units for reporting the results from the laboratory analysis were specified in several documents. No inconsistencies between the documents were found. The reporting units specified in the various documents are summarised in Table 7.

Table 7: Units for Soil Parameters in Submitted File (2015)

Parameter	**Document**				**Check**
Label	*Contract*	*Preliminary Test Plan*	*Template Specimen*	*Final Report*	
CF	%		%	%	%
CLAY	%		% m/m	%	%
SILT	%		% m/m	%	%
SAND	%		% m/m	%	%
PH_CACL2					
PH_H2O					
EC	mS m^{-1}		mS m^{-1}		mS m^{-1}
OC	g kg^{-1}		g kg^{-1}	g kg^{-1}	g kg^{-1}
CACO3	g kg^{-1}		g kg^{-1}	g kg^{-1}	g kg^{-1}
N	g kg^{-1}		g kg^{-1}	g kg^{-1}	g kg^{-1}
P	mg kg^{-1}		mg kg^{-1}	mg kg^{-1}	mg kg^{-1}
K	mg kg^{-1}		mg kg^{-1}	mg kg^{-1}	mg kg^{-1}
CEC	cmol(+) kg^{-1}		cmol(+) kg^{-1}	cmol(+) kg^{-1}	cmol(+) kg^{-1}

The reporting units for the 2015 LUCAS Soil data agree with those specified for the 2009 data.

Parameter Data Type

The file format used (spreadsheet) to store the results of the laboratory analysis does not impose a format type for a parameter. Consequently, there are no specifications of a format type for the parameters. The only parameter for which a format should be specified is the sample identifier. The identifier links the soil data to the LUCAS main survey,which is of type integer. By extension, this format should be applied to the identifier of the soil sample in the laboratory data. For 2015 the results table contains an identifier given by the laboratory in addition to the soil label. This additional identifier in not included in the evaluation.

3.2 Conformity Checks

The Conformity Checks evaluate actual values reported in the data delivered. They are intended to highlight conditions where values are not defined or are outside possible ranges. Codes or identifiers that are not defined generally lead to a warning, while data out of range are considered errors. The range limits are thus set with the aim to exclude impossible values, not to define a range of credible values.

The checks of data Compliance are divided into two sections with 5 groups in each section:

3.2.1 Section 1: Data Structure

The status of data integrity is largely governed and assessed by the rules of the data model of the evaluation RDB.

The groups of checks performed under the section are:

- Duplicate DMT link data (key violation;
- Duplicate LAB link data (key violation);
- Duplicate textural and pH data;
- Duplicate chemical data;
- LAB-DMT link (referential integrity).

DMT here refers to the data of the LUCAS Data Management Tool (Eurostat, 2018). The data is provided by Eurostat to allow linking the soil data to geographic locations and information collected at the points of the LUCAS LUC survey.

The aspect of duplicate records can be assessed by a count of unique entries in a link field. The conditions of key violations are assessed by the rules of referential integrity. Respecting referential integrity is a requirement for relating soil data to spatial locations and information collected for other LUCAS surveys. The DMT data, also those related to soil, are not part of the evaluation, but used to generate a standard data set that allows unambiguous links to the LUCAS land use/cover data that describe the points of the soil sample location.

3.2.2 Section 2: Data Status

The checks of this section evaluate the degree to which data entries agree with expected codes, values or ranges of values.

The groups of checks performed under the section cover:

- Missing data;
- Code for LOD;
- Intrinsic Numeric range;
- Minimum LOD;
- Expected range.

For the first four groups of checks the reference entries are well-defined. The upper and lower limits of the expected range of values are set based on the statistical distribution of the values reported from other large-scale soil surveys. For the evaluation different limits are set for mineral soils and soils high in organic material.

Missing Data

The documents do not specify codes to indicate occurrences of missing data. The checks identify the occurrences, but in the absence of a reference these are not further evaluated.

Code for LOD

The project documents or reports detailing the laboratory methods contain codes and values for limits of detection (LOD). These limits are not in all cases identical between documents and surveys. For the 2009 LUCAS Soil survey the specifications are summarised in Table 8.

Table 8: Limit of Detection for Soil Parameters (2009)

Parameter	**Document**				**Check**
Label	*Contract*	*Preliminary Test Plan*	*Final Test Plan*	*Final Report*	
CF					
CLAY		0.1 %			
SILT		0.1 %			
SAND		0.1 %			
PH_CACL2			2 – 10 pH	2 – 10 pH	2 – 10 pH
PH_H2O			2 – 10 pH	2 – 10 pH	2 – 10 pH
OC			2 g kg^{-1}		2 g kg^{-1}
CACO3		0.1 %	1 g kg^{-1}	1 g kg^{-1}	1 g kg^{-1}
N		0.5 g kg^{-1}	0.2 g kg^{-1}	0.2 g kg^{-1}	0.2 g kg^{-1}
P		3 – 5 mg kg^{-1}	5.0 mg kg^{-1}	10.0 mg kg^{-1}	10.0 mg kg^{-1}
K		20 mg kg^{-1}	10.0 mg kg^{-1}	10.0 mg kg^{-1}	10.0 mg kg^{-1}
CEC			2.0 cmol(+) kg^{-1}	2.0 cmol(+) kg^{-1}	2.0 cmol(+) kg^{-1}

For the LODs of the parameters *N*, *P* and *K* different documents gave different values[9]. The last column of the table contains the values used in the checks, which were given in the *Final Report*.

For data from the 2012 LUCAS Soil survey (Bulgaria and Romania) any documents specifying methods or results were missing. In the absence of a *Test Plan* or a detailed *Final Report* the LOD values were extracted from the range of values and the codes used in the data. The values used are given in Table 9.

[9] One difference noted between monthly data tables and the final data is the indicator given for the limit for measuring soluble phosphor (P): the monthly data files indicate "< 5,0" while the final data contains the indicator "< 10.0". The use of a "." (point) or a "," (comma) as decimal separator is consistent in the data, but not all indications of measurement limits. This is not considered of relevance to this data evaluation.

Table 9: Limit of Detection for Soil Parameters (2012)

Parameter	**Document**				**Check**
Label	*Contract**	*Preliminary Test Plan*	*Final Test Plan*	*Final Report*	
CF					
CLAY		*			
SILT		*			
SAND		*			
PH_CACL2		*			2 – 10 pH
PH_H2O		*			2 – 10 pH
OC		*			6 g kg^{-1}
CACO3		*			0.5 g kg^{-1}
N		*			0.2 g kg^{-1}
P		*			5.0 mg kg^{-1}
K		*			10.0 mg kg^{-1}
CEC		*			2.0 cmol(+) kg^{-1}

* no contractual information available

For the 2015 survey data the LOD values given in the documents are summarised in Table 10.

Table 10: Limit of Detection for Soil Parameters (2015)

Parameter	**Document**				**Check**
Label	*Contract*	*Preliminary Test Plan*	*Template Specimen*	*Final Report*	
CF					
CLAY					
SILT					
SAND					
PH_CACL2					2 – 10 pH
PH_H2O					2 – 10 pH
EC					2 mS m^{-1}
OC					2 g kg^{-1}
CACO3		0.1 %			1 g kg^{-1}
N		0.5 g kg^{-1}			0.2 g kg^{-1}
P		3 – 5 mg kg^{-1}			10.0 mg kg^{-1}
K		20 mg kg^{-1}			10.0 mg kg^{-1}
CEC					2.0 cmol(+) kg^{-1}

The values for the LOD were not specified in the *Final Report* for the analysis of the 2015 data, in contrast to the 2009 data analysis. Values for the LODs are given in the *Preliminary Test Plan* for 2015 and correspond to the LODs given in the *Preliminary Test Plan* for 2009. These values specified for LOD in 2015 are lower and are not in line with the limits given in the *Final Report* for 2009 or the laboratory methods, where specified. As a practical solution to the lack or inconsistent presentation of the LODs for 2015, the LOD limits of 2009 were used for the checks.

Intrinsic Number Range

The intrinsic number range is governed by the data unit used to report the analysis results. It consists of a minimum and maximum value that limit the possible range of reported results. For none of the values evaluated can the minimum be negative. Any negative values can only signify a specific condition, but not a result of the laboratory analysis. The maximum values are generally given by the reporting units. For the particle sizes the results are reported in percent, which limits the maximum to a value of 100. Any values outside the intrinsic number range are flagged as errors.

The values used for evaluating the intrinsic range are presented in Table 11.

Table 11: Intrinsic Number Range for reporting Soil Parameters

Parameter	Unit	Lower Limit	Upper Limit
CF	%	0	100
CLAY	%	0	100
SILT	%	0	100
SAND	%	0	100
PH_CACL2	pH	0	14
PH_H2O	pH	0	14
OC	g kg^{-1}	0	1000
CACO3	g kg^{-1}	0	1000
N	g kg^{-1}	0	1000
P	mg kg^{-1}	0	1000000
K	mg kg^{-1}	0	1000000
CEC	cmol(+) kg^{-1}	0	1000000

The values for the parameters for the texture parameters are reported in integer values. This can lead to rounding imprecisions when calculating the sum of all texture values and an upper limit of 101 could be appropriate.

Minimum LOD

Any value below the LOD should be recorded as the code for the LOD. In case a value smaller than the LOD is recorded a warning is set for the value reported. The warning includes occurrences of the value zero (0) for parameters. However, a value of zero can be a valid result even when a LOD is set. This may happen when the LOD is < 1 and the field format is an integer, as in the case of *coarse fragments*. Under these conditions an entry of zero is not highlighted.

The documents do not specify LOD codes for all parameters measured and all years processed. There is also a difference between the LOD codes given in the various documents and those present in the data. To properly identify cases where an reported value is less than the LOD the codes actually present in the data have to be assessed, in addition to the ones documented.

The entries found in the data that were not numeric entries are listed in Table 12.

Table 12: Codes Present in Data for Test of Soil Parameter Value < LOD for Conformity Check

Parameter	Survey Year					
	2009		2012			2015
Label	*Code 1*	*Code 2*	*Code 1*	*Code 2*	*Code 3*	*Code*
CF	< 1					0
CLAY	< 1	-	-999			0
SILT	< 1	-	-999	-44	-5	0
SAND		-	-999			
PH_CACL2			-999			
PH_H2O			-999			
EC			-999			
OC	< 2.0	< 2,0	-999	<6		
CACO3	< 1		-999	<0.5		0
N	< 0.2	< 0,2	-999			0
P	< 10.0	< 10,0	-999	<5		0
K	< 10.0		-999			0
CEC	< 2.0	< 2,0	-999			0

The methods applied to record cases where measurements resulted in values below the LOD vary between years, but for 2009 also between sources.

2009 Survey Data

CF contains a code of "< 1" and no values of zero (0). *CLAY* and *K* contain an entry of "*no more soil*". *SAND* contains neither a code indicating a LOD, nor a value of zero (0). For *OC*, *N*, *P* and *CEC* the LOD code using a comma (",") as a decimal originates from the additional 897 sample data.

2012 Survey Data

There is no code "*-999*" for the parameter *CF*, as for other parameters of that year. The values for *SILT* contain entries of "*-999*", but also two negative values (-44; -5). The latter are in all probability data errors, not codes. *CLAY* and *SAND* contain entries of zero (0), but not *SILT*.

The parameters *N* and *K* only have a code "*-999*" attached, but no code was found for a LOD. The LOD code for *P* in the data is "<5". *CEC* has a value of "*-999*" attached, contains instances of a value = 0, but no code indicating a LOD.

The LOD codes for *OC*, *CACO3* and *P* are at odds with the LODs for the other surveys. From the limits indicates in the data one could infer that

different laboratory methods were used to measure the soil properties. In the absence of such documents this remains conjecture.

In the evaluation values of "*-999*" are treated as missing data in all cases. Since these values co-exist with codes indicating the LOD they should not be interpreted as substitutes for a LOD code.

2015 Survey Data

In general, the data do not contain codes that would indicate the LOD or missing data. *CLAY* and *SILT* contain values of zero (0), but not *SAND*. *CACO3* contains entries of zero (0), but not *OC*. The values for the parameters *N*, *P*, *K*, *CEC* contain values of zero (0), but not *EC*. An entry of "**3.3*" for the parameter *CEC* is in all likelihood an erroneous entry for a value.

Occurrences of slightly varying alpha-numeric codes, as found for 2009, require only simply means for their identification. However, the use of actual numeric values as codes, as in 2012 and 2015, is potentially problematic. This is the case when comparing data from different surveys, because codes for reporting cases of measurements below the LOD were used for reporting data in 2009.

Expected Value Range

The expected range for values is within a minimum and maximum span of values that are based on a typical range as found in the 2009 and 2015 LUCAS Soil surveys. The minimum value of the expected range was set to the *Limit of Quantification* (LOQ). The value was calculated by multiplying the value of the LOD by 3.3. This procedure is also used by ICP Forests for the evaluation of Soil Condition data (ICP Forests Manual XVI, p.). For the pH parameters this procedure cannot be applied and a 0.25% quantile *($Q_{0.025}$)* is used. A quantile of 97.5% ($Q_{0.975}$) is used to determine the upper range of expected values for all parameters. Where the LOQ is less then the $Q_{0.025}$, the quantile is used

The values used for the evaluation are presented in Table 13.

Table 13: Lower and Upper limits for Expected Value Range for $Q_{0.025}$ and $Q_{0.975}$

Parameter	Year	Unit	Lower		Upper	
			Mineral	*Organic*	*Mineral*	*Organic*
PH_CACL2	2009	pH	3.3	2.8	7.6	6.6
	2015	pH	3.5	2.9	7.7	7.0
PH_H2O	2009	pH	4.1	3.6	8.3	6.9
	2015	pH	4.1	3.7	8.2	7.2
OC	2009	g kg^{-1}	5.3	120.0	120.0	531.3
	2015	g kg^{-1}	4.6	120.0	120.0	524.2
CACO3	2009	g kg^{-1}	1.0	1.0	553.0	314.6
	2015	g kg^{-1}	1.0	1.0	603.2	197.0
N	2009	g kg^{-1}	0.6	3.1	5.9	25.1
	2015	g kg^{-1}	0.6	5.4	6.8	29.1
P	2009	mg kg^{-1}	10.7	11.1	115.2	124.1
	2015	mg kg^{-1}	4.9	11.7	108.2	165.0
K	2009	mg kg^{-1}	24.5	39.5	714.6	653.1
	2015	mg kg^{-1}	19.4	44.6	643.0	674.1
CEC	2009	cmol(+) kg^{-1}	2.8	8.4	37.4	101.5
	2015	cmol(+) kg^{-1}	2.5	7.0	42.0	86.7
EC	2015	mS m^{-1}	3.4	12.1	84.3	236.8

red: LOD
blue: < LOQ

The table provides the quantiles for data from the 2009 and 2015 surveys. For most parameters the differences in the quantile values between the two surveys are small. A notable difference was found for *CACO3* for organic soils and, to a lesser degree, for *extractable phosphor*, for mineral and for organic soils.

In several cases the lower limit quantile is below the LOD (values in blue) and at the LOD (values in red). For *CACO3* this is unavoidable due to the large number of samples with very low carbonate content. For *soluble phosphor* the value of the lower limit is rather unexpected.

3.3 Uniformity Checks

Checks of data Uniformity cover aspects of relationships between parameters for a given survey year and temporal consistency of specifications and values over several surveys. For temporal consistency of values the location of the soil sample plots and data from the LUCAS LUC survey are used.

The Uniformity checks are divided into two sections.

3.3.1 Section 1: Multi-parameter, Single Survey

The checks in Section 1 evaluate the consistency of the values reported for a parameter within a survey.

C:N Ratio

The C:N Ratio in mineral topsoils generally ranges from 15-20 and decreases with soil depth. The C:N Ratio for the evaluation was computed from the OC content and the values for total nitrogen. Following the sampling procedure of the LUCAS Soil component surveys the C:N Ratio refers to the soil stratum of the soil profile. Where present litter or partially decomposed organic material overlaying the soil stratum should have been removed. This reduces the expected rage for the C:N Ratio compared to samples for forests soils.

Difference between pH($CaCl_2$) for pH(H_2O)

A difference between pH($CaCl_2$) for pH(H_2O) is inherent to the measurement methods. However, the value for pH($CaCl_2$) should always be ≤ the value for pH(H_2O) and the difference should not exceed 1.2 *pH* units.

Value of pH($CaCl_2$) for $CaCO_3$

With an increasing presence of $CaCO_3$ the soil pH should decrease. At pH($CaCl_2$) below 6 the presence of carbonates should be at the LOD for the parameter. A distinction in the relationship is made between samples form mineral soils and samples from soils high in OC. For samples high in *OC* the limit is set 0.5 pH units below the limit used for mineral soils (source: ICP Forests Manual XVI).

$CaCO_3$ for pH($CaCl_2$)

A relationship between the presence of carbonates and pH exists also for soils with measurable amounts of carbonates. Where carbonates are above the LOD the soil pH measured as pH($CaCl_2$) should be above 6 for mineral soils and 0.5 pH units lower than for mineral soils for those high in OC.

OC < LOD($CaCO_3$)

A special case of a value below the LOD for a measurement is the LOD for OC. OC is not measured directly, but calculated as the difference between total carbon and inorganic carbon. The formula used to calculate OC is:

$$OC = \frac{TC - 0.12 * C(CaCo_3)}{\text{dry matter (\%)}} * 100 \; [g\ kg^{-1}]$$

with

OC: OC content in the air-dried soil sample [*g kg^{-1}*]

TC: total carbon content [*g kg^{-1}*]

$C(CaCO_3)$: carbonate content [*g kg^{-1}*]

(source: SGS, 2011)

As a result of the method used to determine OC in the samples the LOD of OC, and hence the values reported for OC, cannot be less than the higher value of the LOD for measuring carbonates or total carbon. The only LOD stated for determining total carbon content was 2 *g kg^{-1}*, as given in the *2009 Final Report*.

3.3.2 Section 2: Single Parameter, Multiple Surveys

The checks in Section 2 assess the temporal stability for parameters that can be presumed stable between surveys, such as *pH*, or the detection of change for more dynamic parameters, such as *OC*.

OC Change from/to Mineral or High in Organic Carbon

Over the 6 years between of the main LUCAS Soil surveys no radical changes in OC would be expected. Except for extreme cases of land use changes there should be no conversion of an organic soil to a mineral soil. A change from a mineral soil to a soil high in organic matter or an organic soil would be even more unlikely without major soil disturbances. This check highlights conditions, where the material samples changes from mineral to organic. To avoid including changes in the interim phase the limit for mineral soils was set to 120 *g C kg^{-1}* and the limit for *OC* to 200 *g C kg^{-1}*.

Temporal Change of Parameters within Acceptable Range

Temporal changes in the values reported for a soil parameter between surveys should be limited. The range of plausible changes depends on the parameter. For soil physical parameters, such as texture, the changes should not exceed those expected from taking repeated samples at the same site. For soil chemical parameters the changes can be larger than the variation in repeated samples, but still limited. Changes outside the expected range may be attributed to disturbances at the sampling site or that samples were taken at a different location.

Link to Eurostat Micro data

The results of the laboratory analysis of the LUCAS Soil component data do not contain any information on the geographic context of the sample location. Spatial locations, information on land use and cover, as well as

additional observations at a LUCAS point, are provided by the Eurostat micro-data, which is part of the LUCAS primary data[10]. Combining LUCAS Soil data with the information collected under the LUCAS LUC survey opens a whole new dimension of information. It allows to position the soil samples in the landscape and evaluate the effects of land use on soil properties. For this the soil properties have to be linked to the land use and cover information by an unambiguous link. The check verifies that valid links exist between the data provided by the laboratory, the DMT provided by Eurostat and the publicly available Eurostat micro-data. The check includes a test of the uniqueness of the point identifier in the micro-data and of the geographic co-ordinates of the points that are linked to the DMT.

Observation Distance

Taking soil samples requires a physical presence at the site of data collection. This is not strictly the case for sampling land use and cover data in the LUCAS LUC survey. The survey may report the properties of a location that is not physically accessible, but which can be determined from an observation point that is at some distance from the survey point.

The instructions for the LUCAS LUC survey allow a point of observation to be farther way than 100 m from the theoretical point, but for collecting soil samples this distance should be 100m or less (*14.4.3 Collecting the soil sample*, LUCAS2015_C1-Instructions_20150227.doc)[11].

In the evaluation it is assumed that the soil samples are taken at the location from which the LUCAS grid point was observed for the LUCAS LUC survey. It is further assumed that the land use / cover at the location where the soil sample was taken does not differ from the land use / cover of the LUCAS point and recorded in the LUCAS LUC survey.

For the main survey information on observation distance and direction to the nominal grid position are recorded and given in the data files in the field [OBS_DIST][12]. For the locations of soil samples taken outside the LUCAS LUC survey (Cyprus and Malta in 2009) this information is not available. The check highlights all cases where a soil sample is taken at an observation distance greater then 100 m (except for samples from Malta and Cyprus).

[10] URL: https://ec.europa.eu/eurostat/web/lucas/data/primary-data/2015

[11] URL: https://ec.europa.eu/eurostat/documents/205002/6786255/LUCAS2015-C1-Instructions-20150227.pdf

[12] [OBS_DIST]: Distance between theoretical and reached point in meters.

4 Data Evaluation Results

For the evaluation the data were analysed by year and survey. Thus, the three data sets for 2009 were processed separately, for 2012 data Bulgaria and Romania were processed individually, as were the data from the four Groups in 2015. This resulted in processing and comparing 9 sets of data for the evaluation.

The results of the laboratory analysis available to the evaluation differ in format, content or structure. In addition, over time numerous derivate versions have been generated, using different file formats and diverse reasoning for added processing. An overview of the data available is given in Annex I. No claims for completeness of the data sources are made.

Where possible the files submitted by the central laboratory were used. When data were available in more than one format the data in spreadsheet format was used. The information on the source file was added to the forms for importing data into the evaluation database.

The checks for data Compliance, Conformity and Uniformity Checks of Section 1 are applied to each survey or submitted data set. Because of the different periods of laboratory analysis the results of the evaluation checks are presented by survey year, which is subdivided by the provenance of the data.

The checks for data Uniformity under Section 2 include an evaluation of temporal changes of the soil parameters between surveys. The evaluation results are therefore presented by the type of check.

4.1 Compliance Checks

Compliance checks cover the adherence to formal specifications for the representation of the data in the files submitted.

4.1.1 Compliance Check Results for 2009 LUCAS Soil Surveys

The results of the Compliance Checks for the 2009 LUCAS Soil component survey for EU23 plus Cyprus and Malta are given in Table 14.

Table 14: Results of Compliance Check for 2009 LUCAS Soil Laboratory Data

Check	Cases	Check Label	Message
ID	*No.*		
1	1	EXCEL_COMPATIBLE	File not in 100% Excel-compatible format.
194	8	TYPE_CACO3_2009_CY	Character in data field CACO3.
195	7518	TYPE_CACO3_2009_D1	Character in data field CaCO3.
196	317	TYPE_CACO3_2009_D2	Character in data field CaCO3.
205	464	TYPE_CEC_2009_D1	Character in data field CEC.
206	7	TYPE_CEC_2009_D2	Character in data field CEC.
215	208	TYPE_CF_2009_D1	Character in data field coarse.
216	3	TYPE_CF_2009_D2	Character in data field coarse_fr.
222	5	TYPE_CLAY_2009_D1	Character in data field clay.
233	125	TYPE_K_2009_D1	Character in data field K.
242	2	TYPE_N_2009_CY	Character in data field N.
243	19	TYPE_N_2009_D1	Character in data field N.
253	43	TYPE_OC_2009_D1	Character in data field OC.
254	3	TYPE_OC_2009_D2	Character in data field OC.
282	47	TYPE_P_2009_CY	Character in data field P.
283	4496	TYPE_P_2009_D1	Character in data field P.
284	179	TYPE_P_2009_D2	Character in data field P.
285	2	TYPE_P_2009_MT	Character in data field P.
300	2	TYPE_SILT_2009_D1	Character in data field silt.
307	379	TYPE_SOIL_ID_2009_D1	Character in integer field sample ID.
308	66	TYPE_SOIL_ID_2009_D2	Character in integer field sample ID.

Note:
D1: Laboratory analysis of 20,000 samples
D2: Laboratory analysis of 897 additional samples

File Delivery Format

The file format "*XLS*" (Microsoft® Excel® 97 -2003 Workbook) could be used as source data in all case but one. For data from Malta the source was an ESRI® Shapefile[13]. This inconsistent format should not be attributed to the provider of the source data, because it is very unlikely that the laboratory provided the results of the analysis in this format. Unfortunately, the originally transmitted results for Malta could not be retrieved.

Position of Parameters in File

The checks did not highlight cases of inconsistent positions of parameters in the files. This is to some degree the result of the provisions made to allow importing the data of the spreadsheet files. The important aspect of the result is that the parameters are arranged in the order specified in the documents.

The data file *5.6.LUCAS_Results of 20,000 soil samples.xls* contains an additional column with reference to the country. This information can be used to identify conditions specific to a country, but because it is not specified it is not evaluated.

[13] Environmental Systems Research Institute, Inc., 380 New York Street, Redlands, CA 92373-8100 USA

Decimals reported for parameter

There are no apparent differences in the number of decimals between the specifications used for the check and values recorded in the files.

Reporting Unit

The data would appear to be reported in the units specified. The relevant information is available in some data files in the second row. In other cases it can be found in the project documents.

Parameter Type

The file format used to store the results of the laboratory analysis does not impose a format type for a parameter. The check determines if an entry in a parameter field is numeric or alpha-numeric. The occurrences of alpha-numeric entries in a parameter field are written to a table for further evaluation. This table gives an overview of all codes used in the parameter fields. The information is used at a later stage when standardising the parameter codes, for example to code cases of LOD.

The check highlighted 15,443 cases of alpha-numeric entries in a parameter field. The cases alpha-numeric entries and their number of occurrence are given in Table 15.

Table 15: Alpha-numeric Entries and Number of Occurrences in 2009 Data

Entry	Count	Entry	Count	Entry	Count
< 0,2	17	< 2,0	10	< 10,0	179
< 0.2	4	< 2.0	507	< 10.0	4,668
<0.5	681	<5	635	*3.3	1
< 1	8,060	<6	231	no more soil	3

The cases of alpha-numeric entries are treated as data errors only in one case ("**3.3*"). The entry "*no more soil*" does not trigger an error, but would have been more appropriately entered in the field for comments. All remaining cases indicate measurements with results below the LOD. The summary table shows that the indicator used as decimal point is a comma (",") or a fullstop ("."). The comma separator was used in the file containing the 897 additional samples, while the file with 20,000 samples used a fullstop (".").

There were 447 cases of alpha-numeric entries in the identifier field. In 333 cases a suffix "*UK*" was added to the identifier. In 41 cases a prefix "*L*" was used with a short number. The remaining cases are instances of a suffix "*A*" or "*B*", which would indicate the inner or outside sample bags. These cases were mainly present in the data of the additional 897 samples.

4.1.2 Compliance Check Results for 2012 LUCAS Soil Survey

For Bulgaria and Romania a LUCAS Soil component survey was organised as part of the main LUCAS survey in 2012. The results of the soil analysis were submitted as separate files for each country. The specifications for the analysis and data submission could not be retrieved. Therefore, and because the same central laboratory performed the analysis, it was assumed that they would correspond to those of the analysis of the 2009 samples.

A summary of the results of the data compliance evaluation of the data for Bulgaria and Romania are given in Table 16.

Table 16: Results of Compliance Check for 2012 LUCAS Soil Laboratory Data for Bulgaria and Romania

Check ID	Cases No.	Check Label	Message
42, 43	1, 1	DEC_N_2012_BG DEC_N_2012_RO	N not reported with 1 decimal.
58, 59	1, 1	DEC_PH_CACL2_2012_BG DEC_PH_CACL2_2012_RO	PH_CACL2 not reported with 2 decimals.
74, 75	1, 1	DEC_P_2012_BG DEC_P_2012_RO	P not reported with 1 decimal.
91, 92	1, 1	POS_CACO3_2012_BG POS_CACO3_2012_RO	CACO3 results not included as 9th parameter.
99, 100	1, 1	POS_CEC_2012_BG POS_CEC_2012_RO	CEC results not included as 13th parameter.
107, 108	1, 1	POS_CF_2012_BG POS_CF_2012_RO	CF results not included as 2nd parameter.
115, 116	1, 1	POS_CLAY_ID_2012_BG POS_CLAY_ID_2012_RO	CLAY results not included as 3rd parameter.
122, 123	1, 1	POS_K_2012_BG POS_K_2012_RO	Potassium results not included as 12th parameter.
135, 136	1, 1	POS_N_2012_BG POS_N_2012_RO	Nitrogen results not included as 10th parameter.
143, 144	1, 1	POS_OC_2012_BG POS_OC_2012_RO	OC results not included as 8th parameter.
158, 159	1, 1	POS_PH_CACL2_ID_2012_BG POS_PH_CACL2_ID_2012_RO	pH(CaCl2) results not included as 7th parameter.
161, 162	1, 1	POS_PH_H2O_2012_BG POS_PH_H2O_2012_RO	pH(H2O) results not included as 7th parameter.
169, 170	1, 1	POS_P_2012_BG POS_P_2012_RO	Phosphorous results not included as 11th parameter.
179, 180	1, 1	POS_SAND_ID_2012_BG POS_SAND_ID_2012_RO	SAND results not included as 5th parameter.
184, 185	1, 1	POS_SILT_ID_2012_BG POS_SILT_ID_2012_RO	SILT results not included as 4th parameter.
188, 189	1, 1	POS_SOIL_ID_2012_BG POS_SOIL_ID_2012_RO	Soil sample identifier not included as 1st parameter.
198	180	TYPE_CACO3_2012_BG	Character in data field CaCO3.
199	501	TYPE_CACO3_2012_RO	Character in data field CaCO3.
256	47	TYPE_OC_2012_BG	Character in data field OC.
257	184	TYPE_OC_2012_RO	Character in data field OC.
286	247	TYPE_P_2012_BG	Character in data field P.
287	388	TYPE_P_2012_RO	Character in data field P.
369	1	UNIT_N_2012_BG	N not reported in g kg-1.
370	1	UNIT_N_2012_RO	N not reported in g kg-1.

The source data for Bulgaria and Romania has the same format and the results of the checks are identical except in the number of occurrences.

File Delivery format

The data files used for the evaluation were *Bulgaria.csv* and *Romania.csv*. Files with an "*XLSX*" suffix also exist with an earlier date. However, these files contain unusual settings for cell formats and seem to have been

generated from other data and were, therefore, not used for evaluation. There is no difference in the arrangement of the data or the parameter names between the file types. Some fields in the spreadsheet files have been formatted to present 14 decimal places, such as the particle size data. These data are reported in integer values and the reason for the format settings are not obvious. These format settings were not found in the CSV files, which indicates that they were not generated directly from the spreadsheet files. Because XLS-compatible files are available the check for the file delivery format did not highlight any inconsistency, although a different file was used.

Position of Parameters in File

The file structure for the two files differs to some degree from the 2009 data: The first parameter is the LUCAS point identifier, second and third parameters are the projected point coordinates. The sample identifier [SOIL ID] is given as 17th parameter, followed by geographic coordinates, which in the absence of further information were taken to relate to the observation point.

Noteworthy is that the order of the values for *PH_CACL2* and *PH_H2O* are reversed in the files compared to the 2009 and 2015 data.

Decimals Reported for Parameter

For the number of decimals the 2009 specifications were applied. The checks highlighted three cases of inconsistent conditions:

- *N* was reported with 0 decimals instead of 1 decimal.
- *PH_CACL2* was reported with 1 decimal instead 2 decimals.
- *P* was reported with 0 decimals instead of 1 decimal.

The decimals for *total nitrogen* and pH($CaCl_2$) are those of the 2009 Contract, not of the 2009 *Final Report* and data. The 0 decimals for *soluble phosphor* are not specified or used in other data.

Reporting Unit

The reporting units of the results of the laboratory analysis are not obvious from the files. In this case the parameter values were compared to the values and units used for the 2009 data. A similar check is performed when evaluating the expected range of data under the Conformity checks. However, reporting *N* and *P* with 0 decimals is peculiar. The values for these parameters were therefore compared to values from other samples. For *P* the values are within the expected range of data, but the mean value for *N* for Bulgaria and Romania deviates by a factor of more than 50 from the mean of the 2009 data.

Because the check as implemented results in an error rather than a warning when a deviation is found and the importance of highlighting inconsistencies the unit for reporting laboratory results for *total nitrogen*

were intentionally set to deviate from the nominal entries, thus generating an error.

Parameter Type

The Compliance check on the parameter type highlighted 3 cases of deviations, which were:

Parameter	Country	Entry	Count
CACO3	Bulgaria	<0.5	180
	Romania	<0.5	501
OC	Bulgaria	<6	47
	Romania	<6	184
P	Bulgaria	<5	247
	Romania	<5	388

There are no differences in the cases found between the data for the two countries. The notable aspects about the results are:

- The values for the LOD indicated by the codes are markedly different between *CACO3* and *OC*.
- The values indicated for the LOD of *CACO3* and *OC* differ significantly from those specified for the 2009 laboratory measurements and used for 2015 results.
- The value indicated for the LOD of parameter P deviates from the value for 2009 and 2015 results.
- There are no non-numeric entries for any of the other parameters that could be interpreted as values of the parameter LOD.

The check raises some doubts about how trustworthy the values indicated for the parameter LODs are and, by extension, how comparable the 2012 LUCAS soil data for Bulgaria and Romania are to results from the 2009 and 2012 surveys.

4.1.3 Compliance Check Results for 2015 LUCAS Soil Survey

The results of the analysis of the 2015 LUCAS Soil component survey used in this evaluation were the files submitted by the central laboratory as the final data[14]. The file is in "*XLS-compatible*" format (JRC, 2016), but with a structure that differs from the 2009 data. The main changes are:

- The single file contains on separate pages the results of the laboratory analysis by submission Group.

[14] File name: 5.4_LUCAS_2015_Final_Results.xlsx

- The parameters measured by the laboratory differ between Groups.
- The parameter *Electrical conductivity* (*EC*) has been added to the data for all samples.

The results of the Compliance checks applied to the final data submission are summarised in Table 17.

Table 17: Results of Compliance Check for 2015 LUCAS Soil Laboratory Data

Check	Cases	Check Label	Message
ID	*No.*		
93	1	POS_CACO3_2015_G1	CACO3 results not included as 11th parameter.
94	1	POS_CACO3_2015_G2	CACO3 results not included as 11th parameter.
95	1	POS_CACO3_2015_G3	CACO3 results not included as 11th parameter.
96	1	POS_CACO3_2015_G4	CACO3 results not included as 11th parameter.
101	1	POS_CEC_2015_G1	CEC results not included as 15th parameter.
102	1	POS_CEC_2015_G2	CEC results not included as 15th parameter.
103	1	POS_CEC_2015_G3	CEC results not included as 15th parameter.
104	1	POS_CEC_2015_G4	CEC results not included as 15th parameter.
109	1	POS_CF_2015_G3	CF results not included as 3rd parameter.
113	1	POS_CLAY_2015_G3	CLAY results not included as 4th parameter.
117	1	POS_EC_2015_G1	EC results not included as 9th parameter.
118	1	POS_EC_2015_G2	EC results not included as 9th parameter.
119	1	POS_EC_2015_G3	EC results not included as 9th parameter.
120	1	POS_EC_2015_G4	EC results not included as 9th parameter.
124	1	POS_K_2015_G1	K results not included as 14th parameter.
125	1	POS_K_2015_G2	K results not included as 14th parameter.
126	1	POS_K_2015_G3	K results not included as 14th parameter.
127	1	POS_K_2015_G4	K results not included as 14th parameter.
137	1	POS_N_2015_G1	N results not included as 13th parameter.
138	1	POS_N_2015_G2	N results not included as 13th parameter.
139	1	POS_N_2015_G3	N results not included as 13th parameter.
140	1	POS_N_2015_G4	N results not included as 13th parameter.
145	1	POS_OC_2015_G1	OC results not included as 10th parameter.
146	1	POS_OC_2015_G2	OC results not included as 10th parameter.
147	1	POS_OC_2015_G3	OC results not included as 10th parameter.
148	1	POS_OC_2015_G4	OC results not included as 10th parameter.
153	1	POS_PH_CACL2_2015_G1	PH_CACL2 results not included as 7th parameter.
154	1	POS_PH_CACL2_2015_G2	PH_CACL2 results not included as 7th parameter.
155	1	POS_PH_CACL2_2015_G3	PH_CACL2 results not included as 7th parameter.
156	1	POS_PH_CACL2_2015_G4	PH_CACL2 results not included as 7th parameter.
163	1	POS_PH_H2O_2015_G1	PH_H2O results not included as 8th parameter.
164	1	POS_PH_H2O_2015_G2	PH_H2O results not included as 8th parameter.
165	1	POS_PH_H2O_2015_G3	PH_H2O results not included as 8th parameter.
166	1	POS_PH_H2O_2015_G4	PH_H2O results not included as 8th parameter.
171	1	POS_P_2015_G1	P results not included as 12th parameter.
172	1	POS_P_2015_G2	P results not included as 12th parameter.
173	1	POS_P_2015_G3	P results not included as 12th parameter.
174	1	POS_P_2015_G4	P results not included as 12th parameter.
182	1	POS_SILT_2015_G3	SILT results not included as 5th parameter.
211	1	TYPE_CEC_2015_G2	Character in data field CEC.
313	2	TYPE_SOIL_ID_2015_G2	Character in integer field Client ID.

The Conformity Checks highlight 41 cases of inconsistencies between specifications and entries found. Of these, 39 concern the position of the data in the file and two the format type.

File Delivery Format

The file format of the data submission is compliant with the specifications. Storing the data for Groups on separate worksheets in a single file is not explicitly specified, but a feature of the storage format that is not explicitly barred.

Position of Parameters in File

The number of cases where the position of a parameter in the file differs from the specification is largely due to adding an internal sample identifier as the first parameter. As a consequence, the position of all parameters in the file has shifted to the right. Also changed from the specifications are the field names for the laboratory identifier ([Sample ident] -> [Lab ID]) and the soil sample identifier ([SOIL-ID] -> [Client ID]). A field containing the country code was added as 3rd parameter. This may be useful in the identification of labelling problems although it is not foreseen in the specifications.

For Groups 1, 2 and 4 the parameters for particle size were not analysed by the laboratory. Measuring particle size was specified only for data of Group 3 (sites not previously visited) and are only included in the data for this Group. The data format specifications do not distinguish between these differences. As a consequence, the check highlights such cases.

Of concern than a shift in the position of all parameters in the file is the modification of the order of parameters:

- *Positions of [SAND] and [SILT] are interchanged.*
- *Positions of [P] and [N] are interchanged.*

In particular the interchanged positions of [*SAND*] and [*SILT*] may be easily overlooked, because the parameters cover the same range of values.

Decimals Reported for Parameter

The check on the number of decimals has not raised any cases of warnings.

Reporting Unit

The reporting units for the parameters analysed are also stated explicitly in the file submitted. No deviations from the specifications were highlighted by the check.

Parameter Type

Non-numeric entries in the data for a parameter were found for:

- *Data for CEC contains one entry "*3.3", which raised a warning.*
- *Field [Client ID] has entries for "30133A" and "30133B".*

This low count of non-numeric entries for parameters actually indicates a problem: there are no codes to indicate measurements with results below the LOD. From the data it appears that these cases have been given a value zero ("0"). This practice differs from the data submitted for the results of the laboratory analysis of previous LUCAS Soil surveys and may lead to misinterpretations when comparing data. A value of zero should signify that the laboratory measurements resulted in a confirmed absence of a parameter in a sample. This is, however, not necessarily the case when the measurements become decidedly uncertain at low concentrations. Thus, a zero ("0") in a parameter field should not be treated as a measurement value, but as an indicator that a measurement resulted in a concentration below the LOD. The practice of using a numeric value to code instances where a data value cannot be given, may complicate the analysis of the data, in particular when computing summary statistics or changes.

4.2 Conformity Checks

Conformity checks evaluate the actual values submitted as results of the laboratory analysis.

4.2.1 Conformity Check Results for 2009 LUCAS Soil Surveys

For the results of the analysis of the samples of the 2009 LUCAS Soil component the data from the 897 additional samples were merged with the file containing the results from the analysis of the 20,000 samples. This approach appears reasonable, because the extra data contain results from the same survey and were analysed under the same conditions as the main data. They also link to the same LUCAS LUC survey and it is, therefore, reasonable to apply the checks for data integrity to the combined data for the 2009 LUCAS Soil surveys.

Section 1: Data Structure

The outcome of the Conformity Checks, which assess the data integrity for the combined data for 2009 surveys, are presented in Table 18.

Table 18: Conformity Check Results for 2009 LUCAS Soil Survey, Section 1

Check ID	Cases No.	Check Label	Message
495	8	DUPLICATE_TEXT_2009	LUCAS SOIL: Texture + pH data is duplicated.

Duplicate LAB

The laboratory files contains no duplicate identifiers of soil samples.

Duplicate TEXT

The checks highlighted 8 cases of duplicate data for soil texture data plus *pH*. The reason is the use of the alpha-numeric "-" for texture data, which leaves the two *pH* values as parameters for uniqueness, which his insufficient data to avoid duplicate cases.

Duplicate CHEM

The results of the laboratory analysis contain no duplicate chemical data.

LAB-DMT-LINK

The check found 1,650 case where the soil data could not be linked to the DMT data, because the DMT did not contain a corresponding entry in the link field. The soil data affected are those with alpha-numeric components in their identifier of the laboratory data. Of these,most are found in the 897 additional data. The data from the soil surveys in Cyprus (90) and Malta (19) cannot be linked to the DMT, because no corresponding land use/cover surveys were performed for those points and years. The geographic position for the sample points can be found in other data, but this does still not provide concurrent information on the land use/cover.

Section 2: Data Status

The summary statistics of the Conformity Checks of Section 2 are presented in Table 19.

Table 19: Conformity Check Results for 2009 LUCAS Soil Survey, Section 2

Check ID	Cases No.	Check Label	Message
436	7	CODE_LOD_CEC_2009	Invalid code for quantification limit of CEC results.("< 2.0")
458	17	CODE_LOD_N_2009	Invalid code for quantification limit of N results.("< 0.2")
464	3	CODE_LOD_OC_2009	Invalid code for quantification limit of OC results.("< 2.0")
470	179	CODE_LOD_P_2009	Invalid code for quantification limit of P results.("< 10.0")
513	1	MISSING_CLAY_2009	A value is missing for parameter CLAY.
556	2	MISSING_SAND_2009	A value is missing for parameter SAND.

Check ID	Cases No.	Check Label	Message
559	2	MISSING_SILT_2009	A value is missing for parameter SILT.
556	2	MISSING_SAND_2009	A value is missing for parameter SAND.
559	2	MISSING_SILT_2009	A value is missing for parameter SILT.
568	218	EXP_CACO3_MAX_M_2009	Maximum CACO3 value above expected range for mineral soil.(> 600)
574	10	EXP_CACO3_MAX_O_2009	Maximum CACO3 value above expected range for organic soil.(> 200)
580	5329	EXP_CACO3_MIN_M_2009	Minimum CACO3 value below expected range for mineral soil.(< 3.0)
592	201	EXP_CEC_MAX_M_2009	Maximum CEC value above expected range for mineral soil.(> 50)
598	70	EXP_CEC_MAX_O_2009	Maximum CEC value above expected range for organic soil.(> 105)
604	572	EXP_CEC_MIN_M_2009	Minimum CEC value below expected range for mineral soil.(< 3.0)
610	10	EXP_CEC_MIN_O_2009	Minimum CEC value below expected range for organic soil.(< 8.0)
616	44	EXP_CF_MAX_M_2009	Maximum CF value above expected range.(> 60)
619	6	EXP_CF_MAX_O_2009	Maximum CF value above expected range.(> 60)
644	512	EXP_K_MAX_M_2009	Maximum K value above expected range for mineral.(> 700)
650	77	EXP_K_MAX_O_2009	Maximum K value above expected range for organic soil.(> 650)
656	226	EXP_K_MIN_M_2009	Minimum K value below expected range for mineral soil.(< 20)
662	23	EXP_K_MIN_O_2009	Minimum K value below expected range for organic soil.(< 40)
668	149	EXP_N_MAX_M_2009	Maximum N value above expected range for mineral soil.(> 8)
674	79	EXP_N_MAX_O_2009	Maximum N value above expected range for organic soil.(> 25)
680	288	EXP_N_MIN_M_2009	Minimum N value below expected range for mineral soil.(< 0.5)
686	10	EXP_N_MIN_O_2009	Minimum N value below expected range for organic soil.(< 4.0)
692	252	EXP_OC_MAX_M_2009	Maximum OC value above expected range.(> 120)
698	13	EXP_OC_MAX_O_2009	Maximum OC value above expected range.(> 550)
704	83	EXP_OC_MIN_M_2009	Minimum OC value below expected range.(< 3.0)
716	9	EXP_PH_CACL2_MAX_M_2009	Maximum PH_CACL2 value above expected range.(> 8.1)
722	27	EXP_PH_CACL2_MAX_O_2009	Maximum PH_CACL2 value above expected range.(> 6.6)
728	446	EXP_PH_CACL2_MIN_M_2009	Minimum PH_CACL2 value below expected range.(< 3.3)
734	41	EXP_PH_CACL2_MIN_O_2009	Minimum PH_CACL2 value below expected range.(< 2.8)
740	88	EXP_PH_H2O_MAX_M_2009	Maximum PH_H2O value above expected range.(> 8.5)
746	21	EXP_PH_H2O_MAX_O_2009	Maximum PH_H2O value above expected range.(> 7.0)
752	99	EXP_PH_H2O_MIN_M_2009	Minimum PH_H2O value below expected range.(< 3.8)
758	1	EXP_PH_H2O_MIN_O_2009	Minimum PH_H2O value below expected range.(< 3.3)
776	321	EXP_P_MAX_M_2009	Maximum P value above expected range.(> 120)
782	33	EXP_P_MAX_O_2009	Maximum P value above expected range.(> 125)
788	1056	EXP_P_MIN_M_2009	Minimum P value below expected range.(< 12)
794	143	EXP_P_MIN_O_2009	Minimum P value below expected range.(< 15)
942	1	REP_PH_H2O_MAX_2009	Maximum PH_H2O value above reporting range.(> 10)

The checks highlight 40 conditions and a total of 10,669 cases. The test for values outside the expected range account for 98% of all cases of the check.

Missing Data

For two samples the vales for particle size were missing (SOIL_IDs 14578 and 19372). For sample 19372 the comment "*no more soil*" was found in the field *CLAY*. None of the samples are high in *OC*.

Code LOD

The total number of cases, where the entry indicating the code for LOD was not conform, came to 204. The cases include instances, where the checks found a comma (",") as decimal separator in the value specifying the LOD, but expected a full stop (".."). 179 cases concern the data for the parameter *P* for the 897 additional samples, but not the main survey data.

Numeric Range

The checks identified one case where the numeric value was outside the range (maximum *PH_H2O* value above reporting range (value: 10.08). The documents specify that the maximum *pH* value of 10.0. The value may be seen as within the margins of rounding.

Minimum LOD

No cases were highlighted where the value reported was below the value indicated for the LOD. However, there are 4,363 cases, where the value reported equals the LOD. In particular, the values reported for *CACO3* were frequently at the measurement limit (4,259 cases with *CACO3* = 1).

Expected Range

The number of cases highlighted by the test for values outside the expected range very much depend on setting the upper range limit. The lower range limit cannot be less then the LOD, but upper limit is a statistical value that depends on the data used to determine the distribution from which the expected ranges are derived and the probability at which data may fall outside the range.

For 2,131 cases the value in the data exceeded the maximum limit of the expected range. Most cases concern the parameter *K*, where the results for 512 samples exceeded a value of 700 *mg* kg^{-1}. The is approx. the mean value of the $Q_{0.975}$ between the 2009 and 2015 survey. Setting the value to 720 *mg* kg^{-1}, as indicated by the $Q_{0.975}$ of the 2009 data, reduces the number of cases highlighted cases to 226.

The test for a value exceeding the minimum of the expected range highlighted over 8,000 cases, or 76% of all cases for the test. The test for the minimum *CACO3* highlights 5,329 cases. For this soil parameter the test has little meaning, since many soils are naturally low in $CaCO_3$ and a value near or below the LOD is quite possible. In this case it may be more meaningful to set the lower limit of the test to the LOD.

4.2.2 Conformity Check Results for 2012 LUCAS Soil Surveys

The file and data formats of the 2012 LUCAS Soil survey laboratory results for Bulgaria and Romania are identical and the identifiers for the soil samples have no overlap in numeric codes. Therefore, it is possible to merge the data of the two surveys into a single file for the application of the Conformity Checks.

Section 1: Data Structure

The summary results of the 2012 LUCAS Soil survey for the checks of Section 1 are given in Table 20.

Table 20: Conformity Check Results for 2012 LUCAS Soil Survey, Section 1

Check	Cases	Check Label	Message
ID	*No.*		
483	2	DUPLICATE_CHEM_2012	LUCAS SOIL: Chemical data is duplicated.
496	2	DUPLICATE_TEXT_2012	LUCAS SOIL: Texture + pH data is duplicated.

Duplicate LAB

There are no duplicates for the sample identifier, where an identifier has been recorded in the data. However, there are data for four samples without an identifier.

Duplicate TEXT

The check for duplicate chemical data identified two samples from Romania (ID:35257; ID: 35312) with identical entries in the parameters. These are for samples without data and the entries are set to "*-999*", which results in the duplications highlighted by the test.

Duplicate CHEM

Duplicate entries for chemical data were found for the same two samples as for chemical data and with the same reason ("*-999*").

LAB-DMT-LINK

Since there was no LUCAS land use/cover survey for Bulgaria and Romania in 2012 the link information to the LUCAS points is included in the files containing the results of the analysis of the soil samples. There are no duplicate entries for the identifiers, but the four samples without a sample identifier, but a point identifier and results of measurements.

Section 2: Data Status

The summary statistics of the Conformity checks of Section 2 are presented in Table 21.

Table 21: Conformity Check Results for 2012 LUCAS Soil Survey, Section 2

Check ID	Cases No.	Check Label	Message
430	679	CODE_LOD_CACO3_2012	Invalid code for quantification limit of CACO3 results.("< 0.5")
465	231	CODE_LOD_OC_2012	Invalid code for quantification limit of OC results.("< 6.0")
471	635	CODE_LOD_P_2012	Invalid code for quantification limit of P results.("< 5.0")
581	707	EXP_CACO3_MIN_M_2012	Minimum CACO3 value below expected range for mineral soil.(< 3.0)
593	209	EXP_CEC_MAX_M_2012	Maximum CEC value above expected range for mineral soil.(> 50)
605	41	EXP_CEC_MIN_M_2012	Minimum CEC value below expected range for mineral soil.(< 3.0)
617	129	EXP_CF_MAX_M_2012	Maximum CF value above expected range.(> 60)
645	47	EXP_K_MAX_M_2012	Maximum K value above expected range for mineral.(> 700)
657	2	EXP_K_MIN_M_2012	Minimum K value below expected range for mineral soil.(< 20)
669	1796	EXP_N_MAX_M_2012	Maximum N value above expected range for mineral soil.(> 8)
681	7	EXP_N_MIN_M_2012	Minimum N value below expected range for mineral soil.(< 0.5)
693	2	EXP_OC_MAX_M_2012	Maximum OC value above expected range.(> 120)
705	15	EXP_OC_MIN_M_2012	Minimum OC value below expected range.(< 3.0)
717	1	EXP_PH_CACL2_MAX_M_2012	Maximum PH_CACL2 value above expected range.(> 8.1)
729	2	EXP_PH_CACL2_MIN_M_2012	Minimum PH_CACL2 value below expected range.(< 3.3)
741	7	EXP_PH_H2O_MAX_M_2012	Maximum PH_H2O value above expected range.(> 8.5)
753	2	EXP_PH_H2O_MIN_M_2012	Minimum PH_H2O value below expected range.(< 3.8)
777	23	EXP_P_MAX_M_2012	Maximum P value above expected range.(> 120)
789	670	EXP_P_MIN_M_2012	Minimum P value below expected range.(< 15)
801	8	LOD_CACO3_MIN_2012	Minimum CACO3 value below LOD.(< 1)
807	40	LOD_CEC_MIN_2012	Minimum CEC value below LOD.(< 2.0)
813	2	LOD_K_MIN_2012	Minimum K value below LOD.(< 10)
819	7	LOD_N_MIN_2012	Minimum N value below LOD.(< 0.2)
825	15	LOD_OC_MIN_2012	Minimum OC value below LOD.(< 6)
831	13	LOD_P_MIN_2012	Minimum P value below LOD.(< 5)
843	8	NUM_CACO3_MIN_2012	Minimum CACO3 value below numeric range.(< 0)
849	23	NUM_CEC_MIN_2012	Minimum CEC value below numeric range.(< 0)
864	13	NUM_CLAY_MIN_2012	Minimum CLAY value below numeric range.(< 0)
877	2	NUM_K_MIN_2012	Minimum K value below numeric range.(< 0)
883	1	NUM_N_MAX_2012	Maximum N value above numeric range.(> 1000)
889	7	NUM_N_MIN_2012	Minimum N value below numeric range.(< 0)
901	15	NUM_OC_MIN_2012	Minimum OC value below numeric range.(< 0)
913	13	NUM_P_MIN_2012	Minimum P value below numeric range.(< 0)
922	13	NUM_SAND_MIN_2012	Minimum SAND value below numeric range.(< 0)
928	15	NUM_SILT_MIN_2012	Minimum SILT value below numeric range.(< 0)
937	2	REP_PH_CACL2_MIN_2012	Minimum PH_CACL2 value below reporting range.(< 2)
949	2	REP_PH_H2O_MIN_2012	Minimum PH_H2O value below reporting range.(< 2)

Missing Data

There are no cases highlighted for the test for missing data in the files.

Code LOD

In the absence of a competent document on the laboratory measurement methods and the LOD the test for invalid LODs highlights practically all cases, where the codes are not conform to the 2009 codes. There is no problem with format of the codes, but their values, which differ from 2009 for the parameters *CACO3*, *OC* and *P*.

Numeric Range

For most physical and all chemical parameters the test for the valid numeric range highlights cases with values below the intrinsic range of values. This is caused by the use of the numeric code "*-999*". The intended significance of the code is not evident. It may indicate that a measurement was or could not be taken, but not that a measurement resulted in a value below the LOD, because it co-exists with the latter in the same field.

In one case the value exceeds the intrinsic numeric range (SOIL_ID: 35024; N: 1,038). For a measurement using the unit of [$g\ kg^{-1}$] this should not be possible.

Minimum LOD

There are several cases of a reported condition where [0 < Value < LOD]. This could be attributable to the uncertainty in the LOD actually used, but is more likely a result of an inconsistent application of the LOD.

Expected Value Range

The test for values outside the expected range highlighted numerous cases. The most frequent cases are:

- *1,796 (88.3%)*
  Maximum N value above expected range for mineral soil.(> 8)
- *707 (34.8%)*
  Minimum CACO3 value below expected range for mineral soil.(< 3.0)
- *670 (32.9%)*
  Minimum P value below expected range.(< 15)

The number of cases with a very low concentration of *CACO3* in the soil samples is not as such unusual and was also observed in samples from other surveys. Of more concern are the cases with low extractable phosphorous and total nitrogen. For the latter, 88.3% of the values reported as laboratory measurements are outside the expected range. As already stated, the values for *total nitrogen* were reported in a unit different from 2009 and 2015 and need adjusting before they can be used.

4.2.3 Conformity Check Results for 2015 LUCAS Soil Surveys

The results of the laboratory analysis of the LUCAS Soil data were processed by Group. Groups 1, 2 and 4 contain data for EU28, although not for all Member States in all groups. Group 3 contains also data from non-EU28 countries. The data contain a field that provides the country name for the location of the sample sites. The country names and number of samples assigned to the country are given in Table 22.

Table 22: LUCAS Soil 2015 Country Code data and Sample Number by Group

GROUP 1		GROUP 2		GROUP 3		EU28	GROUP 4	
Country code	*No.*	*Country code*	*No.*	*Country code*	*No.*	*No.*	*Country code*	*No.*
				Albania	120			
Austria	27	Austria	295	Austria	99	99	Austria	6
				Ausztria	144	144		
Belgium	5	Belgium	59	Belgium	82	82	Belgium	1
				Bosnia	243			
		Bulgaria	514	Bulgaria	1	1		
				Bulgária	81	81		
				Croatia	203	203		
				Cyprus	77	77		
Czech	12	Czech	396	Czech	20	20	Czech Republic	14
Denmark	9	Denmark	203	Denmark	4	4	Denmark	6
Estonia	37	Estonia	143	Estonia	12	12	Estonia	3
Finland	316	Finland	683	Finland	127	127	Finland	28
France	32	France	2541	France	413	413	France	67
Germany	68	Germany	1493	Germany	98	98	Germany	38
Greece	3	Greece	415	Greece	217	217	Greece	9
Hungary	4	Hungary	388	Hungary	15	15	Hungary	12
Ireland	40	Ireland	83	Ireland	73	73	Ireland	1
Italy	12	Italy	954	Italy	639	639	Italy	38
Latvia	38	Latvia	261	Latvia	12	12	Latvia	2
Lithuania	22	Lithuania	306	Lithuania	17	17	Lithuania	8
		Luxembourg	3	Luxemburg	10	10		
				Macedonia	120			
				Malta	3	3		
				Montenegro	60			
Netherlands	6			Netherlands	35	35		
		The Netherlands	129	The Netherlands	1	1	The Netherlands	5
Poland	43	Poland	1266	Poland	58	58	Poland	30
Portugal	5	Portugal	408	Portugal	22	22	Portugal	12
Romania	1	Romania	978	Romania	108	108		
				Serbia	412			
Slovakia	3	Slovakia	199	Slovakia	22	22	Slovakia	4
Slovenia	13	Slovenia	92	Slovenia	41	41	Slovenia	1
Spain	27	Spain	2403	Spain	1545	1545	Spain	60
Sweden	556	Sweden	1276	Sweden	57	57	Sweden	22
				Switzerland	320			
U. Kingdom	55	UK	531	U. Kingdom	145	145	United Kingdom	14
Total	**1,334**		**16,019**		**5,656**	**4,381**		**381**

The inconsistencies in the entries is the field [*Country code*] within and between files are not assessed, because the field is not included in the specifications. Notable is the inclusion of data for 1,275 samples from non-EU28 countries in Group 3. For some of the checks these data, although for countries outside EU28, have to be included in the tests, such as the checks for data structure. Duplicate entries for sample identifiers may exist between samples located in EU28 and non-EU28 countries.

Section 1: Data Structure

The summary results of the 2015 LUCAS Soil survey for the Conformity Checks of Section 1 are given in Table 23.

Table 23: Conformity Check Results for 2015 LUCAS Soil Survey, Section 1

Check	Cases	Check Label	Message
ID	*No.*		
487	1	DUPLICATE_DMT_POINT_2015	LUCAS DMT: Duplicate identifier for point.
491	173	DUPLICATE_DMT_SOIL_2015	LUCAS DMT: Duplicate identifier for soil sample.
494	4	DUPLICATE_LAB_SOIL_2015	LUCAS SOIL: Duplicate identifier for soil sample.
497	4	DUPLICATE_TEXT_2015	LUCAS SOIL: Texture + pH data is duplicated.

The results from the Conformity Checks for the integrity of the data structure are detailed below.

Duplicate DMT Point ID

One case of a duplicate ID for a point was found by the check (ID: 51643122).

Duplicate DMT Soil ID

The check indicates 173 occurrences of duplicate soil IDs in the DMT. One case highlighted are duplicates with an ID "*88888*", which concerns 251,072 points in the DMT. Soil IDs of "*1*" to "*9*" are duplicated 28 times. Found were also 164 occurrences of duplicates of other IDs, which affect 330 cases. In all the cases of a valid soil ID the code for [SOIL_TAKEN] is "*1*".

Duplicate LAB

The test for duplicate identifiers found 4 cases:

- [SOIL_ID]: 41820, 41823, 41824, 56275

While the sample identifiers are duplicates, the associated data differ between the duplicates. The data cannot be linked unambiguously to a LUCAS point, which results in the 8 samples without land use/cover information.

Duplicate TEXT

The test for duplicate texture and pH data highlights four cases, which are two duplicate records.

- [SOIL_ID]: 44279 and 44339
- [SOIL_ID]: 30120 and 48307

It is very unlikely to have the same results for all 6 parameters, of which two are of type float. One may, therefore, assume that these entries are duplicates.

Not counted as duplicates are the 2,365 cases, where the pH values are identical between samples, but no texture information is provided. With the limited range of *pH* values and the number of decimals of reporting the results of the analysis the occurrence of the same data pairs is not unusual.

Duplicate CHEM

No duplicate entries for the results from the chemical parameters were found. This includes the cases with duplicate texture and *pH* data.

LAB-DMT-LINK

The check highlighted 1,484 cases where a Laboratory Soil ID exists in the LAB file without correspondence in DMT data. These cases are included in the detailed reports of the checks, but not the summary results. The evaluation cannot assign the lack of correspondence to either data as long as the format specifications for the entries in the link field are respected.

Section 2: Data Status

The summary statistics of the Conformity Checks of Section 2 are presented in Table 24.

Table 24: Conformity Check Results for 2015 LUCAS Soil Survey, Section 2

Check	Cases	Check Label	Message
ID	*No.*		
512	4	MISSING_CF_2015_G3	A value is missing for parameter CF.
570	1	EXP_CACO3_MAX_M_2015_G1	Maximum CACO3 value above expected range for mineral soil.(> 600)
571	158	EXP_CACO3_MAX_M_2015_G2	Maximum CACO3 value above expected range for mineral soil.(> 600)
572	133	EXP_CACO3_MAX_M_2015_G3	Maximum CACO3 value above expected range for mineral soil.(> 600)
573	1	EXP_CACO3_MAX_M_2015_G4	Maximum CACO3 value above expected range for mineral soil.(> 600)
578	4	EXP_CACO3_MAX_O_2015_G3	Maximum CACO3 value above expected range for organic soil.(> 200)
582	555	EXP_CACO3_MIN_M_2015_G1	Minimum CACO3 value below expected range for mineral soil.(< 3.0)
583	10449	EXP_CACO3_MIN_M_2015_G2	Minimum CACO3 value below expected range for mineral soil.(< 3.0)
584	3234	EXP_CACO3_MIN_M_2015_G3	Minimum CACO3 value below expected range for mineral soil.(< 3.0)
585	245	EXP_CACO3_MIN_M_2015_G4	Minimum CACO3 value below expected range for mineral soil.(< 3.0)
588	591	EXP_CACO3_MIN_O_2015_G1	Minimum CACO3 value below expected range for organic soil.(< 1.0)
589	164	EXP_CACO3_MIN_O_2015_G2	Minimum CACO3 value below expected range for organic soil.(< 1.0)
590	69	EXP_CACO3_MIN_O_2015_G3	Minimum CACO3 value below expected range for organic soil.(< 1.0)
591	5	EXP_CACO3_MIN_O_2015_G4	Minimum CACO3 value below expected range for organic soil.(< 1.0)
594	15	EXP_CEC_MAX_M_2015_G1	Maximum CEC value above expected range for mineral soil.(> 50)
595	168	EXP_CEC_MAX_M_2015_G2	Maximum CEC value above expected range for mineral soil.(> 50)

Check ID	Cases No.	Check Label	Message
596	144	EXP_CEC_MAX_M_2015_G3	Maximum CEC value above expected range for mineral soil.(> 50)
597	4	EXP_CEC_MAX_M_2015_G4	Maximum CEC value above expected range for mineral soil.(> 50)
601	1	EXP_CEC_MAX_O_2015_G2	Maximum CEC value above expected range for organic soil.(> 105)
602	17	EXP_CEC_MAX_O_2015_G3	Maximum CEC value above expected range for organic soil.(> 105)
603	1	EXP_CEC_MAX_O_2015_G4	Maximum CEC value above expected range for organic soil.(> 105)
606	10	EXP_CEC_MIN_M_2015_G1	Minimum CEC value below expected range for mineral soil.(< 3.0)
607	507	EXP_CEC_MIN_M_2015_G2	Minimum CEC value below expected range for mineral soil.(< 3.0)
608	173	EXP_CEC_MIN_M_2015_G3	Minimum CEC value below expected range for mineral soil.(< 3.0)
609	24	EXP_CEC_MIN_M_2015_G4	Minimum CEC value below expected range for mineral soil.(< 3.0)
612	35	EXP_CEC_MIN_O_2015_G1	Minimum CEC value below expected range for organic soil.(< 8.0)
613	4	EXP_CEC_MIN_O_2015_G2	Minimum CEC value below expected range for organic soil.(< 8.0)
614	1	EXP_CEC_MIN_O_2015_G3	Minimum CEC value below expected range for organic soil.(< 8.0)
618	77	EXP_CF_MAX_M_2015_G3	Maximum CF value above expected range.(> 60)
621	6	EXP_CF_MAX_O_2015_G3	Maximum CF value above expected range.(> 60)
628	24	EXP_EC_MAX_M_2015_G1	Maximum EC value above expected range.(> 100)
629	296	EXP_EC_MAX_M_2015_G2	Maximum EC value above expected range.(> 100)
630	86	EXP_EC_MAX_M_2015_G3	Maximum EC value above expected range.(> 100)
631	8	EXP_EC_MAX_M_2015_G4	Maximum EC value above expected range.(> 100)
632	18	EXP_EC_MAX_O_2015_G1	Maximum EC value above expected range.(> 250)
633	4	EXP_EC_MAX_O_2015_G2	Maximum EC value above expected range.(> 250)
634	8	EXP_EC_MAX_O_2015_G3	Maximum EC value above expected range.(> 250)
636	16	EXP_EC_MIN_M_2015_G1	Minimum EC value below expected range.(< 3)
637	260	EXP_EC_MIN_M_2015_G2	Minimum EC value below expected range.(< 3)
638	55	EXP_EC_MIN_M_2015_G3	Minimum EC value below expected range.(< 3)
639	6	EXP_EC_MIN_M_2015_G4	Minimum EC value below expected range.(< 3)
640	16	EXP_EC_MIN_O_2015_G1	Minimum EC value below expected range.(< 12)
641	6	EXP_EC_MIN_O_2015_G2	Minimum EC value below expected range.(< 12)
642	1	EXP_EC_MIN_O_2015_G3	Minimum EC value below expected range.(< 12)
647	300	EXP_K_MAX_M_2015_G2	Maximum K value above expected range for mineral.(> 700)
648	93	EXP_K_MAX_M_2015_G3	Maximum K value above expected range for mineral.(> 700)
649	22	EXP_K_MAX_M_2015_G4	Maximum K value above expected range for mineral.(> 700)
652	27	EXP_K_MAX_O_2015_G1	Maximum K value above expected range for organic soil.(> 650)
653	10	EXP_K_MAX_O_2015_G2	Maximum K value above expected range for organic soil.(> 650)
654	4	EXP_K_MAX_O_2015_G3	Maximum K value above expected range for organic soil.(> 650)
658	49	EXP_K_MIN_M_2015_G1	Minimum K value below expected range for mineral soil.(< 20)
659	462	EXP_K_MIN_M_2015_G2	Minimum K value below expected range for mineral soil.(< 20)
660	88	EXP_K_MIN_M_2015_G3	Minimum K value below expected range for mineral soil.(< 20)
661	7	EXP_K_MIN_M_2015_G4	Minimum K value below expected range for mineral soil.(< 20)
664	11	EXP_K_MIN_O_2015_G1	Minimum K value below expected range for organic soil.(< 40)
665	3	EXP_K_MIN_O_2015_G2	Minimum K value below expected range for organic soil.(< 40)
666	1	EXP_K_MIN_O_2015_G3	Minimum K value below expected range for organic soil.(< 40)

Check ID	Cases No.	Check Label	Message
670	72	EXP_N_MAX_M_2015_G1	Maximum N value above expected range for mineral soil.(> 8)
671	120	EXP_N_MAX_M_2015_G2	Maximum N value above expected range for mineral soil.(> 8)
672	162	EXP_N_MAX_M_2015_G3	Maximum N value above expected range for mineral soil.(> 8)
673	4	EXP_N_MAX_M_2015_G4	Maximum N value above expected range for mineral soil.(> 8)
676	90	EXP_N_MAX_O_2015_G1	Maximum N value above expected range for organic soil.(> 25)
677	5	EXP_N_MAX_O_2015_G2	Maximum N value above expected range for organic soil.(> 25)
678	11	EXP_N_MAX_O_2015_G3	Maximum N value above expected range for organic soil.(> 25)
679	1	EXP_N_MAX_O_2015_G4	Maximum N value above expected range for organic soil.(> 25)
682	9	EXP_N_MIN_M_2015_G1	Minimum N value below expected range for mineral soil.(< 0.5)
683	193	EXP_N_MIN_M_2015_G2	Minimum N value below expected range for mineral soil.(< 0.5)
684	64	EXP_N_MIN_M_2015_G3	Minimum N value below expected range for mineral soil.(< 0.5)
685	4	EXP_N_MIN_M_2015_G4	Minimum N value below expected range for mineral soil.(< 0.5)
689	1	EXP_N_MIN_O_2015_G2	Minimum N value below expected range for organic soil.(< 4.0)
694	109	EXP_OC_MAX_M_2015_G1	Maximum OC value above expected range.(> 120)
695	89	EXP_OC_MAX_M_2015_G2	Maximum OC value above expected range.(> 120)
696	132	EXP_OC_MAX_M_2015_G3	Maximum OC value above expected range.(> 120)
697	2	EXP_OC_MAX_M_2015_G4	Maximum OC value above expected range.(> 120)
700	7	EXP_OC_MAX_O_2015_G1	Maximum OC value above expected range.(> 550)
706	2	EXP_OC_MIN_M_2015_G1	Minimum OC value below expected range.(< 3.0)
707	142	EXP_OC_MIN_M_2015_G2	Minimum OC value below expected range.(< 3.0)
708	36	EXP_OC_MIN_M_2015_G3	Minimum OC value below expected range.(< 3.0)
709	2	EXP_OC_MIN_M_2015_G4	Minimum OC value below expected range.(< 3.0)
719	8	EXP_PH_CACL2_MAX_M_2015_G2	Maximum PH_CACL2 value above expected range.(> 8.1)
720	2	EXP_PH_CACL2_MAX_M_2015_G3	Maximum PH_CACL2 value above expected range.(> 8.1)
724	14	EXP_PH_CACL2_MAX_O_2015_G1	Maximum PH_CACL2 value above expected range.(> 6.6)
725	5	EXP_PH_CACL2_MAX_O_2015_G2	Maximum PH_CACL2 value above expected range.(> 6.6)
726	34	EXP_PH_CACL2_MAX_O_2015_G3	Maximum PH_CACL2 value above expected range.(> 6.6)
730	41	EXP_PH_CACL2_MIN_M_2015_G1	Minimum PH_CACL2 value below expected range.(< 3.3)
731	63	EXP_PH_CACL2_MIN_M_2015_G2	Minimum PH_CACL2 value below expected range.(< 3.3)
732	26	EXP_PH_CACL2_MIN_M_2015_G3	Minimum PH_CACL2 value below expected range.(< 3.3)
733	1	EXP_PH_CACL2_MIN_M_2015_G4	Minimum PH_CACL2 value below expected range.(< 3.3)
736	5	EXP_PH_CACL2_MIN_O_2015_G1	Minimum PH_CACL2 value below expected range.(< 2.8)
743	42	EXP_PH_H2O_MAX_M_2015_G2	Maximum PH_H2O value above expected range.(> 8.5)
744	6	EXP_PH_H2O_MAX_M_2015_G3	Maximum PH_H2O value above expected range.(> 8.5)
745	1	EXP_PH_H2O_MAX_M_2015_G4	Maximum PH_H2O value above expected range.(> 8.5)
748	12	EXP_PH_H2O_MAX_O_2015_G1	Maximum PH_H2O value above expected range.(> 7.0)
749	2	EXP_PH_H2O_MAX_O_2015_G2	Maximum PH_H2O value above expected range.(> 7.0)

Check ID	Cases No.	Check Label	Message
750	18	EXP_PH_H2O_MAX_O_2015_G3	Maximum PH_H2O value above expected range.(> 7.0)
754	13	EXP_PH_H2O_MIN_M_2015_G1	Minimum PH_H2O value below expected range.(< 3.8)
755	51	EXP_PH_H2O_MIN_M_2015_G2	Minimum PH_H2O value below expected range.(< 3.8)
756	36	EXP_PH_H2O_MIN_M_2015_G3	Minimum PH_H2O value below expected range.(< 3.8)
757	1	EXP_PH_H2O_MIN_M_2015_G4	Minimum PH_H2O value below expected range.(< 3.8)
778	14	EXP_P_MAX_M_2015_G1	Maximum P value above expected range.(> 120)
779	272	EXP_P_MAX_M_2015_G2	Maximum P value above expected range.(> 120)
780	57	EXP_P_MAX_M_2015_G3	Maximum P value above expected range.(> 120)
781	13	EXP_P_MAX_M_2015_G4	Maximum P value above expected range.(> 120)
784	49	EXP_P_MAX_O_2015_G1	Maximum P value above expected range.(> 125)
785	21	EXP_P_MAX_O_2015_G2	Maximum P value above expected range.(> 125)
786	11	EXP_P_MAX_O_2015_G3	Maximum P value above expected range.(> 125)
790	125	EXP_P_MIN_M_2015_G1	Minimum P value below expected range.(< 15)
791	4658	EXP_P_MIN_M_2015_G2	Minimum P value below expected range.(< 15)
792	3270	EXP_P_MIN_M_2015_G3	Minimum P value below expected range.(< 15)
793	138	EXP_P_MIN_M_2015_G4	Minimum P value below expected range.(< 15)
796	4	EXP_P_MIN_O_2015_G1	Minimum P value below expected range.(< 12)
797	3	EXP_P_MIN_O_2015_G2	Minimum P value below expected range.(< 12)
798	8	EXP_P_MIN_O_2015_G3	Minimum P value below expected range.(< 12)
802	1074	LOD_CACO3_MIN_2015_G1	Minimum CACO3 value below LOD.(< 1)
803	8308	LOD_CACO3_MIN_2015_G2	Minimum CACO3 value below LOD.(< 1)
804	1908	LOD_CACO3_MIN_2015_G3	Minimum CACO3 value below LOD.(< 1)
805	188	LOD_CACO3_MIN_2015_G4	Minimum CACO3 value below LOD.(< 1)
808	12	LOD_CEC_MIN_2015_G1	Minimum CEC value below LOD.(< 2.0)
809	274	LOD_CEC_MIN_2015_G2	Minimum CEC value below LOD.(< 2.0)
810	85	LOD_CEC_MIN_2015_G3	Minimum CEC value below LOD.(< 2.0)
811	11	LOD_CEC_MIN_2015_G4	Minimum CEC value below LOD.(< 2.0)
814	14	LOD_K_MIN_2015_G1	Minimum K value below LOD.(< 10)
815	109	LOD_K_MIN_2015_G2	Minimum K value below LOD.(< 10)
816	11	LOD_K_MIN_2015_G3	Minimum K value below LOD.(< 10)
817	2	LOD_K_MIN_2015_G4	Minimum K value below LOD.(< 10)
820	1	LOD_N_MIN_2015_G1	Minimum N value below LOD.(< 0.2)
821	7	LOD_N_MIN_2015_G2	Minimum N value below LOD.(< 0.2)
822	6	LOD_N_MIN_2015_G3	Minimum N value below LOD.(< 0.2)
826	1	LOD_OC_MIN_2015_G1	Minimum OC value below LOD.(< 2)
827	55	LOD_OC_MIN_2015_G2	Minimum OC value below LOD.(< 2)
828	14	LOD_OC_MIN_2015_G3	Minimum OC value below LOD.(< 2)
829	1	LOD_OC_MIN_2015_G4	Minimum OC value below LOD.(< 2)
832	19	LOD_P_MIN_2015_G1	Minimum P value below LOD.(< 5)
833	705	LOD_P_MIN_2015_G2	Minimum P value below LOD.(< 5)
834	1158	LOD_P_MIN_2015_G3	Minimum P value below LOD.(< 5)
835	35	LOD_P_MIN_2015_G4	Minimum P value below LOD.(< 5)
945	1	REP_PH_H2O_MAX_2015_G2	Maximum PH_H2O value above reporting range.(> 10)

Missing Data

The test indicates four cases of missing data in Group 3 for the parameter *CF*. The corresponding [SOIL_ID]s are:

- 56237 Lithuania
- 14716 Bulgaria
- 27594 Germany
- 39138 The Netherlands

For the samples data on particle size distribution are reported, just the *CF* field contains blank entries.

The laboratory results for these four samples were added to the end of the file with a distinct series of [Sample Ident] codes. From this one may infer that the samples were analysed separately from the other samples and that the values for *CF* were omitted when appending the data to the file.

Code LOD

The temporal consistency of the codes used to indicated results of the analysis below the LOD and any missing data was evaluated based on the parameters given in Table 25.

Table 25: Codes for Limit of Detection and Minimum Value for Parameters in Data

Parameter	Survey				
	2009			2012	2015
	20,000 ->	*incl. Cyprus*	*Malta*		
CF	< 1		N/A	1	1
CLAY	< 1		N/A	1*	1
SILT	< 1		N/A	1*	2
SAND	1		N/A	1*	2
PH_CACL2	2.57		N/A	3.5*	2.6
PH_H2O	3.21		N/A	4.14*	3.17
OC	< 2		N/A	< 6*	0.31
CaCO3	< 1		N/A	< 0.5*	0.1
N	< 0.2		N/A	16*	1
P	< 10		N/A	< 5*	0.1
K	< 10		N/A	20.3*	1.4
CEC	< 2.0		N/A	1.2*	0.2

blue: smallest value > 0
* contains also entries of -999

The value for the LOD for *OC* changed from < 2.0 *g kg*$^{-1}$ in 2009 to < 6.0 *g kg*$^{-1}$ in 2012. The limits were reflected in the data reported for *OC* for both years.

No specific value for the LOD for *OC* measurements was indicated in the 2015 data (2 cases of "<0.0"). The 2015 data contains 70 (0.3%) cases were the value reported was below the LOD specified for 2009. Applying the LOD of 2009 to 2015 *OC* data results in 987 cases, where data are below the LOD indicated. However, it does not seem reasonable to use this comparison as an evaluation criterion.

For the results of the $CaCO_3$ analysis the LOD changed from < 1 *g kg^{-1}* in 2009 to < 0.5 *g kg^{-1}* in 2012. Due to the specifications of the number of decimals for the parameter (0) the change in LOD is of no effect. The lack of an identifier for analysis results below the LOD for $CaCO_3$ in 2015 is an inconsistency in reporting the results. In spite of this, no values below the LOD of 2009 are reported for 2015 data. Thus, any practical consequences depend on the method used to treat the 2015 data, which are below the 2009 LOD value. This interpretation equally applies when comparing data of the 2012 to the 2015 survey.

The test for the use of a code indication a measurement below the LOD did not highlight any cases. The reason for this is not that only valid codes for the LOD were recorded, but that no such code was used for any of the parameters.

Numeric Range

The number of cases highlighted by the test of data outside the intrinsic numeric range indicated one case. The value for the parameter *PH_H2O* was 10.37 and thus above the limit of *pH* 10.

Minimum LOD

For the 2015 data the test for values below the minimum LOD resulted in a large number of cases. This is caused by using a value of zero to code instances where the measurements were below the LOD. In this, the 2015 data deviates from previous practices. With the file format used to store the results of the laboratory analysis there is no technical demand for such a step. The entry of a value zero ("0") denotes a code, not a measured value. It signifies the condition that the presence of the parameter could not be determined accurately at low concentrations, but does not signify a measured absence of a parameter. The use of the value in 2015 can therefore be considered potentially confounding.

Expected Value Range

The number of cases where a value exceeds the expected range suggests that the minimum range limits for *CACO3* and *P* should be the LOD to reduce the number of cases highlighted by the check. The maximum range limit could be increased for parameters *K* for mineral soils (> 700 *mg kg^{-1}*), *CACO3* for mineral soils (> 600 *g kg^{-1}*), *EC* for mineral soils (> 100 *mS m^{-1}*) and *P* for mineral soils (> 120 *mg kg^{-1}*). The range limits set for organic soils lead to less cases highlighted, simply because there are fewer samples from soils with high *OC* content in the survey.

4.3 Uniformity Checks

Uniformity Checks are sub-divided into those that evaluate relationships between parameters for a survey year (Section 1) and those that evaluate temporal changes for a parameter (Section 2).

4.3.1 Section 1: Multi-parameter, Single Survey

A summary of the results from comparing parameters for a survey are presented in Table 26.

Table 26: Uniformity Check Results for 2009 LUCAS Soil Survey, Section 1

Check ID	Cases No.	Check Label	Message
970	3758	CACO3_PH_M_2009	Unexpectedly low CACO3 value for mineral soil with PH_CACL2.(<= 3)
976	13	CACO3_PH_O_2009	Unexpectedly low CACO3 value for organic soil with PH_CACL2.(<= 3)
982	2	CN_RATIO_MAX_M_2009	C/N Ratio unexpectedly high for mineral soil.(>= 100)
994	67	CN_RATIO_MIN_M_2009	C/N Ratio unexpectedly low for mineral soil.(<= 5)
1029	86	PH_CACO3_M_2009	Unexpectedly high CACO3 value for mineral soil with PH_CACL2.(>= 3)
1035	147	PH_CACO3_O_2009	Unexpectedly high CACO3 value for organic soil with PH_CACL2.(>= 3)

C:N Ratio

The C:N Ratio was found outside the expected range in 69 cases. In two cases the values were greater than the maximum:

- ID: 13177 C:N Ratio:172.33
- ID: 13416 C:N Ratio: 196.50

The upper limit for the expected range was set to a value of 100 and the values found were significantly above this limit. A value > 30 may be considered very high and the range limit could be revised to a lower value.

The 67 cases of unexpectedly low values for the C:N Ratio covered a continuous range below the lower limit of 5.0. There are 16 cases with a C:N Ratio below 3, with a minimum of 1.27.

pH Difference

The test on uncommonly high differences in values for *PH_CACO3* and *PH_H2O* did not result in any cases outside the range set for the test.

Low pH and high $CaCO_3$

The test found 86 cases where a mineral soil with a low ph ($pH(CaCl_2)$ < 5) was combined with a high carbonate content (>= 3.0 $g\ kg^{-1}$). The test applied to organic soils ($pH(CaCl_2)$ < 6; >= 3.0 $g\ kg^{-1}$) highlighted 147 cases with unexpected combinations. While most cases exceeded the limit by only a margin, there were five cases where the carbonate content was > 20 $g\ kg^{-1}$ for organic soils, with a maximum of 79 $g\ kg^{-1}$.

Low $CaCO_3$ with high pH

The test of unexpected combinations of a low carbonate content (< 3.0 $g\ kg^{-1}$) with high pH (mineral: >= 5; organic: >= 6) did not highlight any cases.

OC Less than LOD for CACO3

No cases were found where the value for *OC* was less than the LOD for *CACO3*. The test is based on a LOD for carbonates of 1.0 $g\ kg^{-1}$ for all surveys, as specified for the LOD for *CACO3* for 2009. Excluded from the test are entries of zero ("0") or "-999", which are considered codes.

4.3.2 Section 2: Single Parameter, Multiple Survey

Changes in the results of the laboratory analysis were evaluated for samples taken in 2009 and 2015. Not evaluated were changes to or from the 2012 survey data. The 2012 survey covered only two countries and an interval of just three years to other LUCAS Soil surveys. It would be difficult to substantiate any changes over such a period. However, the results from the 2012 survey were considered to evaluate the temporal stability of some soil parameters, although with very limited common data with 2009 and 2015 samples.

A summary of the number of cases highlighted by the Uniformity Checks for temporal changes outside expected ranges are summarised in Table 27.

Table 27: Uniformity Check Results for 2009 and 2015 LUCAS Soil Survey, Section 2

Check	Cases	Check Label	Message
ID	*No.*		
1006	516	DIST_SOIL_POINT_2009	Distance between GPS co-ordinates and OBS_DIST exceeds limit.
1012	122	MICRO_COOR_2009	Ambiguous link between LAB, DMT and Micro data.
1021	22	MIN_TO_ORG_2009_2015_G1	Change from mineral soil to organic substrate.(from <= 120.00 to >= 200.00)
1022	101	MIN_TO_ORG_2009_2015_G2	Change from mineral soil to organic substrate.(from <= 120.00 to >= 200.00)
1024	4	MIN_TO_ORG_2009_2015_G4	Change from mineral soil to organic substrate.(from <= 120.00 to >= 200.00)
1025	151	ORG_TO_MIN_2009_2015_G1	Change from organic substrate to mineral soil type.(from >= 200.00 to <= 120.00)
1026	1	ORG_TO_MIN_2009_2015_G2	Change from organic substrate to mineral soil type.(from >= 200.00 to <= 120.00)
1047	512	CNG_CACO3_2009_2015_G1	Temporal change of CACO3 not within expected range.(+/- > 20%)
1048	6253	CNG_CACO3_2009_2015_G2	Temporal change of CACO3 not within expected range.(+/- > 20%)
1049	3	CNG_CACO3_2009_2015_G3	Temporal change of CACO3 not within expected range.(+/- > 20%)
1050	165	CNG_CACO3_2009_2015_G4	Temporal change of CACO3 not within expected range.(+/- > 20%)
1055	930	CNG_CEC_2009_2015_G1	Temporal change of CEC not within expected range.(+/- > 20%)
1056	8833	CNG_CEC_2009_2015_G2	Temporal change of CEC not within expected range.(+/- > 20%)
1057	2	CNG_CEC_2009_2015_G3	Temporal change of CEC not within expected range.(+/- > 20%)
1063	6	CNG_CF_2009_2015_G3	Temporal change of CF not within expected range.(+/- > 10%)
1065	5	CNG_CLAY_2009_2015_G3	Temporal change of CLAY not within expected range.(+/- > 10%)

Check ID	Cases No.	Check Label	Message
1067	982	CNG_K_2009_2015_G1	Temporal change of K not within expected range.(+/- > 20%)
1068	8906	CNG_K_2009_2015_G2	Temporal change of K not within expected range.(+/- > 20%)
1069	4	CNG_K_2009_2015_G3	Temporal change of K not within expected range.(+/- > 20%)
1070	242	CNG_K_2009_2015_G4	Temporal change of K not within expected range.(+/- > 20%)
1075	797	CNG_N_2009_2015_G1	Temporal change of N not within expected range.(+/- > 20%)
1076	6765	CNG_N_2009_2015_G2	Temporal change of N not within expected range.(+/- > 20%)
1077	5	CNG_N_2009_2015_G3	Temporal change of N not within expected range.(+/- > 20%)
1078	190	CNG_N_2009_2015_G4	Temporal change of N not within expected range.(+/- > 20%)
1083	5	CNG_OC2009_2015_G3	Temporal change of OC not within expected range.(+/- > 20%)
1084	186	CNG_OC2009_2015_G4	Temporal change of OC not within expected range.(+/- > 20%)
1087	758	CNG_OC_2009_2015_G1	Temporal change of OC not within expected range.(+/- > 20%)
1088	7154	CNG_OC_2009_2015_G2	Temporal change of OC not within expected range.(+/- > 20%)
1091	406	CNG_PH_CACL2_2009_2015_G1	Temporal change of PH_CACL2 not within expected range.(+/- > 10%)
1092	3438	CNG_PH_CACL2_2009_2015_G2	Temporal change of PH_CACL2 not within expected range.(+/- > 10%)
1093	2	CNG_PH_CACL2_2009_2015_G3	Temporal change of PH_CACL2 not within expected range.(+/- > 10%)
1094	100	CNG_PH_CACL2_2009_2015_G4	Temporal change of PH_CACL2 not within expected range.(+/- > 10%)
1099	369	CNG_PH_H2O_2009_2015_G1	Temporal change of PH_H2O not within expected range.(+/- > 10%)
1100	3455	CNG_PH_H2O_2009_2015_G2	Temporal change of PH_H2O not within expected range.(+/- > 10%)
1101	3	CNG_PH_H2O_2009_2015_G3	Temporal change of PH_H2O not within expected range.(+/- > 10%)
1102	100	CNG_PH_H2O_2009_2015_G4	Temporal change of PH_H2O not within expected range.(+/- > 10%)
1107	868	CNG_P_2009_2015_G1	Temporal change of P not within expected range.(+/- > 20%)
1108	7024	CNG_P_2009_2015_G2	Temporal change of P not within expected range.(+/- > 20%)
1109	4	CNG_P_2009_2015_G3	Temporal change of P not within expected range.(+/- > 20%)
1110	183	CNG_P_2009_2015_G4	Temporal change of P not within expected range.(+/- > 20%)
1115	5	CNG_SAND_2009_2015_G3	Temporal change of SAND not within expected range.(+/- > 10%)
1117	4	CNG_SILT_2009_2015_G3	Temporal change of SILT not within expected range.(+/- > 10%)

Mineral Soil Exchanged with Soil High in Organic Carbon

The test for changes between samples taken from mineral soils or from soil with high OC content identified 127 cases, where a sample taken from a presumed mineral soil in 2009 showed a high organic content in the

samples from 2015. Conversely, for samples from 152 sites where the OC content indicated a soil high in OC the samples form 2015 had concentrations of OC that were compatible with mineral soils.

That such changes are present in samples taken at the same sampling point is possible in the presence of organic material, such as litter on forests soils. For a better understanding of the areas concerned by the exceptional changes in OC for repeated samples the soil data was linked to the land cover information of the LUCAS LUC data. The relative occurrences of a change in mineral/high organic by land cover class are presented in Table 28.

Table 28: Relative Occurrence of a Change in Mineral/high Organic Carbon between 2009 and 2015 by LUCAS Land Cover Class

LUCAS Land Cover 2009	2015										
	Cereals	Broadleaved woodland	Coniferous woodland	Mixed woodland	Shrubland with sparse tree cover	Shrubland without tree cover	Grassland with sparse tree/shrub cover	Grassland without tree/shrub cover	Spontaneously re-vegetated surfaces	Other bare soil	Inland wetlands
Artificial non-built-up areas			0.4								
Cereals	1.1										
Temporary grassland	0.7										
Broadleaved woodland		3.6		1.8			0.4			0.4	
Coniferous woodland		0.7	33.0	6.1	0.4		0.7		0.4	0.4	
Mixed woodland		2.5	9.7	22.9	1.1	0.4	0.4		0.4		
Shrubland with sparse tree cover		0.4		0.4							
Shrubland without tree cover				0.4		0.4					
Grassland with sparse tree/shrub cover			1.1	0.7			0.4	0.7			
Grassland without tree/shrub cover	0.4	0.4					0.4	6.1			
Spontaneously re-vegetated surfaces				0.4							
Bare land and lichens				0.4							
Inland wetlands											0.7

LC1 Level 1

The table indicates that most of the changes (80.3%) occurred for soil samples taken in woodland. One third concern coniferous woodland. Problems in the consistency of sampling soils in woodlands were also noted for dedicated forest soil sampling surveys (Hiederer et al., 2011; Hiederer, 2018). While this may be one reason for exceptional changes in OC content for repeated samples the table also indicates a certain amount of "noise" in the classification of the samples, which amounts to 10.0% for

the samples with exceptional changes in OC. Changes in a main land cover category are all value outside the boxed areas. An assessment of the consistency of the observations of the LUCAS LUC survey are outside the scope of this evaluation, although this may affect the temporal consistency of soil data from repeated samples.

Temporal Changes

The temporal changes of a parameter is assessed for each sample that is associated with a LUCAS point in two surveys. This is taken as a repeated sample. In the best of cases the repeated sample is taken at the location of the previous sample. The sites are not marked and one may assume that the repeated samples are taken in the vicinity of the place where the previous sample was taken. Therefore, the changes in a parameter include the variability of that parameter over an area that is larger than the area from which the soil sample is collected. It should be interpreted as a repeated sample from an area, not a point.

The local spatial variability may explain the number of cases highlighted by the tests for temporal changes. To obtain an indication of the consistency of the samples taken it would be useful to have such results for parameters that may be safely assumed to vary very little over a period of 6 years. These are the particle size distribution and, to a lesser degree, also pH. Other soil parameters are more subject to vary even over a period of 6 years, for example as a result of land use change. However, the particle size distribution was excluded from being measured for repeated samples, which leaves only *pH* as a parameter to assess consistency of the parameter.

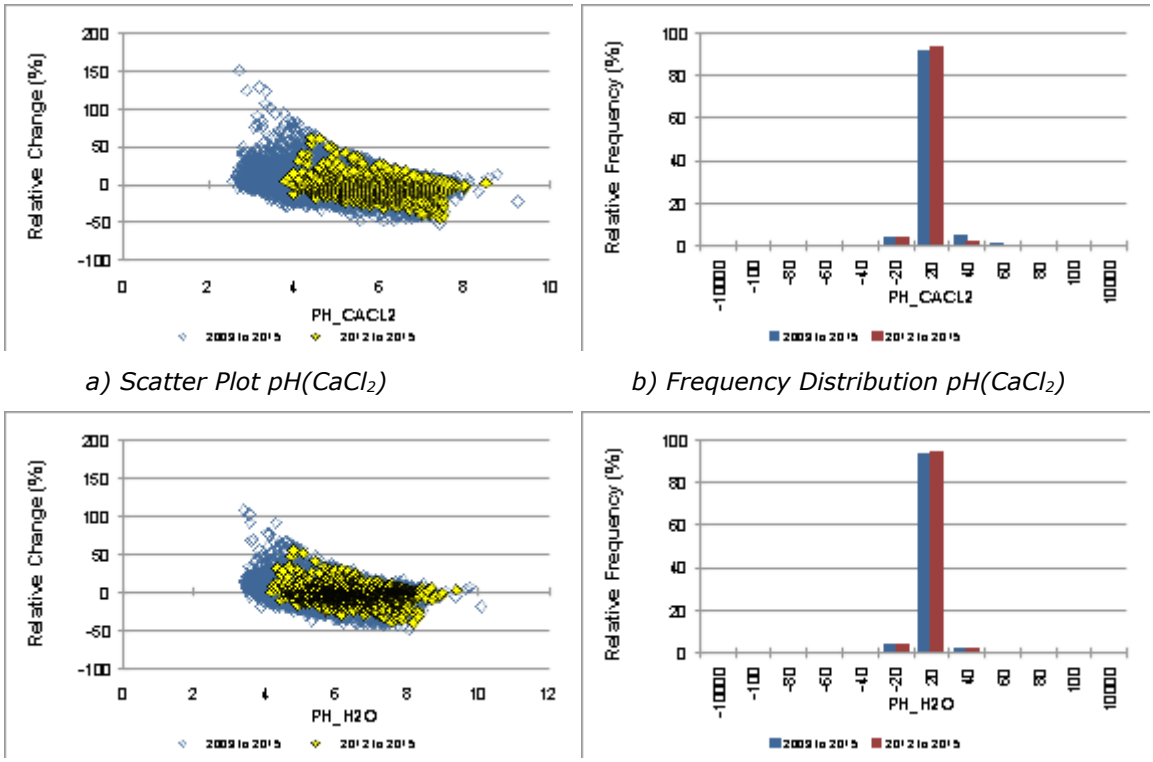
As an indicator of temporal changes or consistency the relative change over the base year was used. For *pH* the range limit was set to 10%, for all other parameters to 20%. This results in a rather large number of cases outside the range limits. In the evaluation of the check results is turned out that these limits are too stringent.

One of the reasons contributing the the number of cases is the variability at low levels of concentrations. At low concentrations an absolute limit such as the LOQ, could reduce the number of cases that are within the range of local variations. For higher concentrations the re-analysis of the same samples could provide some guidelines on the variability of the laboratory methods. This approach may seem more constructive for identifying potentially problematic cases, but requires a deterministic process of when to apply which method.

To better understand the variability in the temporal changes two graphical presentations of data properties were generated. One is a scatter plot graphing the parameter value of the base year against the changes for that plot during a subsequent survey. The second graph depicts the frequency distribution of the relative change.

Temporal Changes: pH($CaCl_2$) and pH(H_2O)

The distribution of the changes for repeated samples is comparable between *PH_CACL2* and *PH_H2O*. The frequency distribution is narrow, with 93% of all cases within +/- 20 from the base year, as shown in Figure 5.



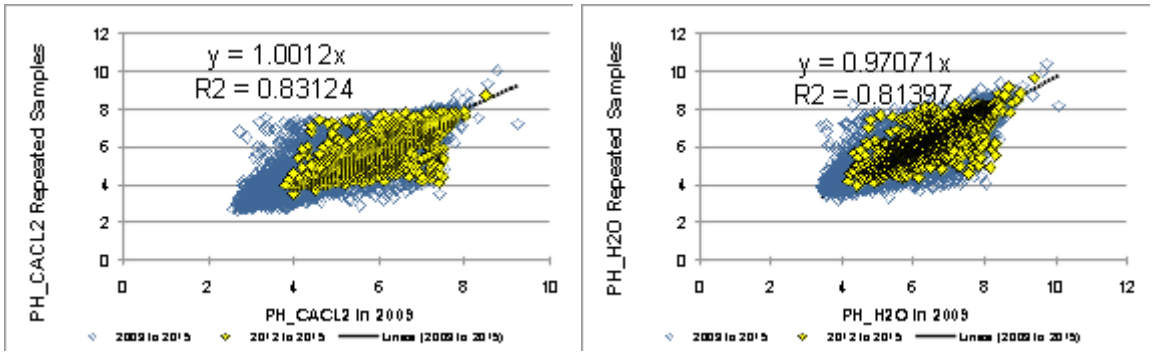
a) Scatter Plot pH($CaCl_2$) *b) Frequency Distribution pH($CaCl_2$)*

c) Scatter Plot pH(H_2O) *d) Frequency Distribution pH(H_2O*

Figure 5: Plot and Frequency Distribution of Temporal Change for Soil Parameters pH($CaCl_2$) and pH(H_2O)

Notable is the perceptible dependency of the change in pH with pH from the 2009 and 2012 to the 2015 survey samples. The average pH of all repeated samples has not changed between surveys (5.7 for 2009 to 2015; 6.1 for 2012 to 2015). Values below the mean tend to increase with a lower pH, while pH units above the mean tend to decrease with pH.

For all repeated samples and surveys a trend in pH values in 2015 is not present in the data. This is graphically illustrated in Figure 6.



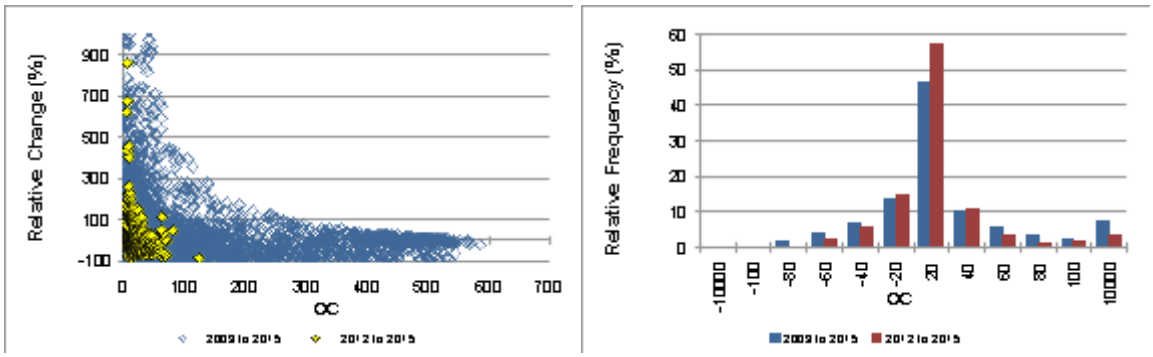
a) pH($CaCl_2$) *b) pH(H_2O)*

Figure 6: Change in Soil Parameters pH($CaCl_2$) and pH(H_2O) from 2009 and 2012 to 2015 for Repeated Soil Samples

It can be considered unusual to have a notable increase in pH in the soil over a period of 3 years. The reanalysis of the 2009/2012 samples (2014 samples) indicates a slope of a linear regression of 1.01 for *PH_CACL2* and 0.96 for *PH_H2O*. These values are reflected in the data of the resampled soils. While there is no discernible change in the overall soil pH there remains a notable variance at point level for a parameter that should have low local and temporal variability.

Temporal Changes: Organic Carbon

The changes for each repeated sample and the frequency distribution of the changes for *OC* are presented in Figure 7.

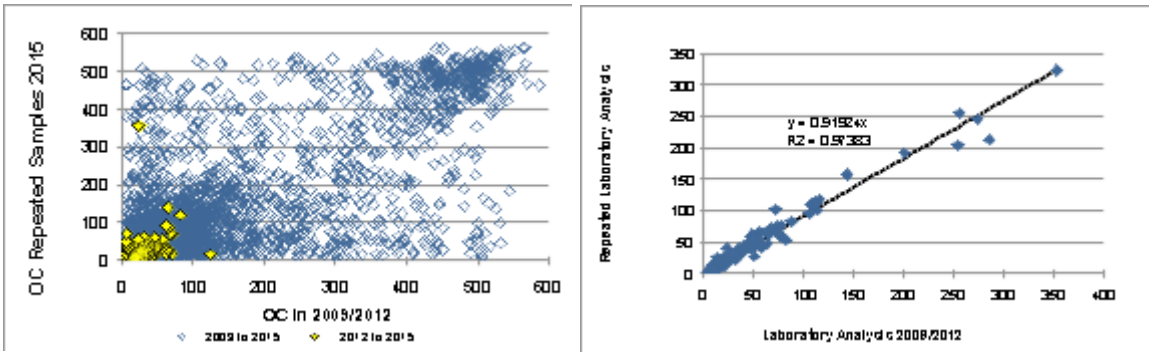


a) Scatter Plot Organic Carbon *b) Frequency Distribution Organic Carbon*

Figure 7: Plot and Frequency Distribution of Temporal Change for Soil Parameter Organic Carbon

Of the changes for *OC* for repeated samples 46.3% are within the range of +/- 20% of the 2009/2012 value. This is due to the steep increase in the relative changes for mineral soils with *OC* content below approx. 80 g kg-1, but also the interchanges of minerals and organic soils.

The comparison of *OC* data in samples from 2009 and 2012 and in repeated samples form 2015 is graphically presented in Figure 8.



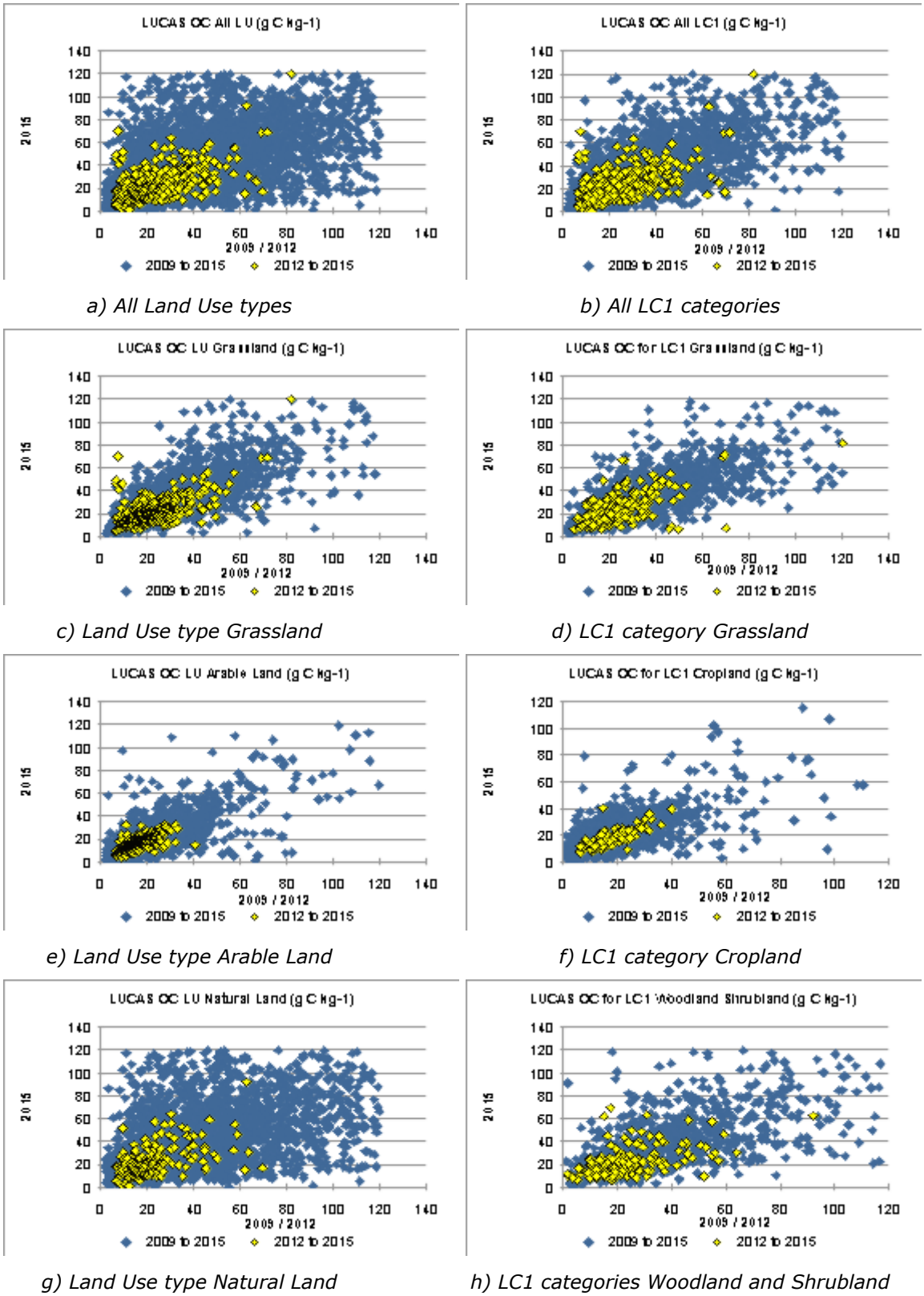
a) Scatter Plot Organic Carbon *b) Reanalysis Organic Carbon*

Figure 8: Change in Soil Parameter Organic Carbon from 2009 and 2012 to 2015 for Repeated Soil Samples and Reanalysis of 2009/2012 Data

The scatter plot of OC data for repeated samples shows the generally stable clusters of mineral soils and soils high in OC, but also the occurrence of exchanges between the clusters. The Reanalysis of the soil samples from 2009 and 2012 shows consistent results. No changes from or to mineral soils were reported, but the 214 samples of the Reanalysis contain only 7 samples with OC content > 120 $g\ kg^{-1}$.

Notable for the reanalysed data is a slope < 1 (0.92). The slope is to some degree affected by the few samples from soils high in OC. Limiting the linear regression of the original analysis to the reanalysed data to samples from mineral soils provides a slope of 0.97. The confidence interval for the slope at a 99% confidence level for all samples is 0.897 to 0.941 and for only mineral soil samples 0.945 to 0.988. The confidence interval for the difference of the mean for the reanalysed data is 1.431 +/- 1.673 (99% confidence level) and 1.27 (95% confidence level). With the H_0 for the slope (no different from 1) could be rejected at the 95% and 99% confidence level the H_0 for the difference of the mean (no difference in mean) could only be rejected at the 95% confidence level. Under the assumption that there is no systematic change introduced by the laboratory method there is insufficient evidence to reject the H_0 hypothesis that there is no difference in the mean OC for the totality of the repeated soil samples.

The results suggest that evaluating changes in OC should be treated separately for mineral soils and soils high in OC. It may also be beneficial to the evaluation to account for the influence of changes in land use / cover when comparing data from different sampling periods. Additional analysis was performed where the OC content was limited to 120 $g\ kg^{-1}$ and restricted to plots where the main LUCAS survey did not indicate a change in land use or cover. Excluded from the comparison were plots with an OC content below the LOD in either survey. The results are presented in Figure 9.



a) All Land Use types

b) All LC1 categories

c) Land Use type Grassland

d) LC1 category Grassland

e) Land Use type Arable Land

f) LC1 category Cropland

g) Land Use type Natural Land

h) LC1 categories Woodland and Shrubland

Figure 9: Comparison of Soil Parameter Organic Carbon for Samples of 2009 and 2012 Repeated in 2015 LUCAS Soil Survey with same Land Use Type and LC1 Category in Corresponding LUCAS LUC Surveys

For the land use type the LUCAS land cover categories were related to the main *Intergovernmental Panel on Climate Change* (IPCC) land use types:

- Grassland corresponds to LC1 code *E*: Grassland
- Long-term arable land corresponds to LC1 code *B*: Cropland
- Natural Land is approximated by LC1 code *C* (Woodland) and *D* (shrubland).

For the comparison of LC1 categories the *OC* content of only those points are included where the LC1 in the base year corresponds to the LC1 in the repeated year. For cropland this means that the same crop was recorded in the LUCAS LUC survey in 2015 as in the previous survey at a point.

A visual comparison indicated that by restricting the changes to the same LU type in both year reduces the variability in the *OC* changes. This is an expected results, because land use is one of the main factors influencing OC over a short period. The results of linear regressions for the comparisons are given in Figure 10.

Figure 10: Linear Regression Parameters for Soil Parameter Organic Carbon from Repeated Sampling for same Land Use Type and Land Cover Category in both years, Mineral Soil Samples

LU / LC1	Same LU		Same LC1	
	Regression Slope	r^2	*Regression Slope*	r^2
All LU	0.89	0.50	0.94	0.60
Grassland	0.98	0.58	0.90	0.58
Arable Land	0.91	0.59	0.90	0.51
Natural Land	0.84	0.28	0.89	0.43

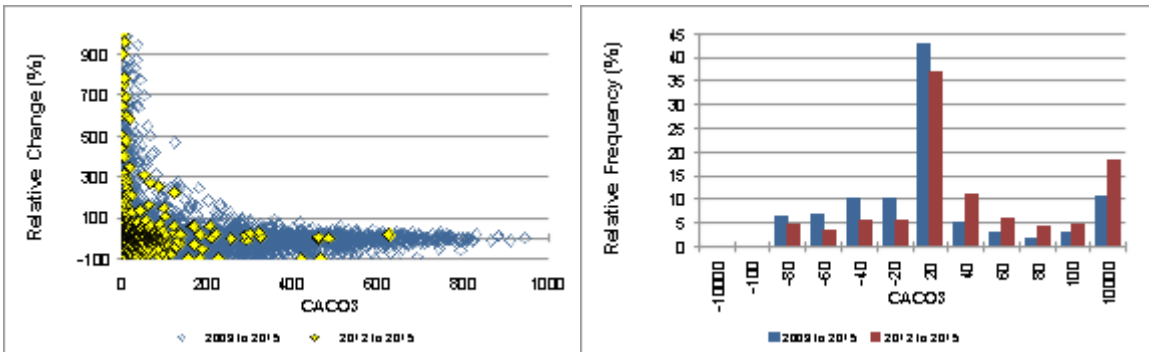
Compared to simply pooling all data on OC content (regression slope: 0.89; r^2: 0.46 for 2009 to 2015 repeated samples) the coefficient of correlation r^2 increased when restricting the samples to the same land use type or land cover category to grassland or cropland. The variability in the OC content seems to significantly larger in natural land than the other land use types, which would explain to some degree the variability on the pooled data.

Common to all changes in OC content is that the slope is < 1.0. This is also the case for the repeated samples for the 2012 LUCAS soil survey (Bulgaria and Romania: regression slope: 0.96 for same LU). One would not have expected a notable change in OC content for cropland remaining cropland over a 3-year period.

The spread of the changes in OC at plot level poses a problem for selecting a range limit of expected changes in OC at the level of the plot. In this case, neither a limit of relative changes nor an absolute limit would lead to a meaningful reduction in the number of cases highlighted.

Temporal Changes: $CaCO_3$

For the results of the parameter *CACO3* changes for each repeated sample and the frequency distribution of the changes are presented in Figure 11.

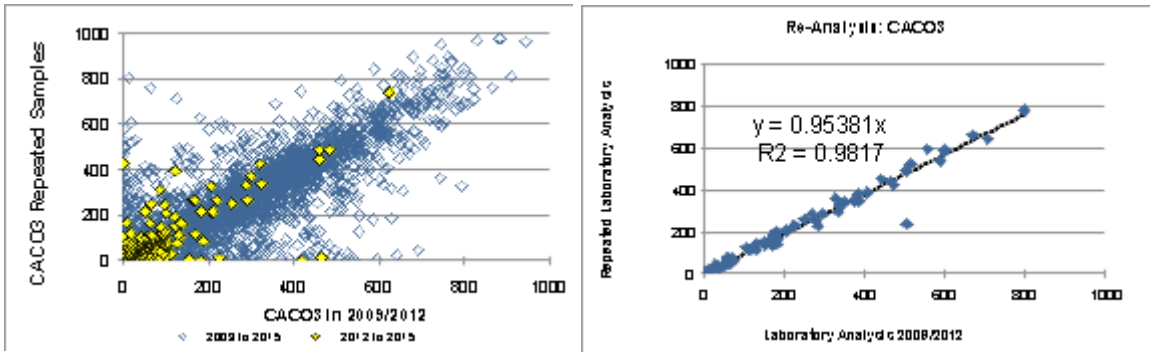


a) Scatter Plot $CaCO_3$ *b) Frequency Distribution $CaCO_3$*

Figure 11: Plot and Frequency Distribution of Temporal Change for Soil Parameter $CaCO_3$

The scatter plot of changes in *CACO3* against the values in the survey base year show an accumulation of changes > +100% below a value of approx. 350 *g kg*$^{-1}$. This is also visible in the frequency distribution of the changes, where the relative frequency of changes remain above 5% for all bins. Changes of < +/-20% were found for 42.9% of the samples analysed. Very notable is the frequency of 10.8% of changes > 100%. This does not include any change from or to values below the LOD or set to zero in 2015 data. The notable changes for repeated samples are not linked to cases where the OC content changed from a mineral soil type to a soil high in OC or vice versa. for 279 cases of mineral/organic changes investigated 12 cases showed a notable change *CACO3*. Consistent with expectations is that whenever an OC content increased from mineral to organic the *CACO3* concentration did not increase. Yet, there were only 5 cases with a *CACO3* concentration > 3 *g kg*$^{-1}$ that changed from mineral to organic, in a data set of over 15,000 data points. No correlation whatsoever was found relating changes in *CACO3* to changes in *OC*.

A scatter plot of the *CACO3* concentrations reported for 2009/2015 and repeated samples in 2015 and the result of the reanalysed samples are presented in Figure 12.



a) Scatter Plot $CaCO_3$ *b) Reanalysis $CaCO_3$*

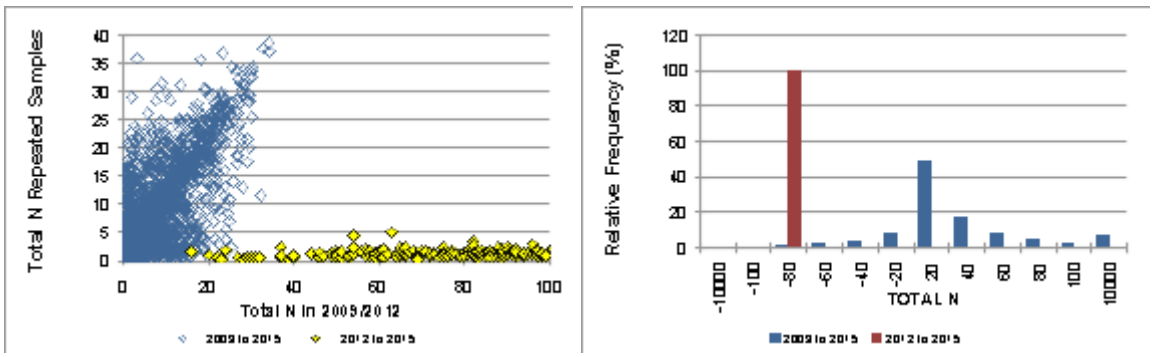
Figure 12: Change in Soil Parameter $CaCO_3$ from 2009 and 2012 to 2015 for Repeated Samples and Reanalysis of 2009/2012 Data

The graph illustrates the variability in the parameter for repeated sampling after three to six years. The correlation of the originally analysed and reanalysed samples shows that the parameter can be determined consistently, although there is one unexplained outlier. Without the outlier the regression slope is 0.97.

These results suggest that the variability in the changes of *CACO3* between the first and the second samples is unlikely a result of the laboratory measurements, but due to other factors, such as differences in the properties of the soil sampled.

Temporal Changes: Total Nitrogen

For the soil parameter *total nitrogen* a comparison of the values from repeated sampling and the relative frequency distribution are presented in Figure 13.

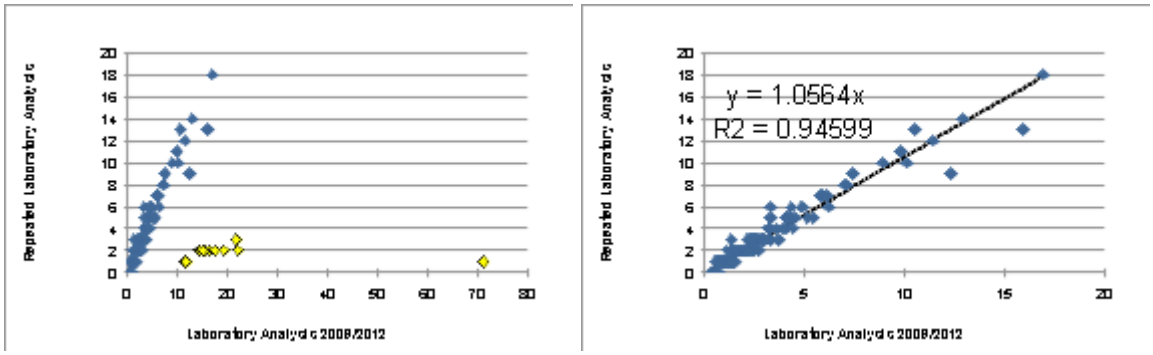


a) Scatter Plot Total Nitrogen *b) Frequency Distribution Total Nitrogen*

Figure 13: Plot and Frequency Distribution of Temporal Change for Soil Parameter Total Nitrogen

The scatter plot as well as the Reanalysis of the 2009/2012 data show that there is a problem with the data from the 2012 LUCAS soil survey. A closer look at the data reveals a difference in the order of one magnitude. Very

likely the data were reported in the wrong unit, i.e. not in *g kg*$^{-1}$. This inconsistency in the data is also present in the reanalysed data, as shown in Figure 14.



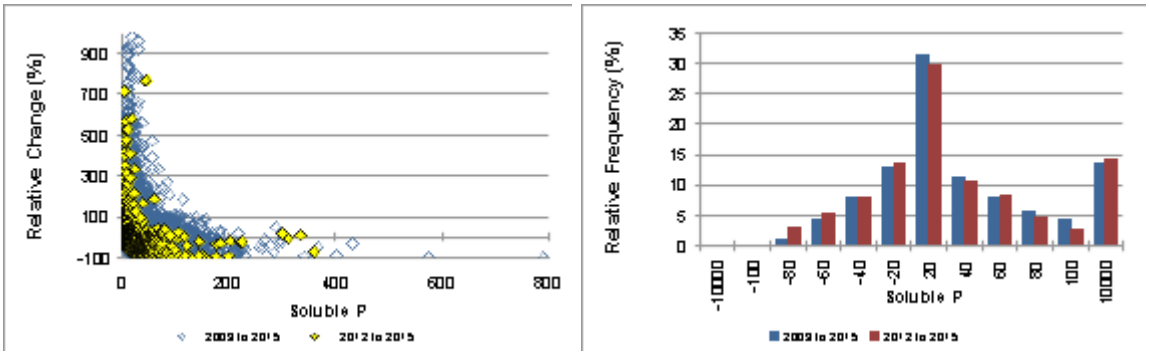
a) Reanalysis 2009 and 2012 *b) Reanalysis 2009 data only*

Figure 14: Laboratory Results from Repeated Analysis of Samples from 2009/2012 LUCAS Soil Surveys for Soil Parameter Total Nitrogen

Restricting the Reanalysis to the 2009 data provides a good fit of the laboratory results.

Temporal Changes: Soluble Phosphor

For the parameter soluble phosphor a comparison of the values from repeated sampling and the relative frequency distribution are presented in Figure 15.

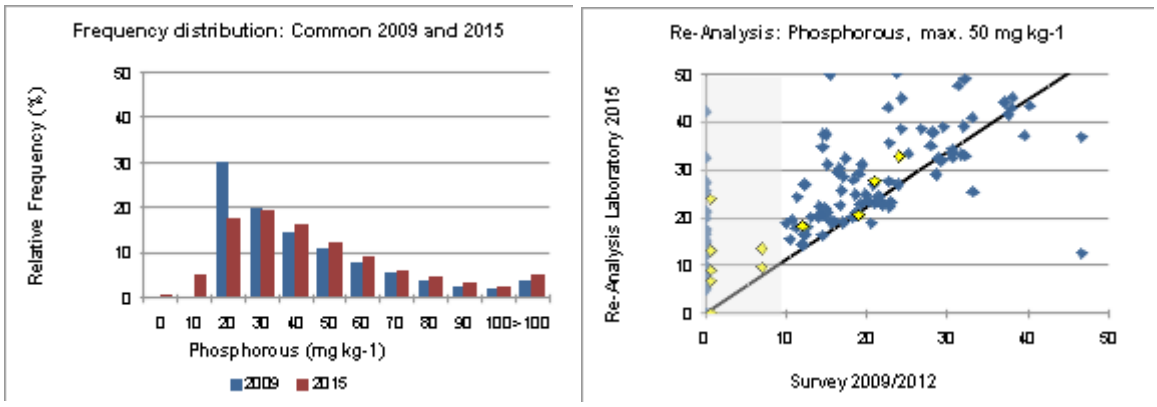


a) Scatter Plot Soluble Phosphor *b) Frequency Distribution Soluble Phosphor*

Figure 15: Plot and Frequency Distribution of Temporal Change for Soil Parameter Soluble Phosphor

The scatter plot and the frequency distribution show a spread of the data pairs across a relative change of +/- 80%. About 30% of the values remain within a range of +/-20%. Notable is the relatively large group of changes > 100%.

To better understand the situation the relative frequency distributions of the values reported for repeatedly surveyed points of the 2009 and 2015 LUCAS soil surveys were compared. The data are graphically is presented in Figure 16.



a) Frequency Distribution Soluble Phosphor *b) Reanalysis Soluble Phosphor*

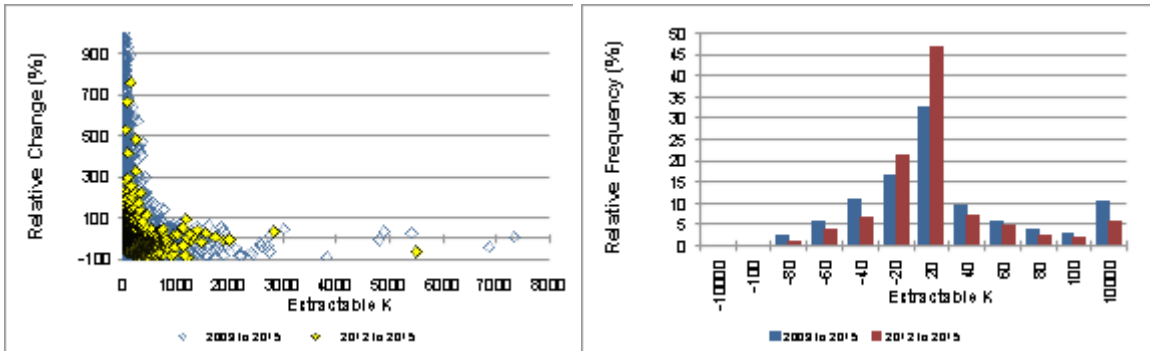
Figure 16: Plot and Frequency Distribution of Temporal Change for Soil Parameter Soluble Phosphor

The frequency distribution of the values indicated a notable difference in the presence of values of 10 to 20 *mg kg^{-1}* between the years. Zooming in on the data of the Reanalysis and values of < 50 *mg kg^{-1}* displays the situation for lower P concentrations. The graphs illustrates that for samples with soluble P concentrations below the LOD in 2009 / 2012 (values set to zero) the Reanalysis found non-negligible amounts for the nutrient and frequently above the LOD. There is also a notable tendency for values below approx. 30 *mg P kg^{-1}* to have higher values in the Reanalysis This concerns 50% of the 2009 samples. When forcing the off-set of the linear regression to zero this tendency will not be noticeable in the slope.

There is, therefore, some uncertainty in the consistency of the change analysis for concentrations of soluble phosphor below 30 *mg kg^{-1}*, independently of the survey year.

Temporal Changes: Extractable Potassium

The relative changes of *extractable potassium* and their frequency distribution are given in Figure 17.

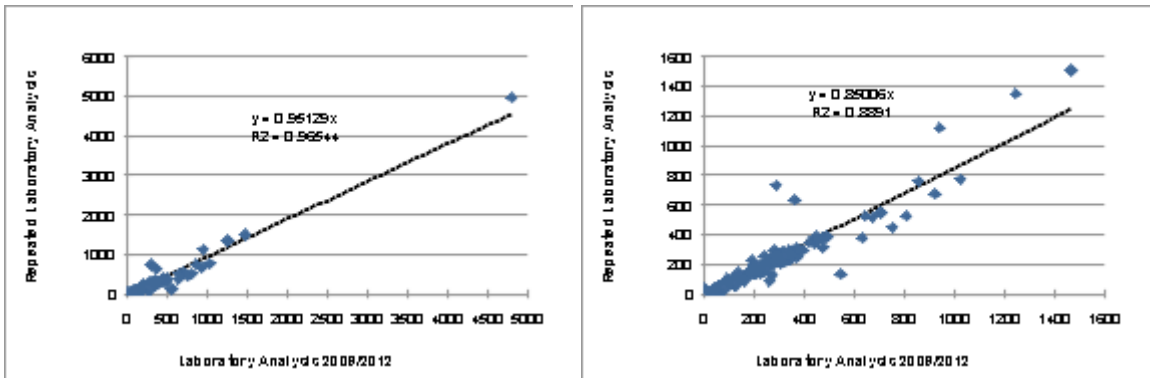


a) Relative change Extractable Potassium *b) Frequency Distribution Extractable Potassium*

Figure 17: Plot and Frequency Distribution of Temporal Change for Soil Parameter Extractable Potassium

The graphs indicate the considerable range of values in the soil samples. Also the changes in *extractable potassium* are quite sizable at lower concentrations. The relative frequency of the changes indicates that the concentrations declined in the 54% of cases from 2009 and 60% of cases from 2012 to 2015 repeated samples. The regression slope for 2009 repeated samples in 2015 is 0.81 and 0.82 for 2012 repeated samples.

The results of the Reanalysis of the 2009 and 2012 data be the laboratory are presented in Figure 18.



a) Reanalysis Extractable K, all data *b) Reanalysis Extractable K, < 1600 mg kg^{-1}*

Figure 18: Reanalysis of 2009 and 2012 Samples for Soil Parameter Extractable Potassium

The regression slope of the 214 reanalysed samples of 2009 and 2012 is largely defined by a single sample high in extractable K. Such values are also found at other points, but are generally rare.

When excluding the single high value for extractable K from data the H_0 for the regression slope is outside the confidence intervals for the 95% and 99% confidence level:

99% confidence interval: $0.80919 \leq \beta \leq 0.89081$

95% confidence interval: $0.81905 \leq \beta \leq 0.88095$

Another indicator for lower values in the reanalysed data than the original data is that out of 211 data pairs the Reanalysis gives for 193 (91%) pairs a lower concentration. The confidence limits for the difference of the mean for the reanalysed data was found to be:

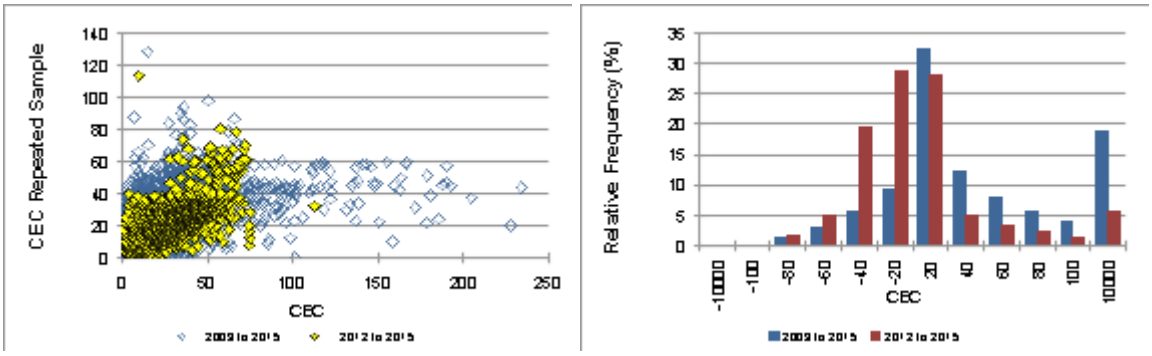
99% confidence interval: $34.58507 \leq \beta \leq 44.42251$

95% confidence interval: $35.76579 \leq \beta \leq 43.24179$

There is very scant substance that supports the Null-hypothesis H_0 of no difference between the mean of the original and the reanalysed samples. Therefore, it cannot be excluded that the changes in extractable K in the repeated samples are significantly influenced by the differences in the laboratory method.

Temporal Changes: Cation Exchange Capacity

The data of the first LUCAS Soil survey compared to the laboratory results for the repeated samples of the 2015 Soil survey for CEC are given in Figure 19.



a) Scatter plot CEC *b) Frequency Distribution CEC*

Figure 19: Scatter Plot of Resample Points and Relative Frequency Distribution of Change for Soil Parameter Cation Exchange Capacity

The data pairs of first and repeated samples do not exhibit a consistent relationship between surveys. From a visual interpretation of the data it would appear that for repeated 2009 samples with 70 *cmol(+) kg^{-1}* the 2015 samples are restricted to a *CEC* of 60 *cmol(+) kg^{-1}*, while a limit of 40 *cmol(+) kg^{-1}* seems to exist for 2012 samples of less than 30 *cmol(+) kg^{-1}*.

The relative frequency distribution shows a marked difference in the changes of the 2009 and 2012 data. The *CEC* for samples form Bulgaria and Romania decreases, whereas such a trend is not present in the resampled data of 2009 points.

The results of the reanalysed samples are presented in Figure 20.

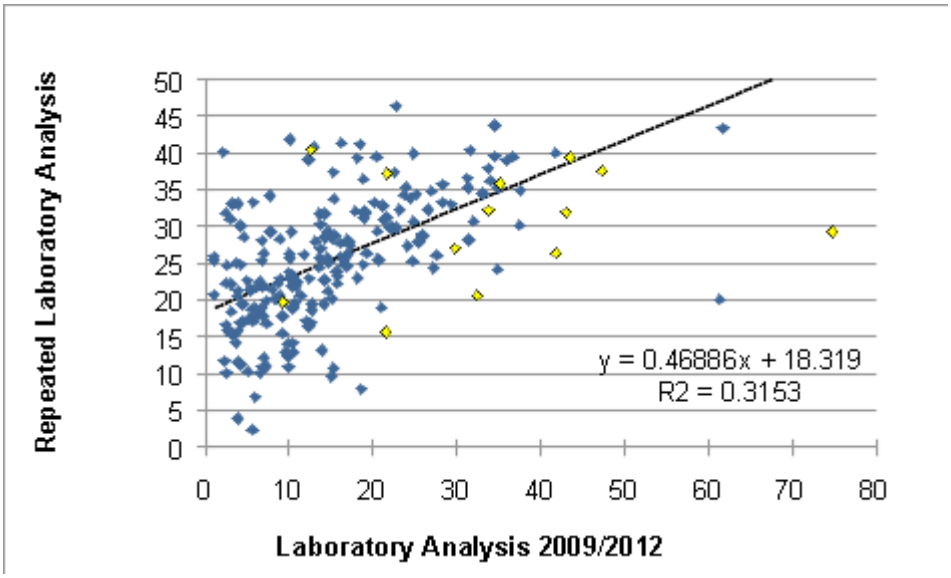


Figure 20: Reanalysed Samples of 2009 and 2012 for Soil Parameter Cation Exchange Capacity

The linear regression of the laboratory data from the reanalysed samples points to a non-zero off-set in the data and a low correlation between the original and the reanalysed data. From the information available the reason for the inconsistent results of the Reanalysis cannot be unequivocally identified. It may be assumed that the erratic results of the Reanalysis of the 2009 and 2012 samples are at least in part responsible for the lack of a consistent changes in the data of the resampled points.

Links to Eurostat Micro Data

A summary of the cases highlighted by the checks for valid external links is given in Table 28.

Table 29: Summary Results for Checks of and Links to Eurostat Micro-Data for Survey Year

Check ID	Cases No.	Check Label	Message
1006	516	DIST_SOIL_POINT_2009	Distance between 2009 GPS co-ordinates and OBS_DIST exceeds limit.
1007	65	DIST_SOIL_POINT_2012	Distance between 2012 GPS co-ordinates and OBS_DIST exceeds limit.
1008	173	DIST_SOIL_POINT_2015_G1	Distance between 2015 GPS co-ordinates and OBS_DIST exceeds limit.
1009	173	DIST_SOIL_POINT_2015_G2	Distance between 2015 GPS co-ordinates and OBS_DIST exceeds limit.
1010	173	DIST_SOIL_POINT_2015_G3	Distance between 2015 GPS co-ordinates and OBS_DIST exceeds limit.
1011	173	DIST_SOIL_POINT_2015_G4	Distance between 2015 GPS co-ordinates and OBS_DIST exceeds limit.
1012	134	MICRO_COOR_2009	Ambiguous link between 2009 LAB, DMT and Micro data.
1013	1	MICRO_COOR_2012	Ambiguous link between 2012 LAB, DMT and Micro data.
1014	2	MICRO_COOR_2015	Ambiguous link between 2015 LAB, DMT and Micro data.

Eurostat Micro Data Points

The check found 134 cases of ambiguous links of the Soil-DMT data to the Eurostat micro-data for the 2009 survey. The number dropped to one case for 2012 and 2 cases for 2015 data links. As regards linking the 2009 soil data to other information there are some restrictions for the data from Cyprus and Malta.

Due to the nature of the 2009 Malta survey the results of the 19 soil samples cannot be linked to the Eurostat LUCAS data on land use/cover. The results from the laboratory analysis can be assigned geographic locations using the additional data available. Rudimentary data on land use was noted during the survey.

For the 2009 LUCAS Soil survey for Cyprus the co-ordinates of the 90 soil sample are those of the LUCAS point grid location. In the absence of a concurrent LUCAS LUC survey information on the distance of the observation point to the grid location and any information on land use or cover of a soil sample can only be deduced from the 2015 LUCAS LUC survey.

Distance of Observation

The test on the distance between the soil sample location and the point to which the land use / cover information relates has highlighted 516 cases where the distance exceeds 100 m for the 2009 survey. For the 2012 survey the distance limit was exceed for 65 samples and for 173 samples for the 2015 survey. The check sets a warning rather than an error, although it may be advisable to remove the data of the soil samples concerned from further analysis.

5 Summary and Conclusions

The detailed assessment of the results of the evaluation checks includes the identification of each item highlighted by the checks. This level of detail is needed to trace the source of any non-standard or peculiar conditions found. To put the number of cases highlighted by the checks into perspective the results are summarised by survey and expressed as a percentage of the total number of items.

5.1 Compliance

This section contains a summary of the groups of checks that assess the adherence to formal aspects of the files and data delivered.

Delivery Format

The files delivered with the results of the laboratory measurements were:

- 2009: 3 (20,000 samples, incl. Cyprus; 897 additional samples; 19 samples for Malta)
- 2012: 2 (Bulgaria, Romania)
- 2015: 1 (Groups 1 to 4 in separate notebooks)

The summary of the compliance of the delivery format to the format specified in is presented in Table 30.

Table 30: Summary of Compliance Check for Delivery Format

Survey	Items	Check Failed	
	No.	*No.*	*%*
2009, 20,000 samples	1	0	0.0
2009, 897 additional samples	1	0	0.0
2009, Malta*	1	N/A	N/A
2012 Bulgaria	1	0	0.0
2012 Romania	1	0	0.0
2015 Group 1, 2, 3 and 4**	1	0	0.0

* retrieved from ESDAC
** single file with Groups on separate worksheets

All LUCAS Soil survey data were available in the format specified in the technical documents. The only data not available in spreadsheet format were the results from the 2009 survey for Malta. This survey was performed outside the frame of

LUCAS and no document specifying the file format for the delivery of the laboratory results could be retrieved.

Parameter Position

The position of parameters in the spreadsheet file is of some importance, because data are frequently accessed by column number and not by parameter or field name. A summary of the checks on parameter position is given in Table 31.

Table 31: Summary of Parameter Position Check

Survey	Items	Check Failed	
	No.	*No.*	*%*
2009, 20,000 samples	12	0	0.0
2009, 897 additional samples	12	0	0.0
2009, Malta*	12	N/A	N/A
2012 Bulgaria*	12	12	100.0
2012 Romania*	12	12	100.0
2015 Group 1	9	9	100.0
2015 Group 2	9	9	100.0
2015 Group 3	13	13	100.0
2015 Group 4	9	9	100.0

* no documents with specifications

More problematic than a general shift in the column position is a change in the order of positions of some parameters. In the data for Malta the results of the parameter pH(H_2O) are recorded before the parameter pH($CaCl_2$). In all 2015 files, *soluble phosphor* is recorded before *total nitrogen*. In Group 3 the results for *SAND* are exchanged with the results for *SILT*. Where data cover similar ranges of values, such as *pH* or particle size distribution, these alterations in the position of a parameter in the file are not immediately obvious, but potentially of consequence.

Reporting Decimals

The number of decimals of the values reported are a specified in the technical documents for each parameter. The documents are not consistent in all cases when specifying the number of decimals, mainly for pH($CaCl_2$) and total nitrogen. In contrast to pH(H_2O), which should be reported with two decimals, the results for pH($CaCl_2$) should be reported with one decimal. *Total nitrogen* should be reported with zero decimals. A summary of the checks for decimals is presented in Table 32.

Table 32: Summary of Reporting Decimals Check

Survey	Items	Check Failed	
	No.	*No.*	*%*
2009, 20,000 samples	12	0	0.0
2009, 897 additional samples	12	0	0.0
2009, Malta*	12	0	0.0
2012 Bulgaria	12	3	25.0
2012 Romania	12	3	25.0
2015 Group 1	9	0	100.0
2015 Group 2	9		100.0
2015 Group 3	13		100.0
2015 Group 4	9		100.0

Data outside the specifications were found for the 2012 LUCAS Soil survey for Bulgaria and Romania for *total nitrogen* and *soluble phosphor*. Data were reported with more than the specified decimals and the effect of the deviation from the specifications on the use of the data should not be of consequence.

Parameter Data Type

The file format used to submit the results of the laboratory analysis does not require a single data type to be used for a parameter (column or field), nor do the technical documents provide any specifications for a data type. The check is applied for completeness of the data evaluation, but also to identify and highlight any non-numeric entries that are stored in the data for parameters. The result of the evaluation is summarised in Table 33.

Table 33: Summary of Parameter Type Check

Survey	Items	Check Failed	
	No.	*No.*	*%*
2009, 20,000 samples	13	10	76.9
2009, 897 additional samples	13	6	46.2
2009, Malta*	13	1	7.7
2012 Bulgaria	13	3	25.0
2012 Romania	13	3	25.0
2015 Group 1	10	0	0.0
2015 Group 2	10	2	20.0
2015 Group 3	14	0	0.0
2015 Group 4	10	0	0.0

The only parameter, for which a single data type (numeric) is needed, is the sample identifier that allows linking the soil data to information collected in other LUCAS surveys. Entries of alpha-numeric type are present in the parameter data, but also the soil identifier, in data for the 2009 LUCAS Soil survey of 20,000 samples and the 897 additional samples. All 2012 data correspond to the expectations for the data type, including the sample identifier. The soil identifier links to a LUCAS grid position. For 2015 data only Group 2 data contained some inconsistent entries.

Reporting Units

The units in which the results of the laboratory analysis should be reported are specified in the technical documents for 2009 and 2015 data. No information is available for the 2012 data. A summary of the results from the check are presented in Table 34.

Table 34: Summary of Parameter Unit Check

Survey	Items	Check Failed	
	No.	*No.*	*%*
2009, 20,000 samples	12	0	0.0
2009, 897 additional samples	12	0	0.0
2009, Malta*	12	0	0.0
2012 Bulgaria	12	1	8.3
2012 Romania	12	1	8.3
2015 Group 1	9	0	0.0
2015 Group 2	9	0	0.0

Survey	Items	Check Failed	
	No.	*No.*	*%*
2015 Group 3	13	0	0.0
2015 Group 4	9	0	0.0

The reporting units remained unchanged between surveys. The only deviation from the specifications was found for total nitrogen of the 2012 surveys. The unit was not specified, but is an order of magnitude outside the range of *mg kg^{-1}*. This is a serious error and the check results in an error message. Without adjustment the use of the data can lead to consequential misinterpretations.

5.2 Conformity

The results of the assessment of the data structure and values reported are summarised by the Section of the Compliance checks. Some of the results require a presentation by survey, others by parameter.

5.2.1 Section 1: Data Structure

The status of data structure is governed by the rules set for data integrity of the data model of the evaluation database. The results of checks performed under the section are:

- Duplicate SOIL_ID in soil data (key violation);
- SOIL_ID missing in DMT (referential integrity);
- Duplicate DMT link data (key violation);
- No. of valid links

Aspects of data integrity of the DMT data, such as duplicate identifiers for points and soil samples, are checked and reported in the detailed results table, but not included in the summary reports since they are external to the LUCAS Soil data.

2009 LUCAS Soil Survey

The checks for data integrity were performed separately for the main data with results for 20,000 samples and the additional 897 samples. The checks could not be applied to the 2009 samples from Malta, which are not included in the DMT for that year. the results are summarised in Table 35.

Table 35: Summary of Data Structure Checks for LUCAS Soil 2009 Data

Check	Main Data		Additional	
	No.	*%*	*No.*	*%*
SOIL_ID missing in DMT	1,546	7.7	104	11.6
Duplicate SOIL_ID in soil data	0	0.0	0	0.0
Duplicate link	434	2.2	17	1.9
Valid links	18,019	90.1	776	86.5
Duplicate textural and pH data	8	<0.1	0	0.0
Duplicate chemical data	0	0.0	0	0.0

When linking the 2009 laboratory data to the DMT the use of the code "9" in the soil data and the DMT data generates 48,885 duplicate links. Excluding the code "9" from the query result in 19,051 links.

For the main data of the 2009 survey duplicate links to the DMT file exist for 434 soil identifiers, of which some appear more than twice. The 2009 DMT file itself has duplicate entries for all soil IDs < 30.

Of the soil IDs in the 2009 soil laboratory data 1,546 have no corresponding entry in the DMT. Missing link entries in the DMT can have several causes and are not necessarily a problem of the soil data. A cause of inconsistency that can be attributed to the soil data is an alpha-numeric entry for the soil identifier, which has to be of type numeric. The condition is assessed as part of the Compliance checks. In total, 1,981 soil identifiers of the 2009 soil data cannot be linked to the DMT.

Of the 897 additional samples of the 2009 laboratory data, 104 have no corresponding entry for the soil ID in the DMT, while 17 soil IDs occur more than once in the link. A valid link to the DMT could be established for 776 samples. Duplicate textural data are caused by missing data, not by repeatedly recorded measurements.

2012 LUCAS Soil Survey

The 2012 soil data contain the information of the corresponding LUCAS grid point in the soil laboratory data. A summary of the evaluation checks for the survey data is presented in Table 36.

Table 36: Summary of Data Structure Checks for LUCAS Soil 2012 Data

Check	Bulgaria		Romania	
	No.	*%*	*No.*	*%*
SOIL_ID missing for LUCAS point*	0	0.0	4	0.3
Duplicate SOIL_ID in soil data	3	0.5	0	0.0
Duplicate link	N/A	N/A	N/A	N/A
Valid links	655	99.1	1,369	99.7
Duplicate textural and pH data	0	0.0	2	0.1
Duplicate chemical data	0	0.0	2	0.1

* No DMT, LUCAS point data included in laboratory data

For the 661 points of the data for Bulgaria three Soil IDs have duplicates in the file. This produces an invalid link for six records of the laboratory analysis and a number of 655 valid links.

For the 1,373 points of the soil data from Romania four point IDs have no corresponding Soil ID. The number of points with soil data is thus reduced to 1,369. The duplicate entries for textural and chemical data are caused by samples with ”*-999*” entries in all parameter fields.

2015 LUCAS Soil Survey

The results of the laboratory analysis of the 2015 LUCAS Soil data are stored separately for each of the four groups. Therefore, the data links are assessed for each of the groups. However, a soil ID may occur in more than one group, which would not be detected when assessing the group data separately. Therefore, the occurrence of duplicate soil IDs in the soil data is also assessed for the combined 2015 LUCAS soil data. the summary of the highlighted conditions for the check by sample Group is given in Table 37.

Table 37: Summary of Data Structure Checks for LUCAS Soil 2015 Group Data

Check	Group 1		Group 2		Group 3		Group 4	
	No.	*%*	*No.*	*%*	*No.*	*%*	*No.*	*%*
SOIL_ID missing in DMT	2	0.1	140	0.9	25 *1,342*	0.6 *23.7*	0	0.0
Duplicate SOIL_ID in soil data	0	0.0	0	0.0	0	0.0	0	0.0
Duplicate links	8	0.6	0	0.0	0	0.0	0	0.0
Valid links	1,324	99.3	15,789	98.6	4,243 *4,246*	96.9 *77.1*	381	100
Duplicate textural and pH data	N/A	N/A	N/A	N/A	6	0.1	N/A	N/A
Duplicate chemical data	0	0.0	0	0.0	0	0.0	0	0.0

Note: analysis of particle size distribution only available fore new sample locations (Group 3).
italics: all data, incl. non-EU28 countries

Of the Group 1 data two SOIL_IDs of the soil data were missing in DMT data. There were no duplicates in of the IDs in the soil data, but 8 cases of duplicate links with DMT data. Overall, 1,324 samples can be linked without ambiguity to the DMT.

For Group 2 data 140 soil IDs have no corresponding entry in the DMT data. An unusual condition for this data is that for 90 soil IDs duplicate Point IDs are recorded in the DMT data. This generates duplicate soil IDs when linking the data.

The links of soil data of Group 3 to the DMT are marked by a notable number of cases highlighted. An entry of the soil ID in the DMT is missing for 1,342 samples, which concerns 23.7% of the samples of that group. When linking the data to the DMT, 68 soil IDs appear as duplicates, because Point IDs are associated with more than one soil ID in the DMT. Yet, these checks are performed on all data in Group 3, including data from non-EU28 countries. These countries lack entries in the link field in the DMT, which leads to the high number of missing links. When restricting the check to EU28 data the number of missing SOIL_IDs is 25, or 0.6% of the 4,381 samples.

No cases were highlighted when linking Group 4 data to the DMT.

For the combined 2015 LUCAS Soil survey laboratory data for 23,386 samples are recorded. Combining all Group data into a single table creates some inconsistencies in the data structure. A summary of the checks on data structure for the combined data are presented in Table 38.

Table 38: Summary of Data Structure Checks for LUCAS Soil 2015 Data of Combined Group Data

Check	All		EU28	
	No.	*%*		*%*
Missing Soil ID in DMT	*1,484*	*6.3*	167	0.8
Duplicate Soil ID in soil data	*4*	*0.7*	4	0.1
Duplicate Links	*0*	*0.0*	0	0.0
Valid links	*21,739*	*93.0*	21,736	98.3

The difference between the valid links by Group and the combined Group data is one sample. The automatic checks were not designed to check this particular case and a manual analysis identified [SAMPLE_ID] 56275 as a duplicate between Groups 2 and 3. It is also assigned to Lithuania and Switzerland. All other duplicated are assigned to Poland (IDs: 41820; 41823; 41824).

The number of valid links between the laboratory results and the DMT (21,736) is lower than the the number of links between the soil IDs of the two tables (22,067). The reason for the lower number of valid links are 162 cases where a soil ID is associated with more than one point ID. This causes ambiguous relations for these samples. The cases are distributed unevenly between countries as given Table 39.

Table 39: Duplicate Links of Point Identifiers in DMT to Soil Identifiers in 2015 LUCAS Soil Laboratory Data of Combined Group Data

Country	No.	%	Country	No.	%	Country	No.	%
Austria	12	2.8	Finland	8	0.7	Lithuania	4	1.1
Belgium	2	1.4	France	64	2.1	Poland	33	2.4
Bulgaria	14	2.3	Germany	21	1.2	Portugal	6	1.3
Croatia	86	42.4	Greece	2	0.3	Romania	4	0.4
Cyprus	2	2.6	Hungary	10	2.4	Spain	20	0.5
Czech	8	1.8	Ireland	2	1.0	Sweden	14	0.7
Denmark	4	1.8	Latvia	6	1.9	UK	4	0.8

Only data from EU28 are affected. Overall, 1.4% of the soil samples for 2015 are affected. At the level of countries the lowest number of more than one point ID assigend to a soil ID was found for Greece (0.3%), the highest for Croatia (42.4%).

5.2.2 Section 2: Data Status

The checks of this section evaluate the degree to which data entries are conform to expected codes, values or ranges of values.

Conformity for LUCAS 2009 Soil Survey Data

A summary of the results obtained from the checks of this section for 2009 LUCAS Soil data is presented in Table 40.

Table 40: Summary of Data Conformity Checks for 2009 LUCAS Soil Data

Check	Parameter											
	CF	Clay	Silt	Sand	pH(CaCl2)	pH(H2O)	OC	CaCO3	N	P	K	CEC
	%	%	%	%	%	%	%	%	%	%	%	%
Missing Data		0.0	0.0	0.0								
Code for LOD							0.0		0.1	0.8		0.0
Numeric Range						0.0						
Minimum < LOD												
Expected Range Min					2.2	0.5	0.4	24.5	1.4	5.5	1.1	2.7
Expected Range, Max	0.2				0.2	0.5	1.2	1.0	1.0	1.6	4.5	1.2

The summary table indicates that the deviations from expected values remain below 5% of the data, with the exception of the minimum value of the expected range for $CaCO_3$ and *soluble phosphor*. The minimum value for $CaCO_3$ was set to <3.0 $g\ kg^{-1}$ for mineral soils and <1.0 $g\ kg^{-1}$ for soils high in organic carbon. The limit for soil high in OC is actually below the LOD for the parameter, which means the values reported by the laboratory are zero for these cases. For *soluble phosphor* the minimum expected value was set to 12 $mg\ kg^{-1}$. This is close to the LOD of 10 $mg\ kg^{-1}$. Such values are possible, but should be considered for a comparison with data from repeated samples taken at the same point.

Conformity for LUCAS 2012 Soil Survey Data

The summary results for the second section of Conformity Checks for 2012 LUCAS Soil data are presented in Table 41.

Table 41: Summary of Data Conformity Checks for 2012 LUCAS Soil Data

Check	Parameter											
	CF	Clay	Silt	Sand	pH(CaCl2)	pH(H2O)	OC	CaCO3	N	P	K	CEC
	%	%	%	%	%	%	%	%	%	%	%	%
Missing Data												
Code for LOD							11.4	33.4		31.2		
Numeric Range		0.6	0.7		0.1	0.1	0.7	0.4	0.4	0.6	0.1	1.1
Minimum < LOD							0.7	0.4	0.3	0.6	0.1	2.0
Expected Range Min					0.1	0.1	0.7	34.8	0.3	27.3	0.1	
Expected Range, Max	6.3				0.0	0.3	0.1		88.3	1.1	2.1	10.3

The results of the analysis of the 2012 LUCAS Soil data shows inconsistent entries for the code used to mark results below the LOD for the parameters *OC*, *CACO3* and *soluble phosphor*. The main cause is the use of the entry ”-999”, which is undefined. The detailed analysis showed that the value neither signifies missing data, nor measurements below the LOD. Notable is also the number of cases with a value reported that is below the minimum of the expected range of values. The relatively high proportion cannot be explained by the use of the code *”-999”*, of which there are only 13 (0.6%). The survey only covers two countries and one cannot exclude that the limited spatial extent contributes to the condition.

As noted, the values reported for the results of the analysis of total nitrogen are largely out of range. These values seem to be reported in a unit different from the one used for other years. A comparison with 2015 data for repeated sites suggest that a simple factor can be applied to adjust he values.

Conformity for LUCAS 2015 Soil Survey Data

The group results of the laboratory analysis of the 2015 LUCAS Soil survey samples were combined to a single survey. A summary of the checks for data conformity is presented in Table 42.

Table 42: Summary of Data Conformity Checks for 2015 LUCAS Soil Data

Check	Parameter											
	CF %	Clay %	Silt %	Sand %	pH(CaCl2) %	pH(H2O) %	OC %	CaCO3 %	N %	P %	K %	CEC %
Missing Data	0.1											
Code for LOD							0.3	49.1	0.1	8.2	0.6	1.6
Numeric Range						0.0						
Minimum < LOD												
Expected Range Min					0.6	0.4	0.8	65.5	1.2	28.5	2.7	3.2
Expected Range, Max	1.5				0.3	0.3	1.4	1.3	2.0	1.9	3.5	1.5

The summary results indicate notable inconsistencies in reporting values below the LOD for $CaCO_3$ (49.1%) and to a lesser degree for *soluble phosphor* (8.2%). The main reason for highlighting almost half the data for $CaCO_3$ as failing the check is the use of the value zero ("0") in 11,478 cases. Assuming that a value of "0" indicates a sample with $CaCO_3$ concentrations below the LOD there is also notable increase of such cases over 2009 (37.6%). The same applies to cases where the reported value for $CaCO_3$ is below the minimum of the expected range of concentrations.

Similarly, there is a very notable increase in the number of cases where the value for *soluble phosphor* is below the expected range. Also here the cause is the use of a value "0" instead of a code to indicate a measurement below the LOD. In the 2009 data the portion of measurements with a result below the LOD for the parameter was 22.5%, but consistently coded.

5.3 Uniformity

The summary of the checks for data Uniformity presents the consistency of multiple parameters by survey (Section 1). The results of the the single-parameter temporal consistency (Section 2) are presented by parameter.

5.3.1 Section 1: Multi-parameter, Single-survey

A summary of the results of the multi-parameter checks is given in Table 43.

Table 43: Summary of Data Uniformity Multi-Parameter Checks

Check	LUCAS Soil Survey		
	2009	**2012**	**2015**
	%	*%*	*%*
C/N Ratio Min.	0.3	7.7	1.3
C/N Ratio Max.	0.0		0.1
pH Difference		0.0	0.0
High pH for low $CaCO_3$	0.6	0.0	0.2
Low $CaCO_3$ for high pH	16.1	2.6	32.7
OC < LOD($CaCO_3$)		0.1	0.3

For the results of the laboratory analysis of the 2009 samples the checks indicate an unexpectedly low carbonate content for a high pH for 16.1% of the samples. This rate doubled for 2015 data, which is consistent with the number of samples low in carbonate. A rate of values below the expected minimum C:N Ratio of 7.7% was found after modifying the data for *total nitrogen*. The rate can be considered high, although the limited spatial range of the sample sites should be considered.

5.3.2 Section 2: Single Parameter, Multiple Surveys

Over a period of no more than 6 years it can be reasonably expected that changes from soils with a *OC* content < 120 $g\ kg^{-1}$, i.e. mineral soils, to soils high in *OC* content are very limited. This would involve re-wettig areas of former peat lands after drainage. The inverse change, from soils high in *OC* to mineral soils, could occur over a short time period for soils that were already marginal in organic material and after a land use change, typically from natural vegetation to arable. When setting the limit for soils high in *OC* to >= 200 $g\ kg^{-1}$, to exclude smaller changes, the changes given in Table 44 were highlighted by the check.

Table 44: Summary of Changes from Mineral to high OC and vice versa

Check	LUCAS Soil Survey		
	2009	**2012**	**2015**
	No. *%*	*No.* *%*	*No.* *%*
Samples high in OC (> 200 *g kg^{-1}*)	1188 5.7%	0 0.0%	853 3.6%
Mineral OC to high OC			127 14.9%
High OC to mineral OC	151 12.7%		

The table shows that for repeated samples 14.9% of the soils high in *OC* (>= 200 *g C kg^{-1}*) contained < 120 *g C kg^{-1}* in 2009. The inverse trend, i.e. for samples with soils high in OC in 2009 a mineral soil OC was reported in 2015, was found for 12.7% of the repeated samples. Setting a limit of 150 *g C kg^{-1}* to signify soils high in *OC* increases to the proportion of change to over 20% of soils high in OC. No soils with OC >= 200 *g C kg^{-1}* were reported for the 2012 samples.

This rate of change is not expected. Possible causes of these exceptional changes are discussed in the detailed section for the check

Temporal changes from 2009/2012 to 2015 are summarised in Table 45.

Table 45: Summary of Temporal Changes from 2009/2012 LUCAS Soil Survey Samples to 2015

Check	Parameter											
	CF	**Clay**	**Silt**	**Sand**	**pH($CaCl_2$)**	**pH(H_2O)**	**OC**	**$CaCO_3$**	**N**	**P**	**K**	**CEC**
	No. *%*	*No.* *%*	*No.* *%*	*No.* *%*	*No.* *%*	*No.* *%*	*No.* *%*	*No.* *%*	*No.* *%*	*No.* *%*	*No.* *%*	*No.* *%*
Change 2009 to 2015	6	5	4	5	3946	3927	8103	6933	7757	8079	10134	9765
	75.0	62.5	50.0	62.5	26.0	25.9	53.4	45.7	51.2	53.3	66.8	64.4
Change 2012 to 2015	0	0	0	0	320	346	646	756	1415	677	757	1003
					22.6	24.4	45.5	53.3	99.7	47.7	53.3	70.7

The percentages are expressed over the total number of revisited points between surveys, including for samples below LOD in any survey year.

The checks highlight numerous cases of changes outside the expected range. For parameters of the particle size distribution and pH the variation limit is set to 10%, for other parameters mostly to 20%. The limits for temporal variation are set well within the acceptable variation for the parameters for the repeated analysis of samples. This indicates that there is a significant amount of variation between the soil samples at revisited points. One factor contributing to the temporal variations are changes at very low concentrations. This would affect the proportion of temporal variations for parameters $CaCO_3$ or phosphorous, but not for soil texture or pH.

5.4 Link of Soil Data to LUCAS Main Survey Point Data

The results from the laboratory analysis of the LUCAS soil samples can be related to geographic locations and the observations of the main LUCAS survey through information provided by Eurostat. The information relates the identifier of the soil samples to the plot identifier of the main LUCAS survey. For the 2009 soil data from Cyprus and Malta and the 2012 data from Bulgaria and Romania the information on the geographic location and thus the corresponding LUCAS point were available from separate tables. LUCAS soil data can then be linked to the LUCAS LUC data as available from the Eurostat LUCAS micro data files.

Although not directly part of the evaluation, the procedures include the option to generate unambiguous links of the LUCAS soil data to the LUCAS micro data. The summary of the check results are presented in Table 46.

Table 46: Summary of Links between LUCAS Soil and Eurostat Micro-Data

Check	LUCAS Soil Survey		
	2009	**2012**	**2015**
	No.	*No*	*No.*
Samples in LUCAS Soil	20,897*	2,034	23,390
Links to LUCAS micro data	18,673	2,024	21,736
Portion of linked samples	89.4%	99.5%	92.9%

* samples from Cyprus and Malta excluded, because there was no LUCAS LUC survey in 2009

The soil data linked to the main LUCAS surveys has been standardised for LOD codes used and modified for any values below the LOD and adjusted to uniform reporting units. The output can be used as the basic data for geographically locating the LUCAS Soil data and adding context to the samples from the LUCAS LUC surveys. The files contain all other data, including values considered questionable.

5.5 Conclusions

The evaluation of the data provided by the central laboratory from the analysis of samples from the LUCAS Soil surveys looked at the compliance of the data submitted to formal specification, the versatility of the data structure and plausibility of the values reported as well as consistency of values within and between surveys.

The results of the checks support the notion that the soil samples have been consistently analysed and that most of the data can be used to dependably estimate the physical and chemical status of European topsoils. Only the data for *cation exchange capacity* appears to be of low reliability over the whole range of values. Uncertainties for consistent data at low concentration were found for the chemical parameters *calcium carbonate* and *soluble phosphor*. This uncertainty is to some degree in the nature of the soil parameter ($CaCO_3$), but also the laboratory analysis (*soluble phosphor*). The temporal stability of parameters was found to be considerably higher than could be expected from repeated samples taken at the same location.

The evaluation of the formal aspects of the data gives mixed results. The files generally provide the data as intended, but deviate notably from the specifications on the position of the data. Each delivery has different arrangements for labelling the data and position of the data in the file. The specified spreadsheet file format may be considered unsuitable for the purpose and the cause of some inconsistencies. It is recommended to use a more inherently structured environment to analyse the data and a more data-focussed file delivery format, such as CSV.

The documentation of the limits of detection of the laboratory analysis method is conflicting between documents. This is also the case for the method used to record such conditions in the data. The use of numerical codes to signify the condition of a measurement below the limit of detection of the instrument used is strongly discouraged. This also applies to using a value of zero instead of a code, as in 2015 data. Data from the 2012 LUCAS Soil survey suffer from a lack of documentation and some non-negligible deviations from data from the 2009 and 2015 surveys. A limit of detection of 6 $g\ C\ kg^{-1}$ for OC, as opposed to 2 $g\ C\ kg^{-1}$ as specified for the laboratory method for 2009, raises the question whether the same laboratory was used in 2012. Together with reporting the results of the analysis of *total nitrogen* in an unknown, but conflicting, unit casts a more general doubt about the authenticity of the 2012 soil data.

A consistent data structure is a prerequisite for geographically locating the sites where soil samples were taken and associating the soil data with land use and cover. The degree to which the results of the laboratory analysis can be linked to other LUCAS data have improved from 2009 (90.1%) to 2015 (98.3% for EU28). The present file format for delivering teh results of the laboratory data is prone to introduce errors. Properly asociating the laboratory data of the soil samples with the georaphic context preovided by the LUCAS land use/cover surveys or other geograpically-coded data could be improved by respecting the rules of a data model.

While the data are largely consistent between the parameters checked for a survey, the degree of the temporal stability of parameters between surveys was found to be markedly higher than could be expected from repeated samples taken from the same location. The temporal stability was tested for the few samples with repeated measurements of particle size and pH, a parameters with low temporal variations. An analysis of extreme changes in *organic carbon* and changes to and from measurements below the limit of detection give support to the perception that there is at times considerable variability in repeated samples. This variability increases the difference required to detect a significant change in a parameter.

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List of abbreviations and definitions

Acronym	Label
ASCII	American Standard Code for Information Interchange
CACO3	Calcium carbonate $CaCO_3$
CEC	Cation exchange capacity
CF	Coarse fragments
CLAY	Clay content
CSV	Comma-separated values file
DMT	Data Management Tool by Eurostat
EC	Electric conductivity
Esri®	Environmental Systems Research Institute, Inc., 380 New York Street, Redlands, CA 92373-8100 USA
ESDAC	European Soil Data Centre
EU	European Union
EU23	European Union of 23 Member States
EU28	European Union of 28 Member States
GIS	Geographic Information System
LOD	Limit of detection of the instrument used
LOQ	Limit of quantification
ID	Identifier in data file
IPCC	Intergovernmental Panel on Climate Change
K	Extractable potassium
LU	Land use
LUC	Land use and cover
LUCAS	Land Use/Cover Area frame Survey
N	Total nitrogen content
OC	Organic carbon
P	Soluble phosphor content
PH_CACL2	pH in $CaCl_2$
PH_H2O	pH in H_2O
RDB	Relational data base
RDBMS	Relational data base management system
SAND	Sand content

Acronym	Label
SGS	Société Générale de Surveillance
SILT	Silt content
SOC	Soil organic carbon
TC	Total carbon
XLS	Microsoft® Excel 97 -2003 Workbook
XLSX	Microsoft® Office Open XML SpreadsheetML File Format

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Annex I

LUCAS Data Sources

ID	Survey Type	Survey Data	Data Type	Date	Comment
	LUCAS Land cover/use	Eurostat Web site			Eurostat LUCAS Web site According to the text the following data should be available from the site: • micro-data • photos • statistical tables and soil data The site "Primary Data" lists **soil data** as available from the site. The site provides a link to ESDAC for the 2009 LUCAS Soil data.
1		Reference data 2009	point	31.03.2011	EU-23, 234707 records, no fields related to soil (LUCA_2009_SH.zip) No reference for other years on the Web-site.
2		LUCAS micro data 2009	CSV	25.11.2016	EU-23 cover (EU23_2009_20161125.csv)
3		LUCAS micro data 2012	CSV	19.10.2016	EU-28 cover (EU-2012-20161019.csv)
4		LUCAS micro data 2015	CSV	28.10.2016	EU-28 cover (EU28_2015_20161028.csv)
5		GISCO.LUCA_PT_2009	point		234709 records, includes LUCA_SOIL_LABL
6		GISCO.LUCA_PT_2012	point		270276 records, includes LUCA_SOIL_LABL
7		GISCO.LUCA_PT_2015	point		348536 records, includes LUCA_SOIL_LABL
	LUCAS Soil	ESDAC Web site			Information and download of "LUCAS 2009 TOPSOIL data".
8		Soil data 2009	XLS	05.09.2013	(LUCAS_TOPSOIL_v1.xls)
		JRC internal			Server or shared
9		Survey: LUCAS Soil 2009	CSV	14.01.2011	Data for ESTAT (Folder) This is preliminary data with several stages of modifications (see readme - LUCAS2009_estat.docx)
10		MOSES: 2009 survey results	XLS	14.06.2011	Final results of the contract no. 385355 to SGS to analyse the LUCAS soil samples. Report, (5.6.LUCAS_Results of 20,000 soil samples.xls)
11		MOSES: 2009 Wageningen	XLS	14.06.2011	Analysis of lab samples (5.5.LUCAS_results of Wageningen tests in 2010-2011.xls)

ID	Survey Type	Survey Data	Data Type	Date	Comment
12		MOSES: 2009 extra samples	XLS	05.10.2011	Extra samples (LUCAS_RECORD_2011-09-27_Results_897_extra samples.xls)
13		Shared: 2009/12 Reanalysis	XLS	18.03.2018	Reanalysis of 2009/12 lab data (Re_analysis_LUCAS2009_2012.xlsx)
14		Local: Malta	DBF, XLS	08.11.2011	2009 survey, only plot data (malta_lucas.*)
15		?: Cyprus	?	?	No original survey data found.
16		Shared: 2009 survey	XLS	11.05.2017	All 2009 data (LUCAS_2009.xlsx)
17		MOSES: 2009/12 survey results	SHP	17.06.2016	Point data (LUCAS_2009_plusBulgariaRomania), includes BG, MT and RO
18		MOSES: 2009/12 survey results	SHP	15.07.2016	Point data (LUCAS_LAEA_ALL), includes BG, CY, MT and RO
19		LUCAS Topsoil survey 2012	XLS, CSV	23.07.2015	Bulgaria, separate data file (Bulgaria.xlsx), CSV generated later
20			XLS, CSV	23.07.2015	Romania, separate data file (Romania.xlsx), CSV generated later
21			XLS	12.03.2018	Bulgaria, separate data file (LUCAS_2012_BG.xlsx)
22			XLS	12.03.2018	Romania, separate data file (LUCAS_2012_RO.xlsx)
		LUCAS 2015			
23		JRC internal	XLS	12.03.2018	Repeated sample sites (LUCAS2015_2009_repeated_points_mineral_soils.xlsx)
24			XLS	12.03.2018	Repeated sample sites (LUCAS2015_2009_repeated_points_organic_soils.xlsx)
25			XLS	12.03.2018	Repeated sample sites for BG and RO (LUCAS2015_2012_repeated_points_BG_RO.xlsx)
26		MOSES: 2009/12 + HM data	XLS	14.03.2018	Consolidated data with heavy metal data (All_Reference_Working.xlsx)
27		MOSES: 2009/12 point	SHP	14.03.2018	Points of consolidated data with heavy metal data (ConsolidatedFile.shp)

1 http://ec.europa.eu/eurostat/cache/GISCO/geodatafiles/LUCA_2009_SH.zip
2 http://ec.europa.eu/eurostat/documents/205002/208938/EU23_2009_20161125.csv
3 http://ec.europa.eu/eurostat/cache/lucas/EU-2012-20161019.csv
4 http://ec.europa.eu/eurostat/documents/205002/6786255/EU28_2015_20161028.csv
5 GISCO SDE
6 GISCO SDE
7 GISCO SDE

8 file:////ies.jrc.it/H05/SOIL/ESDAC/MOSES%20data/LUCAS-2009-data-as-distributed-by-ESDAC/LUCAS_TOPSOIL_v1.xlsx
9 file:////ies.jrc.it/H05/lucas2009_estat/readme%20-%20LUCAS2009_estat.docx
10 file:////ies.jrc.it/H05/SOIL/ESDAC/MOSES%20data/LUCAS_project/LUCAS_SOIL_2009/DATA/Final_Report/5.6.LUCAS_Results%20of%2020,000%20soil%20samples.xls
11 file:////ies.jrc.it/H05/SOIL/ESDAC/MOSES%20data/LUCAS_project/LUCAS_SOIL_2009/DATA/Final_Report/5.5.LUCAS_results%20of%20Wageningen%20tests%20in%202010-2011.xls
12 file:////ies.jrc.it/H05/SOIL/ESDAC/MOSES%20data/LUCAS_project/LUCAS_SOIL_2009/DATA/LUCAS_RECORD_2011-09-27_Results_897_extra%20samples.xls
13 \\ies.jrc.it\H05\SOIL\share\OihaneFernandezUgalde\LUCAS_Topsoil_Survey\Quality_control_lab_analyses\Re_analysis_LUCAS2009_2012.xlsx
14 N/A
15 N/A
16 file:////ies.jrc.it/H05/SOIL/share/OihaneFernandezUgalde/LUCAS_Topsoil_Survey/LUCAS_2009/LUCAS_2009.xlsx
17 file:////ies.jrc.it/H05/SOIL/ESDAC/MOSES%20data/LUCAS_2009_plusBulgariaRomania-shapefile/
18 file:////ies.jrc.it/H05/SOIL/ESDAC/MOSES%20data/LUCAS_2009_plusBulgariaRomaniaCyprus-shapefile/
19 file:////ies.jrc.it/H05/SOIL/ESDAC/MOSES%20data/LUCAS_Romania_Bulgaria/Bulgaria.xlsx
20 file:////ies.jrc.it/H05/SOIL/ESDAC/MOSES%20data/LUCAS_Romania_Bulgaria/Romania.xlsx
21 file:////ies.jrc.it/H05/SOIL/share/OihaneFernandezUgalde/LUCAS_Topsoil_Survey/LUCAS_2012/LUCAS_2012_BG.xlsx
22 file:////ies.jrc.it/H05/SOIL/share/OihaneFernandezUgalde/LUCAS_Topsoil_Survey/LUCAS_2012/LUCAS_2012_RO.xlsx
23 file:////ies.jrc.it/H05/SOIL/share/OihaneFernandezUgalde/LUCAS_Topsoil_Survey/LUCAS_2015_repeated_points/LUCAS2015_2009_repeated_points_mineral_soils.xlsx
24 file:////ies.jrc.it/H05/SOIL/share/OihaneFernandezUgalde/LUCAS_Topsoil_Survey/LUCAS_2015_repeated_points/LUCAS2015_2009_repeated_points_organic_soils.xlsx
25 file:////ies.jrc.it/H05/SOIL/share/OihaneFernandezUgalde/LUCAS_Topsoil_Survey/LUCAS_2015_repeated_points/LUCAS2015_2012_repeated_points_BG_RO.xlsx
26 file:////ies-ud01.jrc.it/soil/ESDAC/MOSES%20data/LUCAS-2009-2012-consolidated+ESTAT+HM/All_Reference_Working.xlsx
27 file:////ies-ud01.jrc.it/soil/ESDAC/MOSES%20data/LUCAS-2009-2012-consolidated+ESTAT+HM/

Annex II

List of Evaluation Checks

CHECK			RANGE	SEVERITY	CHECK	RULE_SOURCE
ID	*Step*	*Label*	*Limit*	*Level*	*Message*	*Source*
1	Compliance	EXCEL_COMPATIBLE	XLS OR XLSX	Warning	File not in 100% Excel-compatible format.	SGS_contract_385355_including_tender_and_offer.pdf
2	Compliance	DEC_CACO3_2009_D1	0	Warning	CACO3 not reported with 0 decimal.	SGS_contract_385355_including_tender_and_offer.pdf
3	Compliance	DEC_CACO3_2009_D2	0	Warning	CACO3 not reported with 0 decimal.	According to 2009 LAB reference.
4	Compliance	DEC_CACO3_2012_BG	0	Warning	CACO3 not reported with 0 decimal.	According to 2009 LAB reference.
5	Compliance	DEC_CACO3_2012_RO	0	Warning	CACO3 not reported with 0 decimal.	According to 2009 LAB reference.
6	Compliance	DEC_CACO3_2015_G1	0	Warning	CACO3 not reported with 0 decimal.	Template_specimen.pdf
7	Compliance	DEC_CACO3_2015_G2	0	Warning	CACO3 not reported with 0 decimal.	Template_specimen.pdf
8	Compliance	DEC_CACO3_2015_G3	0	Warning	CACO3 not reported with 0 decimal.	Template_specimen.pdf
9	Compliance	DEC_CACO3_2015_G4	0	Warning	CACO3 not reported with 0 decimal.	Template_specimen.pdf
10	Compliance	DEC_CEC_2009_D1	1	Warning	CEC not reported with 1 decimal.	Template_specimen.pdf
11	Compliance	DEC_CEC_2009_D2	1	Warning	CEC not reported with 1 decimal.	According to 2009 LAB reference.
12	Compliance	DEC_CEC_2012_BG	1	Warning	CEC not reported with 1 decimal.	According to 2009 LAB reference.
13	Compliance	DEC_CEC_2012_RO	1	Warning	CEC not reported with 1 decimal.	According to 2009 LAB reference.
14	Compliance	DEC_CEC_2015_G1	1	Warning	CEC not reported with 1 decimal.	Template_specimen.pdf
15	Compliance	DEC_CEC_2015_G2	1	Warning	CEC not reported with 1 decimal.	Template_specimen.pdf
16	Compliance	DEC_CEC_2015_G3	1	Warning	CEC not reported with 1 decimal.	Template_specimen.pdf
17	Compliance	DEC_CEC_2015_G4	1	Warning	CEC not reported with 1 decimal.	Template_specimen.pdf
18	Compliance	DEC_CF_2009_D1	0	Warning	CF not reported with 0 decimal.	SGS_contract_385355_including_tender_and_offer.pdf
19	Compliance	DEC_CF_2009_D2	0	Warning	CF not reported with 0 decimal.	According to 2009 LAB reference.
20	Compliance	DEC_CF_2012_BG	0	Warning	CF not reported with 0 decimal.	According to 2009 LAB reference.
21	Compliance	DEC_CF_2012_RO	0	Warning	CF not reported with 0 decimal.	According to 2009 LAB reference.
22	Compliance	DEC_CF_2015_G3	0	Warning	CF not reported with 0 decimal.	Template_specimen.pdf
23	Compliance	DEC_CLAY_2009_D1	0	Warning	CLAY not reported with 0 decimal.	SGS_contract_385355_including_tender_and_offer.pdf
24	Compliance	DEC_CLAY_2009_D2	0	Warning	CLAY not reported with 0 decimal.	According to 2009 LAB reference.
25	Compliance	DEC_CLAY_2012_BG	0	Warning	CLAY not reported with 0 decimal.	According to 2009 LAB reference.
26	Compliance	DEC_CLAY_2012_RO	0	Warning	CLAY not reported with 0 decimal.	According to 2009 LAB reference.
27	Compliance	DEC_CLAY_2015_G3	0	Warning	CLAY not reported with 0 decimal.	Template_specimen.pdf
28	Compliance	DEC_EC_2015_G1	2	Warning	EC not reported with 2 decimals.	Template_specimen.pdf
29	Compliance	DEC_EC_2015_G2	2	Warning	EC not reported with 2 decimals.	Template_specimen.pdf
30	Compliance	DEC_EC_2015_G3	2	Warning	EC not reported with 2 decimals.	Template_specimen.pdf
31	Compliance	DEC_EC_2015_G4	2	Warning	EC not reported with 2 decimals.	Template_specimen.pdf

CHECK			RANGE	SEVERITY	CHECK	RULE_SOURCE
ID	*Step*	*Label*	*Limit*	*Level*	*Message*	*Source*
32	Compliance	DEC_K_2009_D1	1	Warning	K not reported with 1 decimal.	SGS_contract_385355_including_tender_and_offer.pdf
33	Compliance	DEC_K_2009_D2	1	Warning	K not reported with 1 decimal.	According to 2009 LAB reference.
34	Compliance	DEC_K_2012_BG	1	Warning	K not reported with 1 decimal.	According to 2009 LAB reference.
35	Compliance	DEC_K_2012_RO	1	Warning	K not reported with 1 decimal.	According to 2009 LAB reference.
36	Compliance	DEC_K_2015_G1	1	Warning	K not reported with 1 decimal.	Template_specimen.pdf
37	Compliance	DEC_K_2015_G2	1	Warning	K not reported with 1 decimal.	Template_specimen.pdf
38	Compliance	DEC_K_2015_G3	1	Warning	K not reported with 1 decimal.	Template_specimen.pdf
39	Compliance	DEC_K_2015_G4	1	Warning	K not reported with 1 decimal.	Template_specimen.pdf
40	Compliance	DEC_N_2009_D1	1	Warning	N not reported with 1 decimal.	SGS_contract_385355_including_tender_and_offer.pdf
41	Compliance	DEC_N_2009_D2	1	Warning	N not reported with 1 decimal.	According to 2009 LAB reference.
42	Compliance	DEC_N_2012_BG	1	Warning	N not reported with 1 decimal.	According to 2009 LAB reference.
43	Compliance	DEC_N_2012_RO	1	Warning	N not reported with 1 decimal.	According to 2009 LAB reference.
44	Compliance	DEC_N_2015_G1	1	Warning	N not reported with 1 decimal.	Template_specimen.pdf
45	Compliance	DEC_N_2015_G2	1	Warning	N not reported with 1 decimal.	Template_specimen.pdf
46	Compliance	DEC_N_2015_G3	1	Warning	N not reported with 1 decimal.	Template_specimen.pdf
47	Compliance	DEC_N_2015_G4	1	Warning	N not reported with 1 decimal.	Template_specimen.pdf
48	Compliance	DEC_OC_2009_D1	1	Warning	OC not reported with 1 decimal.	SGS_contract_385355_including_tender_and_offer.pdf
49	Compliance	DEC_OC_2009_D2	1	Warning	OC not reported with 1 decimal.	According to 2009 LAB reference.
50	Compliance	DEC_OC_2012_BG	1	Warning	OC not reported with 1 decimal.	According to 2009 LAB reference.
51	Compliance	DEC_OC_2012_RO	1	Warning	OC not reported with 1 decimal.	According to 2009 LAB reference.
52	Compliance	DEC_OC_2015_G1	1	Warning	OC not reported with 1 decimal.	Template_specimen.pdf
53	Compliance	DEC_OC_2015_G2	1	Warning	OC not reported with 1 decimal.	Template_specimen.pdf
54	Compliance	DEC_OC_2015_G3	1	Warning	OC not reported with 1 decimal.	Template_specimen.pdf
55	Compliance	DEC_OC_2015_G4	1	Warning	OC not reported with 1 decimal.	Template_specimen.pdf
56	Compliance	DEC_PH_CACL2_2009_D1	2	Warning	PH_CACL2 not reported with 2 decimals.	SGS_contract_385355_including_tender_and_offer.pdf
57	Compliance	DEC_PH_CACL2_2009_D2	2	Warning	PH_CACL2 not reported with 2 decimals.	According to 2009 LAB reference.
58	Compliance	DEC_PH_CACL2_2012_BG	2	Warning	PH_CACL2 not reported with 2 decimals.	According to 2009 LAB reference.
59	Compliance	DEC_PH_CACL2_2012_RO	2	Warning	PH_CACL2 not reported with 2 decimals.	According to 2009 LAB reference.
60	Compliance	DEC_PH_CACL2_2015_G1	1	Warning	PH_CACL2 not reported with 1 decimal.	Template_specimen.pdf
61	Compliance	DEC_PH_CACL2_2015_G2	1	Warning	PH_CACL2 not reported with 1 decimal.	Template_specimen.pdf
62	Compliance	DEC_PH_CACL2_2015_G3	1	Warning	PH_CACL2 not reported with 1 decimal.	Template_specimen.pdf
63	Compliance	DEC_PH_CACL2_2015_G4	1	Warning	PH_CACL2 not reported with 1 decimal.	Template_specimen.pdf
64	Compliance	DEC_PH_H2O_2009_D1	2	Warning	PH_H2O not reported with 2 decimals.	SGS_contract_385355_including_tender_and_offer.pdf
65	Compliance	DEC_PH_H2O_2009_D2	2	Warning	PH_H2O not reported with 2 decimals.	According to 2009 LAB reference.
66	Compliance	DEC_PH_H2O_2012_BG	2	Warning	PH_H2O not reported with 2 decimals.	According to 2009 LAB reference.
67	Compliance	DEC_PH_H2O_2012_RO	2	Warning	PH_H2O not reported with 2 decimals.	According to 2009 LAB reference.
68	Compliance	DEC_PH_H2O_2015_G1	2	Warning	PH_H2O not reported with 2 decimals.	Template_specimen.pdf

CHECK			RANGE	SEVERITY	CHECK	RULE_SOURCE
ID	*Step*	*Label*	*Limit*	*Level*	*Message*	*Source*
69	Compliance	DEC_PH_H2O_2015_G2	2	Warning	PH_H2O not reported with 2 decimals.	Template_specimen.pdf
70	Compliance	DEC_PH_H2O_2015_G3	2	Warning	PH_H2O not reported with 2 decimals.	Template_specimen.pdf
71	Compliance	DEC_PH_H2O_2015_G4	2	Warning	PH_H2O not reported with 2 decimals.	Template_specimen.pdf
72	Compliance	DEC_P_2009_D1	1	Warning	P not reported with 1 decimal.	SGS_contract_385355_including_tender_and_offer.pdf
73	Compliance	DEC_P_2009_D2	1	Warning	P not reported with 1 decimal.	According to 2009 LAB reference.
74	Compliance	DEC_P_2012_BG	1	Warning	P not reported with 1 decimal.	According to 2009 LAB reference.
75	Compliance	DEC_P_2012_RO	1	Warning	P not reported with 1 decimal.	According to 2009 LAB reference.
76	Compliance	DEC_P_2015_G1	1	Warning	P not reported with 1 decimal.	Template_specimen.pdf
77	Compliance	DEC_P_2015_G2	1	Warning	P not reported with 1 decimal.	Template_specimen.pdf
78	Compliance	DEC_P_2015_G3	1	Warning	P not reported with 1 decimal.	Template_specimen.pdf
79	Compliance	DEC_P_2015_G4	1	Warning	P not reported with 1 decimal.	Template_specimen.pdf
80	Compliance	DEC_SAND_2009_D1	0	Warning	SAND not reported with 0 decimal.	SGS_contract_385355_including_tender_and_offer.pdf
81	Compliance	DEC_SAND_2009_D2	0	Warning	SAND not reported with 0 decimal.	According to 2009 LAB reference.
82	Compliance	DEC_SAND_2012_BG	0	Warning	SAND not reported with 0 decimal.	According to 2009 LAB reference.
83	Compliance	DEC_SAND_2012_RO	0	Warning	SAND not reported with 0 decimal.	According to 2009 LAB reference.
84	Compliance	DEC_SAND_2015_G3	0	Warning	SAND not reported with 0 decimal.	Template_specimen.pdf
85	Compliance	DEC_SILT_2009_D1	0	Warning	SILT not reported with 0 decimal.	SGS_contract_385355_including_tender_and_offer.pdf
86	Compliance	DEC_SILT_2009_D2	0	Warning	SILT not reported with 0 decimal.	According to 2009 LAB reference.
87	Compliance	DEC_SILT_2012_BG	0	Warning	SILT not reported with 0 decimal.	According to 2009 LAB reference.
88	Compliance	DEC_SILT_2012_RO	0	Warning	SILT not reported with 0 decimal.	According to 2009 LAB reference.
89	Compliance	DEC_SILT_2015_G3	0	Warning	SILT not reported with 0 decimal.	Template_specimen.pdf
90	Compliance	POS_CACO3_2009_D1	9	Warning	CACO3 results not included as 9th parameter.	SGS_contract_385355_including_tender_and_offer.pdf
91	Compliance	POS_CACO3_2012_BG	9	Warning	CACO3 results not included as 9th parameter.	2009 specifications applied.
92	Compliance	POS_CACO3_2012_RO	9	Warning	CACO3 results not included as 9th parameter.	2009 specifications applied.
93	Compliance	POS_CACO3_2015_G1	11	Warning	CACO3 results not included as 11th parameter.	Template_specimen.pdf
94	Compliance	POS_CACO3_2015_G2	11	Warning	CACO3 results not included as 11th parameter.	Template_specimen.pdf
95	Compliance	POS_CACO3_2015_G3	11	Warning	CACO3 results not included as 11th parameter.	Template_specimen.pdf
96	Compliance	POS_CACO3_2015_G4	11	Warning	CACO3 results not included as 11th parameter.	Template_specimen.pdf
97	Compliance	POS_CACO3_D2009_D2	9	Warning	CACO3 results not included as 9th parameter.	SGS_contract_385355_including_tender_and_offer.pdf
98	Compliance	POS_CEC_2009_D1	13	Warning	CEC results not included as 13th parameter.	SGS_contract_385355_including_tender_and_offer.pdf

CHECK			RANGE	SEVERITY	CHECK	RULE_SOURCE
ID	*Step*	*Label*	*Limit*	*Level*	*Message*	*Source*
99	Compliance	POS_CEC_2012_BG	13	Warning	CEC results not included as 13th parameter.	2009 specifications applied.
100	Compliance	POS_CEC_2012_RO	13	Warning	CEC results not included as 13th parameter.	2009 specifications applied.
101	Compliance	POS_CEC_2015_G1	15	Warning	CEC results not included as 15th parameter.	Template_specimen.pdf
102	Compliance	POS_CEC_2015_G2	15	Warning	CEC results not included as 15th parameter.	Template_specimen.pdf
103	Compliance	POS_CEC_2015_G3	15	Warning	CEC results not included as 15th parameter.	Template_specimen.pdf
104	Compliance	POS_CEC_2015_G4	15	Warning	CEC results not included as 15th parameter.	Template_specimen.pdf
105	Compliance	POS_CEC_D2009_D2	13	Warning	CEC results not included as 13th parameter.	SGS_contract_385355_including_tender_and_offer.pdf
106	Compliance	POS_CF_2009_D1	2	Warning	CF results not included as 2nd parameter.	SGS_contract_385355_including_tender_and_offer.pdf
107	Compliance	POS_CF_2012_BG	2	Warning	CF results not included as 2nd parameter.	2009 specifications applied.
108	Compliance	POS_CF_2012_RO	2	Warning	CF results not included as 2nd parameter.	2009 specifications applied.
109	Compliance	POS_CF_2015_G3	3	Warning	CF results not included as 3rd parameter.	Template_specimen.pdf
110	Compliance	POS_CF_D2009_D2	2	Warning	CF results not included as 2nd parameter.	SGS_contract_385355_including_tender_and_offer.pdf
112	Compliance	POS_CLAY_2009_D1	3	Warning	CLAY results not included as 3rd parameter.	SGS_contract_385355_including_tender_and_offer.pdf
113	Compliance	POS_CLAY_2015_G3	4	Warning	CLAY results not included as 4th parameter.	Template_specimen.pdf
114	Compliance	POS_CLAY_D2009_D2	3	Warning	CLAY results not included as 3rd parameter.	SGS_contract_385355_including_tender_and_offer.pdf
115	Compliance	POS_CLAY_2012_BG	3	Warning	CLAY results not included as 3rd parameter.	2009 specifications applied.
116	Compliance	POS_CLAY_2012_RO	3	Warning	CLAY results not included as 3rd parameter.	2009 specifications applied.
117	Compliance	POS_EC_2015_G1	9	Warning	EC results not included as 9th parameter.	Template_specimen.pdf
118	Compliance	POS_EC_2015_G2	9	Warning	EC results not included as 9th parameter.	Template_specimen.pdf
119	Compliance	POS_EC_2015_G3	9	Warning	EC results not included as 9th parameter.	Template_specimen.pdf
120	Compliance	POS_EC_2015_G4	9	Warning	EC results not included as 9th parameter.	Template_specimen.pdf
121	Compliance	POS_K_2009_D1	12	Warning	K results not included as 12th parameter.	SGS_contract_385355_including_tender_and_offer.pdf
122	Compliance	POS_K_2012_BG	12	Warning	K results not included as 12th parameter.	2009 specifications applied.
123	Compliance	POS_K_2012_RO	12	Warning	K results not included as 12th parameter.	2009 specifications applied.
124	Compliance	POS_K_2015_G1	14	Warning	K results not included as 14th parameter.	Template_specimen.pdf
125	Compliance	POS_K_2015_G2	14	Warning	K results not included as 14th parameter.	Template_specimen.pdf
126	Compliance	POS_K_2015_G3	14	Warning	K results not included as 14th parameter.	Template_specimen.pdf
127	Compliance	POS_K_2015_G4	14	Warning	K results not included as 14th parameter.	Template_specimen.pdf
128	Compliance	POS_K_D2009_D2	12	Warning	K results not included as 12th parameter.	SGS_contract_385355_including_tender_and_offer.pdf
129	Compliance	POS_LAB_ID_2015_G1	1	Warning	Laboratory ID not included as 1st parameter.	Template_specimen.pdf
130	Compliance	POS_LAB_ID_2015_G2	1	Warning	Laboratory ID not included as 1st parameter.	Template_specimen.pdf
131	Compliance	POS_LAB_ID_2015_G3	1	Warning	Laboratory ID not included as 1st parameter.	Template_specimen.pdf
132	Compliance	POS_LAB_ID_2015_G4	1	Warning	Laboratory ID not included as 1st parameter.	Template_specimen.pdf
133	Compliance	POS_LAB_ID_2015_G4	1	Warning	Laboratory ID not included as 1st parameter.	Template_specimen.pdf

CHECK			RANGE	SEVERITY	CHECK	RULE_SOURCE
ID	*Step*	*Label*	*Limit*	*Level*	*Message*	*Source*
134	Compliance	POS_N_2009_D1	10	Warning	N results not included as 10th parameter.	SGS_contract_385355_including_tender_and_offer.pdf
135	Compliance	POS_N_2012_BG	10	Warning	N results not included as 10th parameter.	2009 specifications applied.
136	Compliance	POS_N_2012_RO	10	Warning	N results not included as 10th parameter.	2009 specifications applied.
137	Compliance	POS_N_2015_G1	13	Warning	N results not included as 13th parameter.	Template_specimen.pdf
138	Compliance	POS_N_2015_G2	13	Warning	N results not included as 13th parameter.	Template_specimen.pdf
139	Compliance	POS_N_2015_G3	13	Warning	N results not included as 13th parameter.	Template_specimen.pdf
140	Compliance	POS_N_2015_G4	13	Warning	N results not included as 13th parameter.	Template_specimen.pdf
141	Compliance	POS_N_D2009_D2	10	Warning	N results not included as 10th parameter.	SGS_contract_385355_including_tender_and_offer.pdf
142	Compliance	POS_OC_2009_D1	8	Warning	OC results not included as 8th parameter.	SGS_contract_385355_including_tender_and_offer.pdf
143	Compliance	POS_OC_2012_BG	8	Warning	OC results not included as 8th parameter.	2009 specifications applied.
144	Compliance	POS_OC_2012_RO	8	Warning	OC results not included as 8th parameter.	2009 specifications applied.
145	Compliance	POS_OC_2015_G1	10	Warning	OC results not included as 10th parameter.	Template_specimen.pdf
146	Compliance	POS_OC_2015_G2	10	Warning	OC results not included as 10th parameter.	Template_specimen.pdf
147	Compliance	POS_OC_2015_G3	10	Warning	OC results not included as 10th parameter.	Template_specimen.pdf
148	Compliance	POS_OC_2015_G4	10	Warning	OC results not included as 10th parameter.	Template_specimen.pdf
149	Compliance	POS_OC_D2009_D2	8	Warning	OC results not included as 8th parameter.	SGS_contract_385355_including_tender_and_offer.pdf
150	Compliance	POS_PH_CACL2_2009_D1_20	6	Warning	PH_CACL2 results not included as 6th parameter.	SGS_contract_385355_including_tender_and_offer.pdf
151	Compliance	POS_PH_CACL2_2012_BG	6	Warning	PH_CACL2 results not included as 6th parameter.	2009 specifications applied.
152	Compliance	POS_PH_CACL2_2012_RO	6	Warning	PH_CACL2 results not included as 6th parameter.	2009 specifications applied.
153	Compliance	POS_PH_CACL2_2015_G1	7	Warning	PH_CACL2 results not included as 7th parameter.	Template_specimen.pdf
154	Compliance	POS_PH_CACL2_2015_G2	7	Warning	PH_CACL2 results not included as 7th parameter.	Template_specimen.pdf
155	Compliance	POS_PH_CACL2_2015_G3	7	Warning	PH_CACL2 results not included as 7th parameter.	Template_specimen.pdf
156	Compliance	POS_PH_CACL2_2015_G4	7	Warning	PH_CACL2 results not included as 7th parameter.	Template_specimen.pdf
157	Compliance	POS_PH_CACL2_D2009_D2	6	Warning	PH_CACL2 results not included as 6th parameter.	SGS_contract_385355_including_tender_and_offer.pdf
158	Compliance	POS_PH_CACL2_ID_2012_BG	7	Warning	PH_CACL2 results not included as 7th parameter.	2009 specifications applied.
159	Compliance	POS_PH_CACL2_ID_2012_RO	7	Warning	PH_CACL2 results not included as 7th parameter.	2009 specifications applied.
160	Compliance	POS_PH_H2O_2009_D1	7	Warning	PH_H2O results not included as 7th parameter.	SGS_contract_385355_including_tender_and_offer.pdf

CHECK			RANGE	SEVERITY	CHECK	RULE_SOURCE
ID	*Step*	*Label*	*Limit*	*Level*	*Message*	*Source*
161	Compliance	POS_PH_H2O_2012_BG	7	Warning	PH_H2O results not included as 7th parameter.	2009 specifications applied.
162	Compliance	POS_PH_H2O_2012_RO	7	Warning	PH_H2O results not included as 7th parameter.	2009 specifications applied.
163	Compliance	POS_PH_H2O_2015_G1	8	Warning	PH_H2O results not included as 8th parameter.	Template_specimen.pdf
164	Compliance	POS_PH_H2O_2015_G2	8	Warning	PH_H2O results not included as 8th parameter.	Template_specimen.pdf
165	Compliance	POS_PH_H2O_2015_G3	8	Warning	PH_H2O results not included as 8th parameter.	Template_specimen.pdf
166	Compliance	POS_PH_H2O_2015_G4	8	Warning	PH_H2O results not included as 8th parameter.	Template_specimen.pdf
167	Compliance	POS_PH_H2O_D2009_D2	7	Warning	PH_H2O results not included as 7th parameter.	SGS_contract_385355_including_tender_and_offer.pdf
168	Compliance	POS_P_2009_D1	11	Warning	P results not included as 11th parameter.	SGS_contract_385355_including_tender_and_offer.pdf
169	Compliance	POS_P_2012_BG	11	Warning	P results not included as 11th parameter.	2009 specifications applied.
170	Compliance	POS_P_2012_RO	11	Warning	P results not included as 11th parameter.	2009 specifications applied.
171	Compliance	POS_P_2015_G1	12	Warning	P results not included as 12th parameter.	Template_specimen.pdf
172	Compliance	POS_P_2015_G2	12	Warning	P results not included as 12th parameter.	Template_specimen.pdf
173	Compliance	POS_P_2015_G3	12	Warning	P results not included as 12th parameter.	Template_specimen.pdf
174	Compliance	POS_P_2015_G4	12	Warning	P results not included as 12th parameter.	Template_specimen.pdf
175	Compliance	POS_P_D2009_D2	11	Warning	P results not included as 11th parameter.	SGS_contract_385355_including_tender_and_offer.pdf
176	Compliance	POS_SAND_2009_D1	5	Warning	SAND results not included as 5th parameter.	SGS_contract_385355_including_tender_and_offer.pdf
177	Compliance	POS_SAND_2015_G3	6	Warning	SAND results not included as 6th parameter.	Template_specimen.pdf
178	Compliance	POS_SAND_D2009_D2	5	Warning	SAND results not included as 5th parameter.	SGS_contract_385355_including_tender_and_offer.pdf
179	Compliance	POS_SAND_ID_2012_BG	5	Warning	SAND results not included as 5th parameter.	2009 specifications applied.
180	Compliance	POS_SAND_ID_2012_RO	5	Warning	SAND results not included as 5th parameter.	2009 specifications applied.
181	Compliance	POS_SILT_2009_D1	4	Warning	SILT results not included as 4th parameter.	SGS_contract_385355_including_tender_and_offer.pdf
182	Compliance	POS_SILT_2015_G3	5	Warning	SILT results not included as 5th parameter.	Template_specimen.pdf
183	Compliance	POS_SILT_D2009_D2	4	Warning	SILT results not included as 4th parameter.	SGS_contract_385355_including_tender_and_offer.pdf
184	Compliance	POS_SILT_ID_2012_BG	4	Warning	SILT results not included as 4th parameter.	2009 specifications applied.
185	Compliance	POS_SILT_ID_2012_RO	4	Warning	SILT results not included as 4th parameter.	2009 specifications applied.
186	Compliance	POS_SOIL_ID_2009_D1	1	Warning	Soil sample identifier not included as 1st parameter.	SGS_contract_385355_including_tender_and_offer.pdf
187	Compliance	POS_SOIL_ID_2009_D2	1	Warning	Soil sample identifier not included as 1st parameter.	SGS_contract_385355_including_tender_and_offer.pdf

CHECK			RANGE	SEVERITY	CHECK	RULE_SOURCE
ID	*Step*	*Label*	*Limit*	*Level*	*Message*	*Source*
188	Compliance	POS_SOIL_ID_2012_BG	1	Warning	Soil sample identifier not included as 1st parameter.	2009 specifications applied.
189	Compliance	POS_SOIL_ID_2012_RO	1	Warning	Soil sample identifier not included as 1st parameter.	2009 specifications applied.
190	Compliance	POS_SOIL_ID_2015_G1	2	Warning	Soil sample identifier not included as 2nd parameter.	Template_specimen.pdf
191	Compliance	POS_SOIL_ID_2015_G2	2	Warning	Soil sample identifier not included as 2nd parameter.	Template_specimen.pdf
192	Compliance	POS_SOIL_ID_2015_G3	2	Warning	Soil sample identifier not included as 2nd parameter.	Template_specimen.pdf
193	Compliance	POS_SOIL_ID_2015_G4	2	Warning	Soil sample identifier not included as 2nd parameter.	Template_specimen.pdf
194	Compliance	TYPE_CACO3_2009_CY	NUMBER	Warning	Character in data field	Intrinsic requirement
195	Compliance	TYPE_CACO3_2009_D1	NUMBER	Warning	Character in data field	Intrinsic requirement
196	Compliance	TYPE_CACO3_2009_D2	NUMBER	Warning	Character in data field	Intrinsic requirement
197	Compliance	TYPE_CACO3_2009_MT	NUMBER	Warning	Character in data field	Intrinsic requirement
198	Compliance	TYPE_CACO3_2012_BG	NUMBER	Warning	Character in data field	Intrinsic requirement
199	Compliance	TYPE_CACO3_2012_RO	NUMBER	Warning	Character in data field	Intrinsic requirement
200	Compliance	TYPE_CACO3_2015_G1	NUMBER	Warning	Character in data field	Intrinsic requirement
201	Compliance	TYPE_CACO3_2015_G2	NUMBER	Warning	Character in data field	Intrinsic requirement
202	Compliance	TYPE_CACO3_2015_G3	NUMBER	Warning	Character in data field	Intrinsic requirement
203	Compliance	TYPE_CACO3_2015_G4	NUMBER	Warning	Character in data field	Intrinsic requirement
204	Compliance	TYPE_CEC_2009_CY	NUMBER	Warning	Character in data field	Intrinsic requirement
205	Compliance	TYPE_CEC_2009_D1	NUMBER	Warning	Character in data field	Intrinsic requirement
206	Compliance	TYPE_CEC_2009_D2	NUMBER	Warning	Character in data field	Intrinsic requirement
207	Compliance	TYPE_CEC_2009_MT	NUMBER	Warning	Character in data field	Intrinsic requirement
208	Compliance	TYPE_CEC_2012_BG	NUMBER	Warning	Character in data field	Intrinsic requirement
209	Compliance	TYPE_CEC_2012_RO	NUMBER	Warning	Character in data field	Intrinsic requirement
210	Compliance	TYPE_CEC_2015_G1	NUMBER	Warning	Character in data field	Intrinsic requirement
211	Compliance	TYPE_CEC_2015_G2	NUMBER	Warning	Character in data field	Intrinsic requirement
212	Compliance	TYPE_CEC_2015_G3	NUMBER	Warning	Character in data field	Intrinsic requirement
213	Compliance	TYPE_CEC_2015_G4	NUMBER	Warning	Character in data field	Intrinsic requirement
214	Compliance	TYPE_CF_2009_CY	NUMBER	Warning	Character in data field	Intrinsic requirement
215	Compliance	TYPE_CF_2009_D1	NUMBER	Warning	Character in data field	Intrinsic requirement
216	Compliance	TYPE_CF_2009_D2	NUMBER	Warning	Character in data field	Intrinsic requirement
217	Compliance	TYPE_CF_2009_MT	NUMBER	Warning	Character in data field	Intrinsic requirement
218	Compliance	TYPE_CF_2012_BG	NUMBER	Warning	Character in data field	Intrinsic requirement
219	Compliance	TYPE_CF_2012_RO	NUMBER	Warning	Character in data field	Intrinsic requirement
220	Compliance	TYPE_CF_2015_G3	NUMBER	Warning	Character in data field	Intrinsic requirement
221	Compliance	TYPE_CLAY_2009_CY	NUMBER	Warning	Character in data field	Intrinsic requirement
222	Compliance	TYPE_CLAY_2009_D1	NUMBER	Warning	Character in data field	Intrinsic requirement
223	Compliance	TYPE_CLAY_2009_D2	NUMBER	Warning	Character in data field	Intrinsic requirement

CHECK			RANGE	SEVERITY	CHECK	RULE_SOURCE
ID	*Step*	*Label*	*Limit*	*Level*	*Message*	*Source*
224	Compliance	TYPE_CLAY_2009_MT	NUMBER	Warning	Character in data field	Intrinsic requirement
225	Compliance	TYPE_CLAY_2012_BG	NUMBER	Warning	Character in data field	Intrinsic requirement
226	Compliance	TYPE_CLAY_2012_RO	NUMBER	Warning	Character in data field	Intrinsic requirement
227	Compliance	TYPE_CLAY_2015_G3	NUMBER	Warning	Character in data field	Intrinsic requirement
228	Compliance	TYPE_EC_2015_G1	NUMBER	Warning	Character in data field	Intrinsic requirement
229	Compliance	TYPE_EC_2015_G2	NUMBER	Warning	Character in data field	Intrinsic requirement
230	Compliance	TYPE_EC_2015_G3	NUMBER	Warning	Character in data field	Intrinsic requirement
231	Compliance	TYPE_EC_2015_G4	NUMBER	Warning	Character in data field	Intrinsic requirement
232	Compliance	TYPE_K_2009_CY	NUMBER	Warning	Character in data field	Intrinsic requirement
233	Compliance	TYPE_K_2009_D1	NUMBER	Warning	Character in data field	Intrinsic requirement
234	Compliance	TYPE_K_2009_D2	NUMBER	Warning	Character in data field	Intrinsic requirement
235	Compliance	TYPE_K_2009_MT	NUMBER	Warning	Character in data field	Intrinsic requirement
236	Compliance	TYPE_K_2012_BG	NUMBER	Warning	Character in data field	Intrinsic requirement
237	Compliance	TYPE_K_2012_RO	NUMBER	Warning	Character in data field	Intrinsic requirement
238	Compliance	TYPE_K_2015_G1	NUMBER	Warning	Character in data field	Intrinsic requirement
239	Compliance	TYPE_K_2015_G2	NUMBER	Warning	Character in data field	Intrinsic requirement
240	Compliance	TYPE_K_2015_G3	NUMBER	Warning	Character in data field	Intrinsic requirement
241	Compliance	TYPE_K_2015_G4	NUMBER	Warning	Character in data field	Intrinsic requirement
242	Compliance	TYPE_N_2009_CY	NUMBER	Warning	Character in data field	Intrinsic requirement
243	Compliance	TYPE_N_2009_D1	NUMBER	Warning	Character in data field	Intrinsic requirement
244	Compliance	TYPE_N_2009_D2	NUMBER	Warning	Character in data field	Intrinsic requirement
245	Compliance	TYPE_N_2009_MT	NUMBER	Warning	Character in data field	Intrinsic requirement
246	Compliance	TYPE_N_2012_BG	NUMBER	Warning	Character in data field	Intrinsic requirement
247	Compliance	TYPE_N_2012_RO	NUMBER	Warning	Character in data field	Intrinsic requirement
248	Compliance	TYPE_N_2015_G1	NUMBER	Warning	Character in data field	Intrinsic requirement
249	Compliance	TYPE_N_2015_G2	NUMBER	Warning	Character in data field	Intrinsic requirement
250	Compliance	TYPE_N_2015_G3	NUMBER	Warning	Character in data field	Intrinsic requirement
251	Compliance	TYPE_N_2015_G4	NUMBER	Warning	Character in data field	Intrinsic requirement
252	Compliance	TYPE_OC_2009_CY	NUMBER	Warning	Character in data field	Intrinsic requirement
253	Compliance	TYPE_OC_2009_D1	NUMBER	Warning	Character in data field	Intrinsic requirement
254	Compliance	TYPE_OC_2009_D2	NUMBER	Warning	Character in data field	Intrinsic requirement
255	Compliance	TYPE_OC_2009_MT	NUMBER	Warning	Character in data field	Intrinsic requirement
256	Compliance	TYPE_OC_2012_BG	NUMBER	Warning	Character in data field	Intrinsic requirement
257	Compliance	TYPE_OC_2012_RO	NUMBER	Warning	Character in data field	Intrinsic requirement
258	Compliance	TYPE_OC_2015_G1	NUMBER	Warning	Character in data field	Intrinsic requirement
259	Compliance	TYPE_OC_2015_G2	NUMBER	Warning	Character in data field	Intrinsic requirement
260	Compliance	TYPE_OC_2015_G3	NUMBER	Warning	Character in data field	Intrinsic requirement
261	Compliance	TYPE_OC_2015_G4	NUMBER	Warning	Character in data field	Intrinsic requirement
262	Compliance	TYPE_PH_CACL2_2009_CY	NUMBER	Warning	Character in data field	Intrinsic requirement
263	Compliance	TYPE_PH_CACL2_2009_D1	NUMBER	Warning	Character in data field	Intrinsic requirement

CHECK			RANGE	SEVERITY	CHECK	RULE_SOURCE
ID	*Step*	*Label*	*Limit*	*Level*	*Message*	*Source*
264	Compliance	TYPE_PH_CACL2_2009_D2	NUMBER	Warning	Character in data field	Intrinsic requirement
265	Compliance	TYPE_PH_CACL2_2009_MT	NUMBER	Warning	Character in data field	Intrinsic requirement
266	Compliance	TYPE_PH_CACL2_2012_BG	NUMBER	Warning	Character in data field	Intrinsic requirement
267	Compliance	TYPE_PH_CACL2_2012_RO	NUMBER	Warning	Character in data field	Intrinsic requirement
268	Compliance	TYPE_PH_CACL2_2015_G1	NUMBER	Warning	Character in data field	Intrinsic requirement
269	Compliance	TYPE_PH_CACL2_2015_G2	NUMBER	Warning	Character in data field	Intrinsic requirement
270	Compliance	TYPE_PH_CACL2_2015_G3	NUMBER	Warning	Character in data field	Intrinsic requirement
271	Compliance	TYPE_PH_CACL2_2015_G4	NUMBER	Warning	Character in data field	Intrinsic requirement
272	Compliance	TYPE_PH_H2O_2009_CY	NUMBER	Warning	Character in data field	Intrinsic requirement
273	Compliance	TYPE_PH_H2O_2009_D1	NUMBER	Warning	Character in data field	Intrinsic requirement
274	Compliance	TYPE_PH_H2O_2009_D2	NUMBER	Warning	Character in data field	Intrinsic requirement
275	Compliance	TYPE_PH_H2O_2009_MT	NUMBER	Warning	Character in data field	Intrinsic requirement
276	Compliance	TYPE_PH_H2O_2012_BG	NUMBER	Warning	Character in data field	Intrinsic requirement
277	Compliance	TYPE_PH_H2O_2012_RO	NUMBER	Warning	Character in data field	Intrinsic requirement
278	Compliance	TYPE_PH_H2O_2015_G1	NUMBER	Warning	Character in data field	Intrinsic requirement
279	Compliance	TYPE_PH_H2O_2015_G2	NUMBER	Warning	Character in data field	Intrinsic requirement
280	Compliance	TYPE_PH_H2O_2015_G3	NUMBER	Warning	Character in data field	Intrinsic requirement
281	Compliance	TYPE_PH_H2O_2015_G4	NUMBER	Warning	Character in data field	Intrinsic requirement
282	Compliance	TYPE_P_2009_CY	NUMBER	Warning	Character in data field	Intrinsic requirement
283	Compliance	TYPE_P_2009_D1	NUMBER	Warning	Character in data field	Intrinsic requirement
284	Compliance	TYPE_P_2009_D2	NUMBER	Warning	Character in data field	Intrinsic requirement
285	Compliance	TYPE_P_2009_MT	NUMBER	Warning	Character in data field	Intrinsic requirement
286	Compliance	TYPE_P_2012_BG	NUMBER	Warning	Character in data field	Intrinsic requirement
287	Compliance	TYPE_P_2012_RO	NUMBER	Warning	Character in data field	Intrinsic requirement
288	Compliance	TYPE_P_2015_G1	NUMBER	Warning	Character in data field	Intrinsic requirement
289	Compliance	TYPE_P_2015_G2	NUMBER	Warning	Character in data field	Intrinsic requirement
290	Compliance	TYPE_P_2015_G3	NUMBER	Warning	Character in data field	Intrinsic requirement
291	Compliance	TYPE_P_2015_G4	NUMBER	Warning	Character in data field	Intrinsic requirement
292	Compliance	TYPE_SAND_2009_CY	NUMBER	Warning	Character in data field	Intrinsic requirement
293	Compliance	TYPE_SAND_2009_D1	NUMBER	Warning	Character in data field	Intrinsic requirement
294	Compliance	TYPE_SAND_2009_D2	NUMBER	Warning	Character in data field	Intrinsic requirement
295	Compliance	TYPE_SAND_2009_MT	NUMBER	Warning	Character in data field	Intrinsic requirement
296	Compliance	TYPE_SAND_2012_BG	NUMBER	Warning	Character in data field	Intrinsic requirement
297	Compliance	TYPE_SAND_2012_RO	NUMBER	Warning	Character in data field	Intrinsic requirement

CHECK			RANGE	SEVERITY	CHECK	RULE_SOURCE
ID	*Step*	*Label*	*Limit*	*Level*	*Message*	*Source*
298	Compliance	TYPE_SAND_2015_G3	NUMBER	Warning	Character in data field	Intrinsic requirement
299	Compliance	TYPE_SILT_2009_CY	NUMBER	Warning	Character in data field	Intrinsic requirement
300	Compliance	TYPE_SILT_2009_D1	NUMBER	Warning	Character in data field	Intrinsic requirement
301	Compliance	TYPE_SILT_2009_D2	NUMBER	Warning	Character in data field	Intrinsic requirement
302	Compliance	TYPE_SILT_2009_MT	NUMBER	Warning	Character in data field	Intrinsic requirement
303	Compliance	TYPE_SILT_2012_BG	NUMBER	Warning	Character in data field	Intrinsic requirement
304	Compliance	TYPE_SILT_2012_RO	NUMBER	Warning	Character in data field	Intrinsic requirement
305	Compliance	TYPE_SILT_2015_G3	NUMBER	Warning	Character in data field	Intrinsic requirement
306	Compliance	TYPE_SOIL_ID_2009_CY	INTEGER	Error	Character in integer field	Intrinsic requirement
307	Compliance	TYPE_SOIL_ID_2009_D1	INTEGER	Error	Character in integer field	Intrinsic requirement
308	Compliance	TYPE_SOIL_ID_2009_D2	INTEGER	Error	Character in integer field	Intrinsic requirement
309	Compliance	TYPE_SOIL_ID_2009_MT	INTEGER	Error	Character in integer field	Intrinsic requirement
310	Compliance	TYPE_SOIL_ID_2012_BG	INTEGER	Error	Character in integer field	Intrinsic requirement
311	Compliance	TYPE_SOIL_ID_2012_RO	INTEGER	Error	Character in integer field	Intrinsic requirement
312	Compliance	TYPE_SOIL_ID_2015_G1	INTEGER	Error	Character in integer field	Intrinsic requirement
313	Compliance	TYPE_SOIL_ID_2015_G2	INTEGER	Error	Character in integer field	Intrinsic requirement
314	Compliance	TYPE_SOIL_ID_2015_G3	INTEGER	Error	Character in integer field	Intrinsic requirement
315	Compliance	TYPE_SOIL_ID_2015_G4	INTEGER	Error	Character in integer field	Intrinsic requirement
316	Compliance	TYPE_SOIL_LABEL	INTEGER	Error	LUCAS DMT: Character in Soil Label data field.	Intrinsic requirement
317	Compliance	UNIT_CACO3_2009_CY	G_PER_KG	Error	CACO3 not reported in g kg-1.	Based on specifications for other results.
318	Compliance	UNIT_CACO3_2009_D1	G_PER_KG	Error	CACO3 not reported in g kg-1.	SGS_contract_385355_including_tender_and_offer.pdf
319	Compliance	UNIT_CACO3_2009_D2	G_PER_KG	Error	CACO3 not reported in g kg-1.	SGS_contract_385355_including_tender_and_offer.pdf
320	Compliance	UNIT_CACO3_2009_MT	G_PER_KG	Error	CACO3 not reported in g kg-1.	Based on specifications for other results.
321	Compliance	UNIT_CACO3_2012_BG	G_PER_KG	Error	CACO3 not reported in g kg-1.	Based on specifications for other results.
322	Compliance	UNIT_CACO3_2012_RO	G_PER_KG	Error	CACO3 not reported in g kg-1.	Based on specifications for other results.
323	Compliance	UNIT_CACO3_2015_G1	G_PER_KG	Error	CACO3 not reported in g kg-1.	Template_specimen.pdf
324	Compliance	UNIT_CACO3_2015_G2	G_PER_KG	Error	CACO3 not reported in g kg-1.	Template_specimen.pdf
325	Compliance	UNIT_CACO3_2015_G3	G_PER_KG	Error	CACO3 not reported in g kg-1.	Template_specimen.pdf
326	Compliance	UNIT_CACO3_2015_G4	G_PER_KG	Error	CACO3 not reported in g kg-1.	Template_specimen.pdf
327	Compliance	UNIT_CEC_2009_CY	CMOL_P_PER_KG	Error	CEC not reported in cmol(+) kg-1.	Based on specifications for other results.
328	Compliance	UNIT_CEC_2009_D1	CMOL_P_PER_KG	Error	CEC not reported in cmol(+) kg-1.	SGS_contract_385355_including_tender_and_offer.pdf
329	Compliance	UNIT_CEC_2009_D2	CMOL_P_PER_KG	Error	CEC not reported in cmol(+) kg-1.	SGS_contract_385355_including_tender_and_offer.pdf
330	Compliance	UNIT_CEC_2009_MT	CMOL_P_PER_KG	Error	CEC not reported in cmol(+) kg-1.	Based on specifications for other results.
331	Compliance	UNIT_CEC_2012_BG	CMOL_P_PER_KG	Error	CEC not reported in cmol(+) kg-1.	Based on specifications for other results.

CHECK			RANGE	SEVERITY	CHECK	RULE_SOURCE
ID	*Step*	*Label*	*Limit*	*Level*	*Message*	*Source*
332	Compliance	UNIT_CEC_2012_RO	CMOL_P_PER_KG	Error	CEC not reported in cmol(+) kg-1.	Based on specifications for other results.
333	Compliance	UNIT_CEC_2015_G1	CMOL_P_PER_KG	Error	CEC not reported in cmol(+) kg-1.	Template_specimen.pdf
334	Compliance	UNIT_CEC_2015_G2	CMOL_P_PER_KG	Error	CEC not reported in cmol(+) kg-1.	Template_specimen.pdf
335	Compliance	UNIT_CEC_2015_G3	CMOL_P_PER_KG	Error	CEC not reported in cmol(+) kg-1.	Template_specimen.pdf
336	Compliance	UNIT_CEC_2015_G4	CMOL_P_PER_KG	Error	CEC not reported in cmol(+) kg-1.	Template_specimen.pdf
337	Compliance	UNIT_CF_2009_CY	PERCENTAGE	Error	CF not reported in %.	Based on specifications for other results.
338	Compliance	UNIT_CF_2009_D1	PERCENTAGE	Error	CF not reported in %.	SGS_contract_385355_including_tender_and_offer.pdf
339	Compliance	UNIT_CF_2009_D2	PERCENTAGE	Error	CF not reported in %.	SGS_contract_385355_including_tender_and_offer.pdf
340	Compliance	UNIT_CF_2009_MT	PERCENTAGE	Error	CF not reported in %.	Based on specifications for other results.
341	Compliance	UNIT_CF_2012_BG	PERCENTAGE	Error	CF not reported in %.	Based on specifications for other results.
342	Compliance	UNIT_CF_2012_RO	PERCENTAGE	Error	CF not reported in %.	Based on specifications for other results.
343	Compliance	UNIT_CF_2015_G3	PERCENTAGE	Error	CF not reported in %.	Template_specimen.pdf
344	Compliance	UNIT_CLAY_2009_CY	PERCENTAGE	Error	CLAY not reported in %.	Based on specifications for other results.
345	Compliance	UNIT_CLAY_2009_D1	PERCENTAGE	Error	CLAY not reported in %.	SGS_contract_385355_including_tender_and_offer.pdf
346	Compliance	UNIT_CLAY_2009_D2	PERCENTAGE	Error	CLAY not reported in %.	SGS_contract_385355_including_tender_and_offer.pdf
347	Compliance	UNIT_CLAY_2009_MT	PERCENTAGE	Error	CLAY not reported in %.	Based on specifications for other results.
348	Compliance	UNIT_CLAY_2012_BG	PERCENTAGE	Error	CLAY not reported in %.	Based on specifications for other results.
349	Compliance	UNIT_CLAY_2012_RO	PERCENTAGE	Error	CLAY not reported in %.	Based on specifications for other results.
350	Compliance	UNIT_CLAY_2015_G3	PERCENTAGE	Error	CLAY not reported in %.	Template_specimen.pdf
351	Compliance	UNIT_EC_2015_G1	MSIEMENS_PER_METER	Error	EC not reported as mS m-1.	Template_specimen.pdf
352	Compliance	UNIT_EC_2015_G2	MSIEMENS_PER_METER	Error	EC not reported as mS m-1.	Template_specimen.pdf
353	Compliance	UNIT_EC_2015_G3	MSIEMENS_PER_METER	Error	EC not reported as mS m-1.	Template_specimen.pdf
354	Compliance	UNIT_EC_2015_G4	MSIEMENS_PER_METER	Error	EC not reported as mS m-1.	Template_specimen.pdf
355	Compliance	UNIT_K_2009_CY	MG_PER_KG	Error	K not reported in mg kg-1.	Based on specifications for other results.
356	Compliance	UNIT_K_2009_D1	MG_PER_KG	Error	K not reported in mg kg-1.	SGS_contract_385355_including_tender_and_offer.pdf
357	Compliance	UNIT_K_2009_D2	MG_PER_KG	Error	K not reported in mg kg-1.	SGS_contract_385355_including_tender_and_offer.pdf
358	Compliance	UNIT_K_2009_MT	MG_PER_KG	Error	K not reported in mg kg-1.	Based on specifications for other results.

CHECK			RANGE	SEVERITY	CHECK	RULE_SOURCE
ID	*Step*	*Label*	*Limit*	*Level*	*Message*	*Source*
359	Compliance	UNIT_K_2012_BG	MG_PER_KG	Error	K not reported in mg kg-1.	Based on specifications for other results.
360	Compliance	UNIT_K_2012_RO	MG_PER_KG	Error	K not reported in mg kg-1.	Based on specifications for other results.
361	Compliance	UNIT_K_2015_G1	MG_PER_KG	Error	K not reported in mg kg-1.	Template_specimen.pdf
362	Compliance	UNIT_K_2015_G2	MG_PER_KG	Error	K not reported in mg kg-1.	Template_specimen.pdf
363	Compliance	UNIT_K_2015_G3	MG_PER_KG	Error	K not reported in mg kg-1.	Template_specimen.pdf
364	Compliance	UNIT_K_2015_G4	MG_PER_KG	Error	K not reported in mg kg-1.	Template_specimen.pdf
365	Compliance	UNIT_N_2009_CY	G_PER_KG	Error	N not reported in g kg-1.	Based on specifications for other results.
366	Compliance	UNIT_N_2009_D1	G_PER_KG	Error	N not reported in g kg-1.	SGS_contract_385355_including_tender_and_offer.pdf
367	Compliance	UNIT_N_2009_D2	G_PER_KG	Error	N not reported in g kg-1.	SGS_contract_385355_including_tender_and_offer.pdf
368	Compliance	UNIT_N_2009_MT	G_PER_KG	Error	N not reported in g kg-1.	Based on specifications for other results.
369	Compliance	UNIT_N_2012_BG	G_PER_KG	Error	N not reported in g kg-1.	Based on specifications for other results.
370	Compliance	UNIT_N_2012_RO	G_PER_KG	Error	N not reported in g kg-1.	Based on specifications for other results.
371	Compliance	UNIT_N_2015_G1	G_PER_KG	Error	N not reported in g kg-1.	Template_specimen.pdf
372	Compliance	UNIT_N_2015_G2	G_PER_KG	Error	N not reported in g kg-1.	Template_specimen.pdf
373	Compliance	UNIT_N_2015_G3	G_PER_KG	Error	N not reported in g kg-1.	Template_specimen.pdf
374	Compliance	UNIT_N_2015_G4	G_PER_KG	Error	N not reported in g kg-1.	Template_specimen.pdf
375	Compliance	UNIT_OC_2009_CY	G_PER_KG	Error	OC not reported in g kg-1.	Based on specifications for other results.
376	Compliance	UNIT_OC_2009_D1	G_PER_KG	Error	OC not reported in g kg-1.	SGS_contract_385355_including_tender_and_offer.pdf
377	Compliance	UNIT_OC_2009_D2	G_PER_KG	Error	OC not reported in g kg-1.	SGS_contract_385355_including_tender_and_offer.pdf
378	Compliance	UNIT_OC_2009_MT	G_PER_KG	Error	OC not reported in g kg-1.	Based on specifications for other results.
379	Compliance	UNIT_OC_2012_BG	G_PER_KG	Error	OC not reported in g kg-1.	Based on specifications for other results.
380	Compliance	UNIT_OC_2012_RO	G_PER_KG	Error	OC not reported in g kg-1.	Based on specifications for other results.
381	Compliance	UNIT_OC_2015_G1	G_PER_KG	Error	OC not reported in g kg-1.	Template_specimen.pdf
382	Compliance	UNIT_OC_2015_G2	G_PER_KG	Error	OC not reported in g kg-1.	Template_specimen.pdf
383	Compliance	UNIT_OC_2015_G3	G_PER_KG	Error	OC not reported in g kg-1.	Template_specimen.pdf
384	Compliance	UNIT_OC_2015_G4	G_PER_KG	Error	OC not reported in g kg-1.	Template_specimen.pdf
385	Compliance	UNIT_PH_CACL2_2009_CY	PH	Error	PH_CACL2 not reported as pH.	Based on specifications for other results.
386	Compliance	UNIT_PH_CACL2_2009_D1	PH	Error	PH_CACL2 not reported as pH.	SGS_contract_385355_including_tender_and_offer.pdf
387	Compliance	UNIT_PH_CACL2_2009_D2	PH	Error	PH_CACL2 not reported as pH.	SGS_contract_385355_including_tender_and_offer.pdf
388	Compliance	UNIT_PH_CACL2_2009_MT	PH	Error	PH_CACL2 not reported as pH.	Based on specifications for other results.
389	Compliance	UNIT_PH_CACL2_2012_BG	PH	Error	PH_CACL2 not reported as pH.	Based on specifications for other results.
390	Compliance	UNIT_PH_CACL2_2012_RO	PH	Error	PH_CACL2 not reported as pH.	Based on specifications for other results.

CHECK			RANGE	SEVERITY	CHECK	RULE_SOURCE
ID	*Step*	*Label*	*Limit*	*Level*	*Message*	*Source*
391	Compliance	UNIT_PH_CACL2_2015_G1	PH	Error	PH_CACL2 not reported as pH.	Template_specimen.pdf
392	Compliance	UNIT_PH_CACL2_2015_G2	PH	Error	PH_CACL2 not reported as pH.	Template_specimen.pdf
393	Compliance	UNIT_PH_CACL2_2015_G3	PH	Error	PH_CACL2 not reported as pH.	Template_specimen.pdf
394	Compliance	UNIT_PH_CACL2_2015_G4	PH	Error	PH_CACL2 not reported as pH.	Template_specimen.pdf
395	Compliance	UNIT_PH_H2O_2009_CY	PH	Error	PH_H2O not reported as pH.	Based on specifications for other results.
396	Compliance	UNIT_PH_H2O_2009_D1	PH	Error	PH_H2O not reported as pH.	SGS_contract_385355_including_tender_and_offer.pdf
397	Compliance	UNIT_PH_H2O_2009_D2	PH	Error	PH_H2O not reported as pH.	SGS_contract_385355_including_tender_and_offer.pdf
398	Compliance	UNIT_PH_H2O_2009_MT	PH	Error	PH_H2O not reported as pH.	Based on specifications for other results.
399	Compliance	UNIT_PH_H2O_2012_BG	PH	Error	PH_H2O not reported as pH.	Based on specifications for other results.
400	Compliance	UNIT_PH_H2O_2012_RO	PH	Error	PH_H2O not reported as pH.	Based on specifications for other results.
401	Compliance	UNIT_PH_H2O_2015_G1	PH	Error	PH_H2O not reported as pH.	Template_specimen.pdf
402	Compliance	UNIT_PH_H2O_2015_G2	PH	Error	PH_H2O not reported as pH.	Template_specimen.pdf
403	Compliance	UNIT_PH_H2O_2015_G3	PH	Error	PH_H2O not reported as pH.	Template_specimen.pdf
404	Compliance	UNIT_PH_H2O_2015_G4	PH	Error	PH_H2O not reported as pH.	Template_specimen.pdf
405	Compliance	UNIT_P_2009_CY	MG_PER_KG	Error	P not reported in mg kg-1.	Based on specifications for other results.
406	Compliance	UNIT_P_2009_D1	MG_PER_KG	Error	P not reported in mg kg-1.	SGS_contract_385355_including_tender_and_offer.pdf
407	Compliance	UNIT_P_2009_D2	MG_PER_KG	Error	P not reported in mg kg-1.	SGS_contract_385355_including_tender_and_offer.pdf
408	Compliance	UNIT_P_2009_MT	MG_PER_KG	Error	P not reported in mg kg-1.	Based on specifications for other results.
409	Compliance	UNIT_P_2012_BG	MG_PER_KG	Error	P not reported in mg kg-1.	Based on specifications for other results.
410	Compliance	UNIT_P_2012_RO	MG_PER_KG	Error	P not reported in mg kg-1.	Based on specifications for other results.
411	Compliance	UNIT_P_2015_G1	MG_PER_KG	Error	P not reported in mg kg-1.	Template_specimen.pdf
412	Compliance	UNIT_P_2015_G2	MG_PER_KG	Error	P not reported in mg kg-1.	Template_specimen.pdf
413	Compliance	UNIT_P_2015_G3	MG_PER_KG	Error	P not reported in mg kg-1.	Template_specimen.pdf
414	Compliance	UNIT_P_2015_G4	MG_PER_KG	Error	P not reported in mg kg-1.	Template_specimen.pdf
415	Compliance	UNIT_SAND_2009_CY	PERCENTAGE	Error	SAND not reported in %.	Based on specifications for other results.
416	Compliance	UNIT_SAND_2009_D1	PERCENTAGE	Error	SAND not reported in %.	SGS_contract_385355_including_tender_and_offer.pdf
417	Compliance	UNIT_SAND_2009_D2	PERCENTAGE	Error	SAND not reported in %.	SGS_contract_385355_including_tender_and_offer.pdf
418	Compliance	UNIT_SAND_2009_MT	PERCENTAGE	Error	SAND not reported in %.	Based on specifications for other results.
419	Compliance	UNIT_SAND_2012_BG	PERCENTAGE	Error	SAND not reported in %.	Based on specifications for other results.
420	Compliance	UNIT_SAND_2012_RO	PERCENTAGE	Error	SAND not reported in %.	Based on specifications for other results.
421	Compliance	UNIT_SAND_2015_G3	PERCENTAGE	Error	SAND not reported in %.	Template_specimen.pdf
422	Compliance	UNIT_SILT_2009_CY	PERCENTAGE	Error	SILT not reported in %.	Based on specifications for other results.

CHECK			RANGE	SEVERITY	CHECK	RULE_SOURCE
ID	*Step*	*Label*	*Limit*	*Level*	*Message*	*Source*
423	Compliance	UNIT_SILT_2009_D1	PERCENTAGE	Error	SILT not reported in %.	SGS_contract_385355_including_tender_and_offer.pdf
424	Compliance	UNIT_SILT_2009_D2	PERCENTAGE	Error	SILT not reported in %.	SGS_contract_385355_including_tender_and_offer.pdf
425	Compliance	UNIT_SILT_2009_MT	PERCENTAGE	Error	SILT not reported in %.	Based on specifications for other results.
426	Compliance	UNIT_SILT_2012_BG	PERCENTAGE	Error	SILT not reported in %.	Based on specifications for other results.
427	Compliance	UNIT_SILT_2012_RO	PERCENTAGE	Error	SILT not reported in %.	Based on specifications for other results.
428	Compliance	UNIT_SILT_2015_G3	PERCENTAGE	Error	SILT not reported in %.	Template_specimen.pdf
429	Conformity	CODE_LOD_CACO3_2009	< 1	Warning	Invalid code for quantification limit of CACO3 results.	5.8.2.LUCAS_Final_Test_Plan.pdf
430	Conformity	CODE_LOD_CACO3_2012	< 0.5	Warning	Invalid code for quantification limit of CACO3 results.	Not specified, defiened as 2009.
431	Conformity	CODE_LOD_CACO3_2015_G1	< 1	Warning	Invalid code for quantification limit of CACO3 results.	2_Preliminary_Test_Plan.pdf
432	Conformity	CODE_LOD_CACO3_2015_G2	< 1	Warning	Invalid code for quantification limit of CACO3 results.	2_Preliminary_Test_Plan.pdf
433	Conformity	CODE_LOD_CACO3_2015_G2	< 1	Warning	Invalid code for quantification limit of CACO3 results.	2_Preliminary_Test_Plan.pdf
434	Conformity	CODE_LOD_CACO3_2015_G3	< 1	Warning	Invalid code for quantification limit of CACO3 results.	2_Preliminary_Test_Plan.pdf
435	Conformity	CODE_LOD_CACO3_2015_G4	< 1	Warning	Invalid code for quantification limit of CACO3 results.	2_Preliminary_Test_Plan.pdf
436	Conformity	CODE_LOD_CEC_2009	< 2.0	Warning	Invalid code for quantification limit of CEC results.	5.8.2.LUCAS_Final_Test_Plan.pdf
437	Conformity	CODE_LOD_CEC_2012	< 2.0	Warning	Invalid code for quantification limit of CEC results.	Not specified, defiened as 2009.
438	Conformity	CODE_LOD_CEC_2015_G1	< 2.0	Warning	Invalid code for quantification limit of CEC results.	2_Preliminary_Test_Plan.pdf
439	Conformity	CODE_LOD_CEC_2015_G2	< 2.0	Warning	Invalid code for quantification limit of CEC results.	2_Preliminary_Test_Plan.pdf
440	Conformity	CODE_LOD_CEC_2015_G3	< 2.0	Warning	Invalid code for quantification limit of CEC results.	2_Preliminary_Test_Plan.pdf
441	Conformity	CODE_LOD_CEC_2015_G4	< 2.0	Warning	Invalid code for quantification limit of CEC results.	2_Preliminary_Test_Plan.pdf
442	Conformity	CODE_LOD_CF_2009	< 1	Warning	Invalid code for quantification limit of CF results.	From field decimal specifications.
443	Conformity	CODE_LOD_CF_2012	< 1	Warning	Invalid code for quantification limit of CF results.	Not specified, defiened as 2009.
444	Conformity	CODE_LOD_CF_2015_G3	< 1	Warning	Invalid code for quantification limit of CF results.	Not specified, defiened as 2009.
445	Conformity	CODE_LOD_CLAY_2009	< 1	Warning	Invalid code for quantification limit of CLAY results.	From field decimal specifications.

CHECK			RANGE	SEVERITY	CHECK	RULE_SOURCE
ID	*Step*	*Label*	*Limit*	*Level*	*Message*	*Source*
446	Conformity	CODE_LOD_CLAY_2012	< 1	Warning	Invalid code for quantification limit of CLAY results.	Not specified, defiened as 2009.
447	Conformity	CODE_LOD_CLAY_2015_G3	< 1	Warning	Invalid code for quantification limit of CLAY results.	Not specified, defiened as 2009.
448	Conformity	CODE_LOD_EC_2015_G1	< 2.0	Warning	Invalid code for quantification limit of EC results.	Not available or specified.
449	Conformity	CODE_LOD_EC_2015_G2	< 2.0	Warning	Invalid code for quantification limit of EC results.	Not available or specified.
450	Conformity	CODE_LOD_EC_2015_G3	< 2.0	Warning	Invalid code for quantification limit of EC results.	Not available or specified.
451	Conformity	CODE_LOD_EC_2015_G4	< 2.0	Warning	Invalid code for quantification limit of EC results.	Not available or specified.
452	Conformity	CODE_LOD_K_2009	< 10.0	Warning	Invalid code for quantification limit of K results.	5.8.2.LUCAS_Final_Test_Plan.pdf
453	Conformity	CODE_LOD_K_2012	< 10.0	Warning	Invalid code for quantification limit of K results.	Not specified, defiened as 2009.
454	Conformity	CODE_LOD_K_2015_G1	< 5.0	Warning	Invalid code for quantification limit of K results.	2_Preliminary_Test_Plan.pdf
455	Conformity	CODE_LOD_K_2015_G2	< 5.0	Warning	Invalid code for quantification limit of K results.	2_Preliminary_Test_Plan.pdf
456	Conformity	CODE_LOD_K_2015_G3	< 5.0	Warning	Invalid code for quantification limit of K results.	2_Preliminary_Test_Plan.pdf
457	Conformity	CODE_LOD_K_2015_G4	< 5.0	Warning	Invalid code for quantification limit of K results.	2_Preliminary_Test_Plan.pdf
458	Conformity	CODE_LOD_N_2009	< 0.2	Warning	Invalid code for quantification limit of N results.	5.8.2.LUCAS_Final_Test_Plan.pdf
459	Conformity	CODE_LOD_N_2012	< 0.2	Warning	Invalid code for quantification limit of N results.	Not specified, defiened as 2009.
460	Conformity	CODE_LOD_N_2015_G1	< 0.2	Warning	Invalid code for quantification limit of N results.	2_Preliminary_Test_Plan.pdf
461	Conformity	CODE_LOD_N_2015_G2	< 0.2	Warning	Invalid code for quantification limit of N results.	2_Preliminary_Test_Plan.pdf
462	Conformity	CODE_LOD_N_2015_G3	< 0.2	Warning	Invalid code for quantification limit of N results.	2_Preliminary_Test_Plan.pdf
463	Conformity	CODE_LOD_N_2015_G4	< 0.2	Warning	Invalid code for quantification limit of N results.	2_Preliminary_Test_Plan.pdf
464	Conformity	CODE_LOD_OC_2009	< 2.0	Warning	Invalid code for quantification limit of OC results.	5.8.2.LUCAS_Final_Test_Plan.pdf
465	Conformity	CODE_LOD_OC_2012	< 6.0	Warning	Invalid code for quantification limit of OC results.	Not specified, derived from data.
466	Conformity	CODE_LOD_OC_2015_G1	< 2.0	Warning	Invalid code for quantification limit of OC results.	2_Preliminary_Test_Plan.pdf

CHECK			RANGE	SEVERITY	CHECK	RULE_SOURCE
ID	*Step*	*Label*	*Limit*	*Level*	*Message*	*Source*
467	Conformity	CODE_LOD_OC_2015_G2	< 2.0	Warning	Invalid code for quantification limit of OC results.	2_Preliminary_Test_Plan.pdf
468	Conformity	CODE_LOD_OC_2015_G3	< 2.0	Warning	Invalid code for quantification limit of OC results.	2_Preliminary_Test_Plan.pdf
469	Conformity	CODE_LOD_OC_2015_G4	< 2.0	Warning	Invalid code for quantification limit of OC results.	2_Preliminary_Test_Plan.pdf
470	Conformity	CODE_LOD_P_2009	< 10.0	Warning	Invalid code for quantification limit of P results.	5.8.2.LUCAS_Final_Test_Plan.pdf
471	Conformity	CODE_LOD_P_2012	< 5.0	Warning	Invalid code for quantification limit of P results.	Not specified, defiened as 2009.
472	Conformity	CODE_LOD_P_2015_G1	< 10.0	Warning	Invalid code for quantification limit of P results.	2_Preliminary_Test_Plan.pdf
473	Conformity	CODE_LOD_P_2015_G2	< 10.0	Warning	Invalid code for quantification limit of P results.	2_Preliminary_Test_Plan.pdf
474	Conformity	CODE_LOD_P_2015_G3	< 10.0	Warning	Invalid code for quantification limit of P results.	2_Preliminary_Test_Plan.pdf
475	Conformity	CODE_LOD_P_2015_G4	< 10.0	Warning	Invalid code for quantification limit of P results.	2_Preliminary_Test_Plan.pdf
476	Conformity	CODE_LOD_SAND_2009	< 1	Warning	Invalid code for quantification limit of SAND results.	From field decimal specifications.
477	Conformity	CODE_LOD_SAND_2012	< 1	Warning	Invalid code for quantification limit of SAND results.	Not specified, defiened as 2009.
478	Conformity	CODE_LOD_SAND_2015_G3	< 1	Warning	Invalid code for quantification limit of SAND results.	Not specified, defiened as 2009.
479	Conformity	CODE_LOD_SILT_2009	< 1	Warning	Invalid code for quantification limit of SILT results.	From field decimal specifications.
480	Conformity	CODE_LOD_SILT_2012	< 1	Warning	Invalid code for quantification limit of SILT results.	Not specified, defiened as 2009.
481	Conformity	CODE_LOD_SILT_2015_G3	< 1	Warning	Invalid code for quantification limit of SILT results.	Not specified, defiened as 2009.
482	Conformity	DUPLICATE_CHEM_2009	COUNT ALL = 1	Warning	LUCAS SOIL: Chemical data is duplicated.	Indicator for sample labelling problem.
483	Conformity	DUPLICATE_CHEM_2012	COUNT ALL = 1	Warning	LUCAS SOIL: Chemical data is duplicated.	Indicator for sample labelling problem.
484	Conformity	DUPLICATE_CHEM_2015	COUNT ALL = 1	Warning	LUCAS SOIL: Chemical data is duplicated.	Indicator for sample labelling problem.
485	Conformity	DUPLICATE_DMT_POINT_2009	COUNT ALL = 1	Error	LUCAS DMT: Duplicate identifier for point.	Requirement for key.
486	Conformity	DUPLICATE_DMT_POINT_2012	COUNT ALL = 1	Error	LUCAS DMT: Duplicate identifier for point.	Requirement for key.
487	Conformity	DUPLICATE_DMT_POINT_2015	COUNT ALL = 1	Error	LUCAS DMT: Duplicate identifier for point.	Requirement for key.

CHECK			RANGE	SEVERITY	CHECK	RULE_SOURCE
ID	*Step*	*Label*	*Limit*	*Level*	*Message*	*Source*
488	Conformity	DUPLICATE_DMT_SOIL_2009	COUNT ALL = 1	Error	LUCAS DMT: Duplicate identifier for soil sample.	Requirement for reference.
489	Conformity	DUPLICATE_DMT_SOIL_2012	COUNT ALL = 1	Error	LUCAS DMT: Duplicate identifier for soil sample.	Requirement for reference.
490	Conformity	DUPLICATE_DMT_SOIL_2012	COUNT ALL = 1	Error	LUCAS DMT: Duplicate identifier for soil sample.	Requirement for reference.
491	Conformity	DUPLICATE_DMT_SOIL_2015	COUNT ALL = 1	Error	LUCAS DMT: Duplicate identifier for soil sample.	Requirement for reference.
492	Conformity	DUPLICATE_LAB_SOIL_2009	COUNT ALL = 1	Error	LUCAS SOIL: Duplicate identifier for soil sample.	Requirement for database model.
493	Conformity	DUPLICATE_LAB_SOIL_2012	COUNT ALL = 1	Error	LUCAS SOIL: Duplicate identifier for soil sample.	Requirement for database model.
494	Conformity	DUPLICATE_LAB_SOIL_2015	COUNT ALL = 1	Error	LUCAS SOIL: Duplicate identifier for soil sample.	Requirement for database model.
495	Conformity	DUPLICATE_TEXT_2009	COUNT ALL = 1	Warning	LUCAS SOIL: Texture + pH data is duplicated.	Indicator for sample labelling problem.
496	Conformity	DUPLICATE_TEXT_2012	COUNT ALL = 1	Warning	LUCAS SOIL: Texture + pH data is duplicated.	Indicator for sample labelling problem.
497	Conformity	DUPLICATE_TEXT_2015	COUNT ALL = 1	Warning	LUCAS SOIL: Texture + pH data is duplicated.	Indicator for sample labelling problem.
498	Conformity	MISSING_CACO3_2009	BLANK	Warning	A value is missing for parameter CACO3.	Completeness.
499	Conformity	MISSING_CACO3_2012	BLANK	Warning	A value is missing for parameter CACO3.	Completeness.
500	Conformity	MISSING_CACO3_2015_G1	BLANK	Warning	A value is missing for parameter CACO3.	Completeness.
501	Conformity	MISSING_CACO3_2015_G2	BLANK	Warning	A value is missing for parameter CACO3.	Completeness.
502	Conformity	MISSING_CACO3_2015_G3	BLANK	Warning	A value is missing for parameter CACO3.	Completeness.
503	Conformity	MISSING_CACO3_2015_G4	BLANK	Warning	A value is missing for parameter CACO3.	Completeness.
504	Conformity	MISSING_CEC_2009	BLANK	Warning	A value is missing for parameter CEC.	Completeness.
505	Conformity	MISSING_CEC_2012	BLANK	Warning	A value is missing for parameter CEC.	Completeness.
506	Conformity	MISSING_CEC_2015_G1	BLANK	Warning	A value is missing for parameter CEC.	Completeness.
507	Conformity	MISSING_CEC_2015_G2	BLANK	Warning	A value is missing for parameter CEC.	Completeness.
508	Conformity	MISSING_CEC_2015_G3	BLANK	Warning	A value is missing for parameter CEC.	Completeness.
509	Conformity	MISSING_CEC_2015_G4	BLANK	Warning	A value is missing for parameter CEC.	Completeness.
510	Conformity	MISSING_CF_2009	BLANK	Warning	A value is missing for parameter CF.	Completeness.
511	Conformity	MISSING_CF_2012	BLANK	Warning	A value is missing for parameter CF.	Completeness.
512	Conformity	MISSING_CF_2015_G3	BLANK	Warning	A value is missing for parameter CF.	Completeness.
513	Conformity	MISSING_CLAY_2009	BLANK	Warning	A value is missing for parameter CLAY.	Completeness.
514	Conformity	MISSING_CLAY_2012	BLANK	Warning	A value is missing for parameter CLAY.	Completeness.
515	Conformity	MISSING_CLAY_2015_G3	BLANK	Warning	A value is missing for parameter CLAY.	Completeness.

CHECK			RANGE	SEVERITY	CHECK	RULE_SOURCE
ID	*Step*	*Label*	*Limit*	*Level*	*Message*	*Source*
516	Conformity	MISSING_EC_2015_G1	BLANK	Warning	A value is missing for parameter EC.	Completeness.
517	Conformity	MISSING_EC_2015_G2	BLANK	Warning	A value is missing for parameter EC.	Completeness.
518	Conformity	MISSING_EC_2015_G3	BLANK	Warning	A value is missing for parameter EC.	Completeness.
519	Conformity	MISSING_EC_2015_G4	BLANK	Warning	A value is missing for parameter EC.	Completeness.
520	Conformity	MISSING_K_2009	BLANK	Warning	A value is missing for parameter K.	Completeness.
521	Conformity	MISSING_K_2012	BLANK	Warning	A value is missing for parameter K.	Completeness.
522	Conformity	MISSING_K_2015_G1	BLANK	Warning	A value is missing for parameter K.	Completeness.
523	Conformity	MISSING_K_2015_G2	BLANK	Warning	A value is missing for parameter K.	Completeness.
524	Conformity	MISSING_K_2015_G3	BLANK	Warning	A value is missing for parameter K.	Completeness.
525	Conformity	MISSING_K_2015_G4	BLANK	Warning	A value is missing for parameter K.	Completeness.
526	Conformity	MISSING_N_2009	BLANK	Warning	A value is missing for parameter N.	Completeness.
527	Conformity	MISSING_N_2012	BLANK	Warning	A value is missing for parameter N.	Completeness.
528	Conformity	MISSING_N_2015_G1	BLANK	Warning	A value is missing for parameter N.	Completeness.
529	Conformity	MISSING_N_2015_G2	BLANK	Warning	A value is missing for parameter N.	Completeness.
530	Conformity	MISSING_N_2015_G3	BLANK	Warning	A value is missing for parameter N.	Completeness.
531	Conformity	MISSING_N_2015_G4	BLANK	Warning	A value is missing for parameter N.	Completeness.
532	Conformity	MISSING_OC_2009	BLANK	Warning	A value is missing for parameter OC.	Completeness.
533	Conformity	MISSING_OC_2012	BLANK	Warning	A value is missing for parameter OC.	Completeness.
534	Conformity	MISSING_OC_2015_G1	BLANK	Warning	A value is missing for parameter OC.	Completeness.
535	Conformity	MISSING_OC_2015_G2	BLANK	Warning	A value is missing for parameter OC.	Completeness.
536	Conformity	MISSING_OC_2015_G3	BLANK	Warning	A value is missing for parameter OC.	Completeness.
537	Conformity	MISSING_OC_2015_G4	BLANK	Warning	A value is missing for parameter OC.	Completeness.
538	Conformity	MISSING_PH_CACL2_2009	BLANK	Warning	A value is missing for parameter PH_CACL2.	Completeness.
539	Conformity	MISSING_PH_CACL2_2012	BLANK	Warning	A value is missing for parameter PH_CACL2.	Completeness.
540	Conformity	MISSING_PH_CACL2_2015_G1	BLANK	Warning	A value is missing for parameter PH_CACL2.	Completeness.
541	Conformity	MISSING_PH_CACL2_2015_G2	BLANK	Warning	A value is missing for parameter PH_CACL2.	Completeness.
542	Conformity	MISSING_PH_CACL2_2015_G3	BLANK	Warning	A value is missing for parameter PH_CACL2.	Completeness.
543	Conformity	MISSING_PH_CACL2_2015_G4	BLANK	Warning	A value is missing for parameter PH_CACL2.	Completeness.
544	Conformity	MISSING_PH_H2O_2009	BLANK	Warning	A value is missing for parameter PH_H2O.	Completeness.
545	Conformity	MISSING_PH_H2O_2012	BLANK	Warning	A value is missing for parameter PH_H2O.	Completeness.
546	Conformity	MISSING_PH_H2O_2015_G1	BLANK	Warning	A value is missing for parameter PH_H2O.	Completeness.
547	Conformity	MISSING_PH_H2O_2015_G2	BLANK	Warning	A value is missing for parameter PH_H2O.	Completeness.
548	Conformity	MISSING_PH_H2O_2015_G3	BLANK	Warning	A value is missing for parameter PH_H2O.	Completeness.

CHECK			RANGE	SEVERITY	CHECK	RULE_SOURCE
ID	*Step*	*Label*	*Limit*	*Level*	*Message*	*Source*
549	Conformity	MISSING_PH_H2O_2015_G4	BLANK	Warning	A value is missing for parameter PH_H2O.	Completeness.
550	Conformity	MISSING_P_2009	BLANK	Warning	A value is missing for parameter P.	Completeness.
551	Conformity	MISSING_P_2012	BLANK	Warning	A value is missing for parameter P.	Completeness.
552	Conformity	MISSING_P_2015_G1	BLANK	Warning	A value is missing for parameter P.	Completeness.
553	Conformity	MISSING_P_2015_G2	BLANK	Warning	A value is missing for parameter P.	Completeness.
554	Conformity	MISSING_P_2015_G3	BLANK	Warning	A value is missing for parameter P.	Completeness.
555	Conformity	MISSING_P_2015_G4	BLANK	Warning	A value is missing for parameter P.	Completeness.
556	Conformity	MISSING_SAND_2009	BLANK	Warning	A value is missing for parameter SAND.	Completeness.
557	Conformity	MISSING_SAND_2012	BLANK	Warning	A value is missing for parameter SAND.	Completeness.
558	Conformity	MISSING_SAND_2015_G3	BLANK	Warning	A value is missing for parameter SAND.	Completeness.
559	Conformity	MISSING_SILT_2009	BLANK	Warning	A value is missing for parameter SILT.	Completeness.
560	Conformity	MISSING_SILT_2012	BLANK	Warning	A value is missing for parameter SILT.	Completeness.
561	Conformity	MISSING_SILT_2015_G3	BLANK	Warning	A value is missing for parameter SILT.	Completeness.
562	Conformity	MISSING_SOIL_ID_2009	BLANK	Error	A value is missing for soil sample identifier.	Requirement for database model.
563	Conformity	MISSING_SOIL_ID_2012	BLANK	Error	A value is missing for soil sample identifier.	Requirement for database model.
564	Conformity	MISSING_SOIL_ID_2015_G1	BLANK	Error	A value is missing for soil sample identifier.	Requirement for database model.
565	Conformity	MISSING_SOIL_ID_2015_G2	BLANK	Error	A value is missing for soil sample identifier.	Requirement for database model.
566	Conformity	MISSING_SOIL_ID_2015_G3	BLANK	Error	A value is missing for soil sample identifier.	Requirement for database model.
567	Conformity	MISSING_SOIL_ID_2015_G4	BLANK	Error	A value is missing for soil sample identifier.	Requirement for database model.
568	Conformity	EXP_CACO3_MAX_M_2009	600	Warning	Maximum CACO3 value above expected range for mineral soil.	LUCAS Soil quantile for mineral soil.
569	Conformity	EXP_CACO3_MAX_M_2012	600	Warning	Maximum CACO3 value above expected range for mineral soil.	LUCAS Soil quantile for mineral soil.
570	Conformity	EXP_CACO3_MAX_M_2015_G1	600	Warning	Maximum CACO3 value above expected range for mineral soil.	LUCAS Soil quantile for mineral soil.
571	Conformity	EXP_CACO3_MAX_M_2015_G2	600	Warning	Maximum CACO3 value above expected range for mineral soil.	LUCAS Soil quantile for mineral soil.
572	Conformity	EXP_CACO3_MAX_M_2015_G3	600	Warning	Maximum CACO3 value above expected range for mineral soil.	LUCAS Soil quantile for mineral soil.
573	Conformity	EXP_CACO3_MAX_M_2015_G4	600	Warning	Maximum CACO3 value above expected range for mineral soil.	LUCAS Soil quantile for mineral soil.
574	Conformity	EXP_CACO3_MAX_O_2009	200	Warning	Maximum CACO3 value above expected range for organic soil.	LUCAS Soil quantile for organic soil.
575	Conformity	EXP_CACO3_MAX_O_2012	200	Warning	Maximum CACO3 value above expected range for organic soil.	LUCAS Soil quantile for organic soil.
576	Conformity	EXP_CACO3_MAX_O_2015_G1	200	Warning	Maximum CACO3 value above expected range for organic soil.	LUCAS Soil quantile for organic soil.

CHECK			RANGE	SEVERITY	CHECK	RULE_SOURCE
ID	*Step*	*Label*	*Limit*	*Level*	*Message*	*Source*
577	Conformity	EXP_CACO3_MAX_O_2015_G2	200	Warning	Maximum CACO3 value above expected range for organic soil.	LUCAS Soil quantile for organic soil.
578	Conformity	EXP_CACO3_MAX_O_2015_G3	200	Warning	Maximum CACO3 value above expected range for organic soil.	LUCAS Soil quantile for organic soil.
579	Conformity	EXP_CACO3_MAX_O_2015_G4	200	Warning	Maximum CACO3 value above expected range for organic soil.	LUCAS Soil quantile for organic soil.
580	Conformity	EXP_CACO3_MIN_M_2009	3	Warning	Minimum CACO3 value below expected range for mineral soil.	LUCAS Soil quantile for mineral soil.
581	Conformity	EXP_CACO3_MIN_M_2012	3	Warning	Minimum CACO3 value below expected range for mineral soil.	LUCAS Soil quantile for mineral soil.
582	Conformity	EXP_CACO3_MIN_M_2015_G1	3	Warning	Minimum CACO3 value below expected range for mineral soil.	LUCAS Soil quantile for mineral soil.
583	Conformity	EXP_CACO3_MIN_M_2015_G2	3	Warning	Minimum CACO3 value below expected range for mineral soil.	LUCAS Soil quantile for mineral soil.
584	Conformity	EXP_CACO3_MIN_M_2015_G3	3	Warning	Minimum CACO3 value below expected range for mineral soil.	LUCAS Soil quantile for mineral soil.
585	Conformity	EXP_CACO3_MIN_M_2015_G4	3	Warning	Minimum CACO3 value below expected range for mineral soil.	LUCAS Soil quantile for mineral soil.
586	Conformity	EXP_CACO3_MIN_O_2009	1	Warning	Minimum CACO3 value below expected range for organic soil.	LUCAS Soil quantile for organic soil.
587	Conformity	EXP_CACO3_MIN_O_2012	1	Warning	Minimum CACO3 value below expected range for organic soil.	LUCAS Soil quantile for organic soil.
588	Conformity	EXP_CACO3_MIN_O_2015_G1	1	Warning	Minimum CACO3 value below expected range for organic soil.	LUCAS Soil quantile for organic soil.
589	Conformity	EXP_CACO3_MIN_O_2015_G2	1	Warning	Minimum CACO3 value below expected range for organic soil.	LUCAS Soil quantile for organic soil.
590	Conformity	EXP_CACO3_MIN_O_2015_G3	1	Warning	Minimum CACO3 value below expected range for organic soil.	LUCAS Soil quantile for organic soil.
591	Conformity	EXP_CACO3_MIN_O_2015_G4	1	Warning	Minimum CACO3 value below expected range for organic soil.	LUCAS Soil quantile for organic soil.
592	Conformity	EXP_CEC_MAX_M_2009	50	Warning	Maximum CEC value above expected range for mineral soil.	LUCAS Soil quantile for mineral soil.
593	Conformity	EXP_CEC_MAX_M_2012	50	Warning	Maximum CEC value above expected range for mineral soil.	LUCAS Soil quantile for mineral soil.
594	Conformity	EXP_CEC_MAX_M_2015_G1	50	Warning	Maximum CEC value above expected range for mineral soil.	LUCAS Soil quantile for mineral soil.
595	Conformity	EXP_CEC_MAX_M_2015_G2	50	Warning	Maximum CEC value above expected range for mineral soil.	LUCAS Soil quantile for mineral soil.
596	Conformity	EXP_CEC_MAX_M_2015_G3	50	Warning	Maximum CEC value above expected range for mineral soil.	LUCAS Soil quantile for mineral soil.
597	Conformity	EXP_CEC_MAX_M_2015_G4	50	Warning	Maximum CEC value above expected range for mineral soil.	LUCAS Soil quantile for mineral soil.

CHECK			RANGE	SEVERITY	CHECK	RULE_SOURCE
ID	*Step*	*Label*	*Limit*	*Level*	*Message*	*Source*
598	Conformity	EXP_CEC_MAX_O_2009	105	Warning	Maximum CEC value above expected range for organic soil.	LUCAS Soil quantile for organic soil.
599	Conformity	EXP_CEC_MAX_O_2012	105	Warning	Maximum CEC value above expected range for organic soil.	LUCAS Soil quantile for organic soil.
600	Conformity	EXP_CEC_MAX_O_2015_G1	105	Warning	Maximum CEC value above expected range for organic soil.	LUCAS Soil quantile for organic soil.
601	Conformity	EXP_CEC_MAX_O_2015_G2	105	Warning	Maximum CEC value above expected range for organic soil.	LUCAS Soil quantile for organic soil.
602	Conformity	EXP_CEC_MAX_O_2015_G3	105	Warning	Maximum CEC value above expected range for organic soil.	LUCAS Soil quantile for organic soil.
603	Conformity	EXP_CEC_MAX_O_2015_G4	105	Warning	Maximum CEC value above expected range for organic soil.	LUCAS Soil quantile for organic soil.
604	Conformity	EXP_CEC_MIN_M_2009	3	Warning	Minimum CEC value below expected range for mineral soil.	LUCAS Soil quantile for mineral soil.
605	Conformity	EXP_CEC_MIN_M_2012	3	Warning	Minimum CEC value below expected range for mineral soil.	LUCAS Soil quantile for mineral soil.
606	Conformity	EXP_CEC_MIN_M_2015_G1	3	Warning	Minimum CEC value below expected range for mineral soil.	LUCAS Soil quantile for mineral soil.
607	Conformity	EXP_CEC_MIN_M_2015_G2	3	Warning	Minimum CEC value below expected range for mineral soil.	LUCAS Soil quantile for mineral soil.
608	Conformity	EXP_CEC_MIN_M_2015_G3	3	Warning	Minimum CEC value below expected range for mineral soil.	LUCAS Soil quantile for mineral soil.
609	Conformity	EXP_CEC_MIN_M_2015_G4	3	Warning	Minimum CEC value below expected range for mineral soil.	LUCAS Soil quantile for mineral soil.
610	Conformity	EXP_CEC_MIN_O_2009	8	Warning	Minimum CEC value below expected range for organic soil.	LUCAS Soil quantile for organic soil.
611	Conformity	EXP_CEC_MIN_O_2012	8	Warning	Minimum CEC value below expected range for organic soil.	LUCAS Soil quantile for organic soil.
612	Conformity	EXP_CEC_MIN_O_2015_G1	8	Warning	Minimum CEC value below expected range for organic soil.	LUCAS Soil quantile for organic soil.
613	Conformity	EXP_CEC_MIN_O_2015_G2	8	Warning	Minimum CEC value below expected range for organic soil.	LUCAS Soil quantile for organic soil.
614	Conformity	EXP_CEC_MIN_O_2015_G3	8	Warning	Minimum CEC value below expected range for organic soil.	LUCAS Soil quantile for organic soil.
615	Conformity	EXP_CEC_MIN_O_2015_G4	8	Warning	Minimum CEC value below expected range for organic soil.	LUCAS Soil quantile for organic soil.
616	Conformity	EXP_CF_MAX_M_2009	60	Warning	Maximum CF value above expected range.	List_of_checks_2009_10_21_V2.pdf
617	Conformity	EXP_CF_MAX_M_2012	60	Warning	Maximum CF value above expected range.	List_of_checks_2009_10_21_V2.pdf
618	Conformity	EXP_CF_MAX_M_2015_G3	60	Warning	Maximum CF value above expected range.	List_of_checks_2009_10_21_V2.pdf
619	Conformity	EXP_CF_MAX_O_2009	60	Warning	Maximum CF value above expected range.	List_of_checks_2009_10_21_V2.pdf
620	Conformity	EXP_CF_MAX_O_2012	60	Warning	Maximum CF value above expected range.	List_of_checks_2009_10_21_V2.pdf
621	Conformity	EXP_CF_MAX_O_2015_G3	60	Warning	Maximum CF value above expected range.	List_of_checks_2009_10_21_V2.pdf

CHECK			RANGE	SEVERITY	CHECK	RULE_SOURCE
ID	*Step*	*Label*	*Limit*	*Level*	*Message*	*Source*
622	Conformity	EXP_CF_MIN_M_2009	0	Warning	Minimum CF value below expected range.	List_of_checks_2009_10_21_V2.pdf
623	Conformity	EXP_CF_MIN_M_2012	0	Warning	Minimum CF value below expected range.	List_of_checks_2009_10_21_V2.pdf
624	Conformity	EXP_CF_MIN_M_2015_G3	0	Warning	Minimum CF value below expected range.	List_of_checks_2009_10_21_V2.pdf
625	Conformity	EXP_CF_MIN_O_2009	0	Warning	Minimum CF value below expected range.	List_of_checks_2009_10_21_V2.pdf
626	Conformity	EXP_CF_MIN_O_2012	0	Warning	Minimum CF value below expected range.	List_of_checks_2009_10_21_V2.pdf
627	Conformity	EXP_CF_MIN_O_2015_G3	0	Warning	Minimum CF value below expected range.	List_of_checks_2009_10_21_V2.pdf
628	Conformity	EXP_EC_MAX_M_2015_G1	100	Warning	Maximum EC value above expected range.	LUCAS Soil quantile for mineral soil.
629	Conformity	EXP_EC_MAX_M_2015_G2	100	Warning	Maximum EC value above expected range.	LUCAS Soil quantile for mineral soil.
630	Conformity	EXP_EC_MAX_M_2015_G3	100	Warning	Maximum EC value above expected range.	LUCAS Soil quantile for mineral soil.
631	Conformity	EXP_EC_MAX_M_2015_G4	100	Warning	Maximum EC value above expected range.	LUCAS Soil quantile for mineral soil.
632	Conformity	EXP_EC_MAX_O_2015_G1	250	Warning	Maximum EC value above expected range.	LUCAS Soil quantile for organic soil.
633	Conformity	EXP_EC_MAX_O_2015_G2	250	Warning	Maximum EC value above expected range.	LUCAS Soil quantile for organic soil.
634	Conformity	EXP_EC_MAX_O_2015_G3	250	Warning	Maximum EC value above expected range.	LUCAS Soil quantile for organic soil.
635	Conformity	EXP_EC_MAX_O_2015_G4	250	Warning	Maximum EC value above expected range.	LUCAS Soil quantile for organic soil.
636	Conformity	EXP_EC_MIN_M_2015_G1	3	Warning	Minimum EC value below expected range.	LUCAS Soil quantile for mineral soil.
637	Conformity	EXP_EC_MIN_M_2015_G2	3	Warning	Minimum EC value below expected range.	LUCAS Soil quantile for mineral soil.
638	Conformity	EXP_EC_MIN_M_2015_G3	3	Warning	Minimum EC value below expected range.	LUCAS Soil quantile for mineral soil.
639	Conformity	EXP_EC_MIN_M_2015_G4	3	Warning	Minimum EC value below expected range.	LUCAS Soil quantile for mineral soil.
640	Conformity	EXP_EC_MIN_O_2015_G1	12	Warning	Minimum EC value below expected range.	LUCAS Soil quantile for organic soil.
641	Conformity	EXP_EC_MIN_O_2015_G2	12	Warning	Minimum EC value below expected range.	LUCAS Soil quantile for organic soil.
642	Conformity	EXP_EC_MIN_O_2015_G3	12	Warning	Minimum EC value below expected range.	LUCAS Soil quantile for organic soil.
643	Conformity	EXP_EC_MIN_O_2015_G4	12	Warning	Minimum EC value below expected range.	LUCAS Soil quantile for organic soil.
644	Conformity	EXP_K_MAX_M_2009	720	Warning	Maximum K value above expected range for mineral.	LUCAS Soil quantile for mineral soil.
645	Conformity	EXP_K_MAX_M_2012	720	Warning	Maximum K value above expected range for mineral.	LUCAS Soil quantile for mineral soil.
646	Conformity	EXP_K_MAX_M_2015_G1	720	Warning	Maximum K value above expected range for mineral.	LUCAS Soil quantile for mineral soil.
647	Conformity	EXP_K_MAX_M_2015_G2	720	Warning	Maximum K value above expected range for mineral.	LUCAS Soil quantile for mineral soil.
648	Conformity	EXP_K_MAX_M_2015_G3	720	Warning	Maximum K value above expected range for mineral.	LUCAS Soil quantile for mineral soil.
649	Conformity	EXP_K_MAX_M_2015_G4	720	Warning	Maximum K value above expected range for mineral.	LUCAS Soil quantile for mineral soil.
650	Conformity	EXP_K_MAX_O_2009	650	Warning	Maximum K value above expected range for organic soil.	LUCAS Soil quantile for organic soil.
651	Conformity	EXP_K_MAX_O_2012	650	Warning	Maximum K value above expected range for organic soil.	LUCAS Soil quantile for organic soil.

CHECK			RANGE	SEVERITY	CHECK	RULE_SOURCE
ID	*Step*	*Label*	*Limit*	*Level*	*Message*	*Source*
652	Conformity	EXP_K_MAX_O_2015_G1	650	Warning	Maximum K value above expected range for organic soil.	LUCAS Soil quantile for organic soil.
653	Conformity	EXP_K_MAX_O_2015_G2	650	Warning	Maximum K value above expected range for organic soil.	LUCAS Soil quantile for organic soil.
654	Conformity	EXP_K_MAX_O_2015_G3	650	Warning	Maximum K value above expected range for organic soil.	LUCAS Soil quantile for organic soil.
655	Conformity	EXP_K_MAX_O_2015_G4	650	Warning	Maximum K value above expected range for organic soil.	LUCAS Soil quantile for organic soil.
656	Conformity	EXP_K_MIN_M_2009	20	Warning	Minimum K value below expected range for mineral soil.	LUCAS Soil quantile for mineral soil.
657	Conformity	EXP_K_MIN_M_2012	20	Warning	Minimum K value below expected range for mineral soil.	LUCAS Soil quantile for mineral soil.
658	Conformity	EXP_K_MIN_M_2015_G1	20	Warning	Minimum K value below expected range for mineral soil.	LUCAS Soil quantile for mineral soil.
659	Conformity	EXP_K_MIN_M_2015_G2	20	Warning	Minimum K value below expected range for mineral soil.	LUCAS Soil quantile for mineral soil.
660	Conformity	EXP_K_MIN_M_2015_G3	20	Warning	Minimum K value below expected range for mineral soil.	LUCAS Soil quantile for mineral soil.
661	Conformity	EXP_K_MIN_M_2015_G4	20	Warning	Minimum K value below expected range for mineral soil.	LUCAS Soil quantile for mineral soil.
662	Conformity	EXP_K_MIN_O_2009	40	Warning	Minimum K value below expected range for organic soil.	LUCAS Soil quantile for organic soil.
663	Conformity	EXP_K_MIN_O_2012	40	Warning	Minimum K value below expected range for organic soil.	LUCAS Soil quantile for organic soil.
664	Conformity	EXP_K_MIN_O_2015_G1	40	Warning	Minimum K value below expected range for organic soil.	LUCAS Soil quantile for organic soil.
665	Conformity	EXP_K_MIN_O_2015_G2	40	Warning	Minimum K value below expected range for organic soil.	LUCAS Soil quantile for organic soil.
666	Conformity	EXP_K_MIN_O_2015_G3	40	Warning	Minimum K value below expected range for organic soil.	LUCAS Soil quantile for organic soil.
667	Conformity	EXP_K_MIN_O_2015_G4	40	Warning	Minimum K value below expected range for organic soil.	LUCAS Soil quantile for organic soil.
668	Conformity	EXP_N_MAX_M_2009	8	Warning	Maximum N value above expected range for mineral soil.	LUCAS Soil quantile for mineral soil.
669	Conformity	EXP_N_MAX_M_2012	8	Warning	Maximum N value above expected range for mineral soil.	LUCAS Soil quantile for mineral soil.
670	Conformity	EXP_N_MAX_M_2015_G1	8	Warning	Maximum N value above expected range for mineral soil.	LUCAS Soil quantile for mineral soil.
671	Conformity	EXP_N_MAX_M_2015_G2	8	Warning	Maximum N value above expected range for mineral soil.	LUCAS Soil quantile for mineral soil.
672	Conformity	EXP_N_MAX_M_2015_G3	8	Warning	Maximum N value above expected range for mineral soil.	LUCAS Soil quantile for mineral soil.

CHECK			RANGE	SEVERITY	CHECK	RULE_SOURCE
ID	*Step*	*Label*	*Limit*	*Level*	*Message*	*Source*
673	Conformity	EXP_N_MAX_M_2015_G4	8	Warning	Maximum N value above expected range for mineral soil.	LUCAS Soil quantile for mineral soil.
674	Conformity	EXP_N_MAX_O_2009	25	Warning	Maximum N value above expected range for organic soil.	LUCAS Soil quantile for organic soil.
675	Conformity	EXP_N_MAX_O_2012	25	Warning	Maximum N value above expected range for organic soil.	LUCAS Soil quantile for organic soil.
676	Conformity	EXP_N_MAX_O_2015_G1	25	Warning	Maximum N value above expected range for organic soil.	LUCAS Soil quantile for organic soil.
677	Conformity	EXP_N_MAX_O_2015_G2	25	Warning	Maximum N value above expected range for organic soil.	LUCAS Soil quantile for organic soil.
678	Conformity	EXP_N_MAX_O_2015_G3	25	Warning	Maximum N value above expected range for organic soil.	LUCAS Soil quantile for organic soil.
679	Conformity	EXP_N_MAX_O_2015_G4	25	Warning	Maximum N value above expected range for organic soil.	LUCAS Soil quantile for organic soil.
680	Conformity	EXP_N_MIN_M_2009	0.5	Warning	Minimum N value below expected range for mineral soil.	LUCAS Soil quantile for mineral soil.
681	Conformity	EXP_N_MIN_M_2012	0.5	Warning	Minimum N value below expected range for mineral soil.	LUCAS Soil quantile for mineral soil.
682	Conformity	EXP_N_MIN_M_2015_G1	0.5	Warning	Minimum N value below expected range for mineral soil.	LUCAS Soil quantile for mineral soil.
683	Conformity	EXP_N_MIN_M_2015_G2	0.5	Warning	Minimum N value below expected range for mineral soil.	LUCAS Soil quantile for mineral soil.
684	Conformity	EXP_N_MIN_M_2015_G3	0.5	Warning	Minimum N value below expected range for mineral soil.	LUCAS Soil quantile for mineral soil.
685	Conformity	EXP_N_MIN_M_2015_G4	0.5	Warning	Minimum N value below expected range for mineral soil.	LUCAS Soil quantile for mineral soil.
686	Conformity	EXP_N_MIN_O_2009	4	Warning	Minimum N value below expected range for organic soil.	LUCAS Soil quantile for organic soil.
687	Conformity	EXP_N_MIN_O_2012	4	Warning	Minimum N value below expected range for organic soil.	LUCAS Soil quantile for organic soil.
688	Conformity	EXP_N_MIN_O_2015_G1	4	Warning	Minimum N value below expected range for organic soil.	LUCAS Soil quantile for organic soil.
689	Conformity	EXP_N_MIN_O_2015_G2	4	Warning	Minimum N value below expected range for organic soil.	LUCAS Soil quantile for organic soil.
690	Conformity	EXP_N_MIN_O_2015_G3	4	Warning	Minimum N value below expected range for organic soil.	LUCAS Soil quantile for organic soil.
691	Conformity	EXP_N_MIN_O_2015_G4	4	Warning	Minimum N value below expected range for organic soil.	LUCAS Soil quantile for organic soil.
692	Conformity	EXP_OC_MAX_M_2009	120	Warning	Maximum OC value above expected range.	EUR_23020_EN2.pdf
693	Conformity	EXP_OC_MAX_M_2012	120	Warning	Maximum OC value above expected range.	EUR_23020_EN2.pdf
694	Conformity	EXP_OC_MAX_M_2015_G1	120	Warning	Maximum OC value above expected range.	EUR_23020_EN2.pdf

CHECK			RANGE	SEVERITY	CHECK	RULE_SOURCE
ID	*Step*	*Label*	*Limit*	*Level*	*Message*	*Source*
695	Conformity	EXP_OC_MAX_M_2015_G2	120	Warning	Maximum OC value above expected range.	EUR_23020_EN2.pdf
696	Conformity	EXP_OC_MAX_M_2015_G3	120	Warning	Maximum OC value above expected range.	EUR_23020_EN2.pdf
697	Conformity	EXP_OC_MAX_M_2015_G4	120	Warning	Maximum OC value above expected range.	EUR_23020_EN2.pdf
698	Conformity	EXP_OC_MAX_O_2009	550	Warning	Maximum OC value above expected range.	LUCAS Soil quantile for organic soil.
699	Conformity	EXP_OC_MAX_O_2012	550	Warning	Maximum OC value above expected range.	LUCAS Soil quantile for organic soil.
700	Conformity	EXP_OC_MAX_O_2015_G1	550	Warning	Maximum OC value above expected range.	LUCAS Soil quantile for organic soil.
701	Conformity	EXP_OC_MAX_O_2015_G2	550	Warning	Maximum OC value above expected range.	LUCAS Soil quantile for organic soil.
702	Conformity	EXP_OC_MAX_O_2015_G3	550	Warning	Maximum OC value above expected range.	LUCAS Soil quantile for organic soil.
703	Conformity	EXP_OC_MAX_O_2015_G4	550	Warning	Maximum OC value above expected range.	LUCAS Soil quantile for organic soil.
704	Conformity	EXP_OC_MIN_M_2009	3	Warning	Minimum OC value below expected range.	LUCAS Soil quantile for mineral soil.
705	Conformity	EXP_OC_MIN_M_2012	3	Warning	Minimum OC value below expected range.	LUCAS Soil quantile for mineral soil.
706	Conformity	EXP_OC_MIN_M_2015_G1	3	Warning	Minimum OC value below expected range.	LUCAS Soil quantile for mineral soil.
707	Conformity	EXP_OC_MIN_M_2015_G2	3	Warning	Minimum OC value below expected range.	LUCAS Soil quantile for mineral soil.
708	Conformity	EXP_OC_MIN_M_2015_G3	3	Warning	Minimum OC value below expected range.	LUCAS Soil quantile for mineral soil.
709	Conformity	EXP_OC_MIN_M_2015_G4	3	Warning	Minimum OC value below expected range.	LUCAS Soil quantile for mineral soil.
710	Conformity	EXP_OC_MIN_O_2009	120	Warning	Minimum OC value below expected range.	EUR_23020_EN2.pdf
711	Conformity	EXP_OC_MIN_O_2012	120	Warning	Minimum OC value below expected range.	EUR_23020_EN2.pdf
712	Conformity	EXP_OC_MIN_O_2015_G1	120	Warning	Minimum OC value below expected range.	EUR_23020_EN2.pdf
713	Conformity	EXP_OC_MIN_O_2015_G2	120	Warning	Minimum OC value below expected range.	EUR_23020_EN2.pdf
714	Conformity	EXP_OC_MIN_O_2015_G3	120	Warning	Minimum OC value below expected range.	EUR_23020_EN2.pdf
715	Conformity	EXP_OC_MIN_O_2015_G4	120	Warning	Minimum OC value below expected range.	EUR_23020_EN2.pdf
716	Conformity	EXP_PH_CACL2_MAX_M_2009	8.1	Warning	Maximum PH_CACL2 value above expected range.	LUCAS Soil quantile for mineral soil.
717	Conformity	EXP_PH_CACL2_MAX_M_2012	8.1	Warning	Maximum PH_CACL2 value above expected range.	LUCAS Soil quantile for mineral soil.
718	Conformity	EXP_PH_CACL2_MAX_M_2015_G1	8.1	Warning	Maximum PH_CACL2 value above expected range.	LUCAS Soil quantile for mineral soil.
719	Conformity	EXP_PH_CACL2_MAX_M_2015_G2	8.1	Warning	Maximum PH_CACL2 value above expected range.	LUCAS Soil quantile for mineral soil.
720	Conformity	EXP_PH_CACL2_MAX_M_2015_G3	8.1	Warning	Maximum PH_CACL2 value above expected range.	LUCAS Soil quantile for mineral soil.

CHECK			RANGE	SEVERITY	CHECK	RULE_SOURCE
ID	*Step*	*Label*	*Limit*	*Level*	*Message*	*Source*
721	Conformity	EXP_PH_CACL2_MAX_M_2015_G4	8.1	Warning	Maximum PH_CACL2 value above expected range.	LUCAS Soil quantile for mineral soil.
722	Conformity	EXP_PH_CACL2_MAX_O_2009	6.6	Warning	Maximum PH_CACL2 value above expected range.	LUCAS Soil quantile for organic soil.
723	Conformity	EXP_PH_CACL2_MAX_O_2012	6.6	Warning	Maximum PH_CACL2 value above expected range.	LUCAS Soil quantile for organic soil.
724	Conformity	EXP_PH_CACL2_MAX_O_2015_G1	6.6	Warning	Maximum PH_CACL2 value above expected range.	LUCAS Soil quantile for organic soil.
725	Conformity	EXP_PH_CACL2_MAX_O_2015_G2	6.6	Warning	Maximum PH_CACL2 value above expected range.	LUCAS Soil quantile for organic soil.
726	Conformity	EXP_PH_CACL2_MAX_O_2015_G3	6.6	Warning	Maximum PH_CACL2 value above expected range.	LUCAS Soil quantile for organic soil.
727	Conformity	EXP_PH_CACL2_MAX_O_2015_G4	6.6	Warning	Maximum PH_CACL2 value above expected range.	LUCAS Soil quantile for organic soil.
728	Conformity	EXP_PH_CACL2_MIN_M_2009	3.3	Warning	Minimum PH_CACL2 value below expected range.	LUCAS Soil quantile for mineral soil.
729	Conformity	EXP_PH_CACL2_MIN_M_2012	3.3	Warning	Minimum PH_CACL2 value below expected range.	LUCAS Soil quantile for mineral soil.
730	Conformity	EXP_PH_CACL2_MIN_M_2015_G1	3.3	Warning	Minimum PH_CACL2 value below expected range.	LUCAS Soil quantile for mineral soil.
731	Conformity	EXP_PH_CACL2_MIN_M_2015_G2	3.3	Warning	Minimum PH_CACL2 value below expected range.	LUCAS Soil quantile for mineral soil.
732	Conformity	EXP_PH_CACL2_MIN_M_2015_G3	3.3	Warning	Minimum PH_CACL2 value below expected range.	LUCAS Soil quantile for mineral soil.
733	Conformity	EXP_PH_CACL2_MIN_M_2015_G4	3.3	Warning	Minimum PH_CACL2 value below expected range.	LUCAS Soil quantile for mineral soil.
734	Conformity	EXP_PH_CACL2_MIN_O_2009	2.8	Warning	Minimum PH_CACL2 value below expected range.	LUCAS Soil quantile for organic soil.
735	Conformity	EXP_PH_CACL2_MIN_O_2012	2.8	Warning	Minimum PH_CACL2 value below expected range.	LUCAS Soil quantile for organic soil.
736	Conformity	EXP_PH_CACL2_MIN_O_2015_G1	2.8	Warning	Minimum PH_CACL2 value below expected range.	LUCAS Soil quantile for organic soil.
737	Conformity	EXP_PH_CACL2_MIN_O_2015_G2	2.8	Warning	Minimum PH_CACL2 value below expected range.	LUCAS Soil quantile for organic soil.
738	Conformity	EXP_PH_CACL2_MIN_O_2015_G3	2.8	Warning	Minimum PH_CACL2 value below expected range.	LUCAS Soil quantile for organic soil.
739	Conformity	EXP_PH_CACL2_MIN_O_2015_G4	2.8	Warning	Minimum PH_CACL2 value below expected range.	LUCAS Soil quantile for organic soil.
740	Conformity	EXP_PH_H2O_MAX_M_2009	8.5	Warning	Maximum PH_H2O value above expected range.	LUCAS Soil quantile for mineral soil.
741	Conformity	EXP_PH_H2O_MAX_M_2012	8.5	Warning	Maximum PH_H2O value above expected range.	LUCAS Soil quantile for mineral soil.

CHECK			RANGE	SEVERITY	CHECK	RULE_SOURCE
ID	*Step*	*Label*	*Limit*	*Level*	*Message*	*Source*
742	Conformity	EXP_PH_H2O_MAX_M_2015_G1	8.5	Warning	Maximum PH_H2O value above expected range.	LUCAS Soil quantile for mineral soil.
743	Conformity	EXP_PH_H2O_MAX_M_2015_G2	8.5	Warning	Maximum PH_H2O value above expected range.	LUCAS Soil quantile for mineral soil.
744	Conformity	EXP_PH_H2O_MAX_M_2015_G3	8.5	Warning	Maximum PH_H2O value above expected range.	LUCAS Soil quantile for mineral soil.
745	Conformity	EXP_PH_H2O_MAX_M_2015_G4	8.5	Warning	Maximum PH_H2O value above expected range.	LUCAS Soil quantile for mineral soil.
746	Conformity	EXP_PH_H2O_MAX_O_2009	7	Warning	Maximum PH_H2O value above expected range.	LUCAS Soil quantile for organic soil.
747	Conformity	EXP_PH_H2O_MAX_O_2012	7	Warning	Maximum PH_H2O value above expected range.	LUCAS Soil quantile for organic soil.
748	Conformity	EXP_PH_H2O_MAX_O_2015_G1	7	Warning	Maximum PH_H2O value above expected range.	LUCAS Soil quantile for organic soil.
749	Conformity	EXP_PH_H2O_MAX_O_2015_G2	7	Warning	Maximum PH_H2O value above expected range.	LUCAS Soil quantile for organic soil.
750	Conformity	EXP_PH_H2O_MAX_O_2015_G3	7	Warning	Maximum PH_H2O value above expected range.	LUCAS Soil quantile for organic soil.
751	Conformity	EXP_PH_H2O_MAX_O_2015_G4	7	Warning	Maximum PH_H2O value above expected range.	LUCAS Soil quantile for organic soil.
752	Conformity	EXP_PH_H2O_MIN_M_2009	3.8	Warning	Minimum PH_H2O value below expected range.	LUCAS Soil quantile for mineral soil.
753	Conformity	EXP_PH_H2O_MIN_M_2012	3.8	Warning	Minimum PH_H2O value below expected range.	LUCAS Soil quantile for mineral soil.
754	Conformity	EXP_PH_H2O_MIN_M_2015_G1	3.8	Warning	Minimum PH_H2O value below expected range.	LUCAS Soil quantile for mineral soil.
755	Conformity	EXP_PH_H2O_MIN_M_2015_G2	3.8	Warning	Minimum PH_H2O value below expected range.	LUCAS Soil quantile for mineral soil.
756	Conformity	EXP_PH_H2O_MIN_M_2015_G3	3.8	Warning	Minimum PH_H2O value below expected range.	LUCAS Soil quantile for mineral soil.
757	Conformity	EXP_PH_H2O_MIN_M_2015_G4	3.8	Warning	Minimum PH_H2O value below expected range.	LUCAS Soil quantile for mineral soil.
758	Conformity	EXP_PH_H2O_MIN_O_2009	3.3	Warning	Minimum PH_H2O value below expected range.	LUCAS Soil quantile for organic soil.
759	Conformity	EXP_PH_H2O_MIN_O_2012	3.3	Warning	Minimum PH_H2O value below expected range.	LUCAS Soil quantile for organic soil.
760	Conformity	EXP_PH_H2O_MIN_O_2015_G1	3.3	Warning	Minimum PH_H2O value below expected range.	LUCAS Soil quantile for organic soil.
761	Conformity	EXP_PH_H2O_MIN_O_2015_G2	3.3	Warning	Minimum PH_H2O value below expected range.	LUCAS Soil quantile for organic soil.
762	Conformity	EXP_PH_H2O_MIN_O_2015_G3	3.3	Warning	Minimum PH_H2O value below expected range.	LUCAS Soil quantile for organic soil.

CHECK			RANGE	SEVERITY	CHECK	RULE_SOURCE
ID	*Step*	*Label*	*Limit*	*Level*	*Message*	*Source*
763	Conformity	EXP_PH_H2O_MIN_O_2015_G4	3.3	Warning	Minimum PH_H2O value below expected range.	LUCAS Soil quantile for organic soil.
764	Conformity	EXP_PSD_TOTAL_MAX_M_2009	101	Error	Maximum PSD_TOTAL value above expected range.	implicit from Unit
765	Conformity	EXP_PSD_TOTAL_MAX_M_2012	101	Error	Maximum PSD_TOTAL value above expected range.	implicit from Unit
766	Conformity	EXP_PSD_TOTAL_MAX_M_2015_G3	101	Error	Maximum PSD_TOTAL value above expected range.	implicit from Unit
767	Conformity	EXP_PSD_TOTAL_MAX_O_2009	101	Error	Maximum PSD_TOTAL value above expected range.	implicit from Unit
768	Conformity	EXP_PSD_TOTAL_MAX_O_2012	101	Error	Maximum PSD_TOTAL value above expected range.	implicit from Unit
769	Conformity	EXP_PSD_TOTAL_MAX_O_2015_G3	101	Error	Maximum PSD_TOTAL value above expected range.	implicit from Unit
770	Conformity	EXP_PSD_TOTAL_MIN_M_2009	99	Error	Minimum PSD_TOTAL value below expected range.	implicit from Unit
771	Conformity	EXP_PSD_TOTAL_MIN_M_2012	99	Error	Minimum PSD_TOTAL value below expected range.	implicit from Unit
772	Conformity	EXP_PSD_TOTAL_MIN_M_2015_G3	99	Error	Minimum PSD_TOTAL value below expected range.	implicit from Unit
773	Conformity	EXP_PSD_TOTAL_MIN_O_2009	99	Error	Minimum PSD_TOTAL value below expected range.	implicit from Unit
774	Conformity	EXP_PSD_TOTAL_MIN_O_2012	99	Error	Minimum PSD_TOTAL value below expected range.	implicit from Unit
775	Conformity	EXP_PSD_TOTAL_MIN_O_2015_G3	99	Error	Minimum PSD_TOTAL value below expected range.	implicit from Unit
776	Conformity	EXP_P_MAX_M_2009	120	Warning	Maximum P value above expected range.	ICP_Manual_2016_01_part16.pdf, paragraph 3.3.2.2.3
777	Conformity	EXP_P_MAX_M_2012	120	Warning	Maximum P value above expected range.	ICP_Manual_2016_01_part16.pdf, paragraph 3.3.2.2.3
778	Conformity	EXP_P_MAX_M_2015_G1	120	Warning	Maximum P value above expected range.	ICP_Manual_2016_01_part16.pdf, paragraph 3.3.2.2.3
779	Conformity	EXP_P_MAX_M_2015_G2	120	Warning	Maximum P value above expected range.	ICP_Manual_2016_01_part16.pdf, paragraph 3.3.2.2.3
780	Conformity	EXP_P_MAX_M_2015_G3	120	Warning	Maximum P value above expected range.	ICP_Manual_2016_01_part16.pdf, paragraph 3.3.2.2.3
781	Conformity	EXP_P_MAX_M_2015_G4	120	Warning	Maximum P value above expected range.	ICP_Manual_2016_01_part16.pdf, paragraph 3.3.2.2.3
782	Conformity	EXP_P_MAX_O_2009	125	Warning	Maximum P value above expected range.	ICP_Manual_2016_01_part16.pdf, paragraph 3.3.2.2.3
783	Conformity	EXP_P_MAX_O_2012	125	Warning	Maximum P value above expected range.	ICP_Manual_2016_01_part16.pdf, paragraph 3.3.2.2.3

CHECK			RANGE	SEVERITY	CHECK	RULE_SOURCE
ID	*Step*	*Label*	*Limit*	*Level*	*Message*	*Source*
784	Conformity	EXP_P_MAX_O_2015_G1	125	Warning	Maximum P value above expected range.	ICP_Manual_2016_01_part16.pdf, paragraph 3.3.2.2.3
785	Conformity	EXP_P_MAX_O_2015_G2	125	Warning	Maximum P value above expected range.	ICP_Manual_2016_01_part16.pdf, paragraph 3.3.2.2.3
786	Conformity	EXP_P_MAX_O_2015_G3	125	Warning	Maximum P value above expected range.	ICP_Manual_2016_01_part16.pdf, paragraph 3.3.2.2.3
787	Conformity	EXP_P_MAX_O_2015_G4	125	Warning	Maximum P value above expected range.	ICP_Manual_2016_01_part16.pdf, paragraph 3.3.2.2.3
788	Conformity	EXP_P_MIN_M_2009	12	Warning	Minimum P value below expected range.	http://al-labs-plains.com/soil/2511974
789	Conformity	EXP_P_MIN_M_2012	12	Warning	Minimum P value below expected range.	http://al-labs-plains.com/soil/2511974
790	Conformity	EXP_P_MIN_M_2015_G1	12	Warning	Minimum P value below expected range.	http://al-labs-plains.com/soil/2511974
791	Conformity	EXP_P_MIN_M_2015_G2	12	Warning	Minimum P value below expected range.	http://al-labs-plains.com/soil/2511974
792	Conformity	EXP_P_MIN_M_2015_G3	12	Warning	Minimum P value below expected range.	http://al-labs-plains.com/soil/2511974
793	Conformity	EXP_P_MIN_M_2015_G4	12	Warning	Minimum P value below expected range.	http://al-labs-plains.com/soil/2511974
794	Conformity	EXP_P_MIN_O_2009	15	Warning	Minimum P value below expected range.	http://al-labs-plains.com/soil/2511974
795	Conformity	EXP_P_MIN_O_2012	15	Warning	Minimum P value below expected range.	http://al-labs-plains.com/soil/2511974
796	Conformity	EXP_P_MIN_O_2015_G1	15	Warning	Minimum P value below expected range.	http://al-labs-plains.com/soil/2511974
797	Conformity	EXP_P_MIN_O_2015_G2	15	Warning	Minimum P value below expected range.	http://al-labs-plains.com/soil/2511974
798	Conformity	EXP_P_MIN_O_2015_G3	15	Warning	Minimum P value below expected range.	http://al-labs-plains.com/soil/2511974
799	Conformity	EXP_P_MIN_O_2015_G4	15	Warning	Minimum P value below expected range.	http://al-labs-plains.com/soil/2511974
800	Conformity	LOD_CACO3_MIN_2009	1	Error	Minimum CACO3 value below LOD.	5.8.2.LUCAS_Final_Test_Plan.pdf
801	Conformity	LOD_CACO3_MIN_2012	1	Error	Minimum CACO3 value below LOD.	2009 parameter specifications used.
802	Conformity	LOD_CACO3_MIN_2015_G1	1	Error	Minimum CACO3 value below LOD.	5.8.2.LUCAS_Final_Test_Plan.pdf
803	Conformity	LOD_CACO3_MIN_2015_G2	1	Error	Minimum CACO3 value below LOD.	5.8.2.LUCAS_Final_Test_Plan.pdf
804	Conformity	LOD_CACO3_MIN_2015_G3	1	Error	Minimum CACO3 value below LOD.	5.8.2.LUCAS_Final_Test_Plan.pdf
805	Conformity	LOD_CACO3_MIN_2015_G4	1	Error	Minimum CACO3 value below LOD.	5.8.2.LUCAS_Final_Test_Plan.pdf
806	Conformity	LOD_CEC_MIN_2009	2	Error	Minimum CEC value below LOD.	5.8.2.LUCAS_Final_Test_Plan.pdf
807	Conformity	LOD_CEC_MIN_2012	2	Error	Minimum CEC value below LOD.	2009 parameter specifications used.
808	Conformity	LOD_CEC_MIN_2015_G1	2	Error	Minimum CEC value below LOD.	5.8.2.LUCAS_Final_Test_Plan.pdf
809	Conformity	LOD_CEC_MIN_2015_G2	2	Error	Minimum CEC value below LOD.	5.8.2.LUCAS_Final_Test_Plan.pdf
810	Conformity	LOD_CEC_MIN_2015_G3	2	Error	Minimum CEC value below LOD.	5.8.2.LUCAS_Final_Test_Plan.pdf
811	Conformity	LOD_CEC_MIN_2015_G4	2	Error	Minimum CEC value below LOD.	5.8.2.LUCAS_Final_Test_Plan.pdf
812	Conformity	LOD_K_MIN_2009	10	Error	Minimum K value below LOD.	5.8.2.LUCAS_Final_Test_Plan.pdf
813	Conformity	LOD_K_MIN_2012	10	Error	Minimum K value below LOD.	2009 parameter specifications used.
814	Conformity	LOD_K_MIN_2015_G1	10	Error	Minimum K value below LOD.	5.8.2.LUCAS_Final_Test_Plan.pdf
815	Conformity	LOD_K_MIN_2015_G2	10	Error	Minimum K value below LOD.	5.8.2.LUCAS_Final_Test_Plan.pdf
816	Conformity	LOD_K_MIN_2015_G3	10	Error	Minimum K value below LOD.	5.8.2.LUCAS_Final_Test_Plan.pdf
817	Conformity	LOD_K_MIN_2015_G4	10	Error	Minimum K value below LOD.	5.8.2.LUCAS_Final_Test_Plan.pdf

CHECK			RANGE	SEVERITY	CHECK	RULE_SOURCE
ID	*Step*	*Label*	*Limit*	*Level*	*Message*	*Source*
818	Conformity	LOD_N_MIN_2009	0.2	Error	Minimum N value below LOD.	5.8.2.LUCAS_Final_Test_Plan.pdf
819	Conformity	LOD_N_MIN_2012	0.2	Error	Minimum N value below LOD.	2009 parameter specifications used.
820	Conformity	LOD_N_MIN_2015_G1	0.2	Error	Minimum N value below LOD.	5.8.2.LUCAS_Final_Test_Plan.pdf
821	Conformity	LOD_N_MIN_2015_G2	0.2	Error	Minimum N value below LOD.	5.8.2.LUCAS_Final_Test_Plan.pdf
822	Conformity	LOD_N_MIN_2015_G3	0.2	Error	Minimum N value below LOD.	5.8.2.LUCAS_Final_Test_Plan.pdf
823	Conformity	LOD_N_MIN_2015_G4	0.2	Error	Minimum N value below LOD.	5.8.2.LUCAS_Final_Test_Plan.pdf
824	Conformity	LOD_OC_MIN_2009	2	Error	Minimum OC value below LOD.	5.8.2.LUCAS_Final_Test_Plan.pdf
825	Conformity	LOD_OC_MIN_2012	6	Error	Minimum OC value below LOD.	Derived from data.
826	Conformity	LOD_OC_MIN_2015_G1	2	Error	Minimum OC value below LOD.	5.8.2.LUCAS_Final_Test_Plan.pdf
827	Conformity	LOD_OC_MIN_2015_G2	2	Error	Minimum OC value below LOD.	5.8.2.LUCAS_Final_Test_Plan.pdf
828	Conformity	LOD_OC_MIN_2015_G3	2	Error	Minimum OC value below LOD.	5.8.2.LUCAS_Final_Test_Plan.pdf
829	Conformity	LOD_OC_MIN_2015_G4	2	Error	Minimum OC value below LOD.	5.8.2.LUCAS_Final_Test_Plan.pdf
830	Conformity	LOD_P_MIN_2009	5	Error	Minimum P value below LOD.	5.8.2.LUCAS_Final_Test_Plan.pdf
831	Conformity	LOD_P_MIN_2012	5	Error	Minimum P value below LOD.	2009 parameter specifications used.
832	Conformity	LOD_P_MIN_2015_G1	5	Error	Minimum P value below LOD.	5.8.2.LUCAS_Final_Test_Plan.pdf
833	Conformity	LOD_P_MIN_2015_G2	5	Error	Minimum P value below LOD.	5.8.2.LUCAS_Final_Test_Plan.pdf
834	Conformity	LOD_P_MIN_2015_G3	5	Error	Minimum P value below LOD.	5.8.2.LUCAS_Final_Test_Plan.pdf
835	Conformity	LOD_P_MIN_2015_G4	5	Error	Minimum P value below LOD.	5.8.2.LUCAS_Final_Test_Plan.pdf
836	Conformity	NUM_CACO3_MAX_2009	1000	Error	Maximum CACO3 value above numeric range.	Implicit from paramter type and unit.
837	Conformity	NUM_CACO3_MAX_2012	1000	Error	Maximum CACO3 value above numeric range.	Implicit from paramter type and unit.
838	Conformity	NUM_CACO3_MAX_2015_G1	1000	Error	Maximum CACO3 value above numeric range.	Implicit from paramter type and unit.
839	Conformity	NUM_CACO3_MAX_2015_G2	1000	Error	Maximum CACO3 value above numeric range.	Implicit from paramter type and unit.
840	Conformity	NUM_CACO3_MAX_2015_G3	1000	Error	Maximum CACO3 value above numeric range.	Implicit from paramter type and unit.
841	Conformity	NUM_CACO3_MAX_2015_G4	1000	Error	Maximum CACO3 value above numeric range.	Implicit from paramter type and unit.
842	Conformity	NUM_CACO3_MIN_2009	0	Error	Minimum CACO3 value below numeric range.	Implicit from paramter type and unit.
843	Conformity	NUM_CACO3_MIN_2012	0	Error	Minimum CACO3 value below numeric range.	Implicit from paramter type and unit.
844	Conformity	NUM_CACO3_MIN_2015_G1	0	Error	Minimum CACO3 value below numeric range.	Implicit from paramter type and unit.
845	Conformity	NUM_CACO3_MIN_2015_G2	0	Error	Minimum CACO3 value below numeric range.	Implicit from paramter type and unit.
846	Conformity	NUM_CACO3_MIN_2015_G3	0	Error	Minimum CACO3 value below numeric range.	Implicit from paramter type and unit.
847	Conformity	NUM_CACO3_MIN_2015_G4	0	Error	Minimum CACO3 value below numeric range.	Implicit from paramter type and unit.
848	Conformity	NUM_CEC_MIN_2009	0	Error	Minimum CEC value below numeric range.	Implicit from paramter type and unit.
849	Conformity	NUM_CEC_MIN_2012	0	Error	Minimum CEC value below numeric range.	Implicit from paramter type and unit.

CHECK			RANGE	SEVERITY	CHECK	RULE_SOURCE
ID	*Step*	*Label*	*Limit*	*Level*	*Message*	*Source*
850	Conformity	NUM_CEC_MIN_2015_G1	0	Error	Minimum CEC value below numeric range.	Implicit from paramter type and unit.
851	Conformity	NUM_CEC_MIN_2015_G2	0	Error	Minimum CEC value below numeric range.	Implicit from paramter type and unit.
852	Conformity	NUM_CEC_MIN_2015_G3	0	Error	Minimum CEC value below numeric range.	Implicit from paramter type and unit.
853	Conformity	NUM_CEC_MIN_2015_G4	0	Error	Minimum CEC value below numeric range.	Implicit from paramter type and unit.
854	Conformity	NUM_CF_MAX_2009	100	Error	Maximum CF value above numeric range.	Implicit from paramter type and unit.
855	Conformity	NUM_CF_MAX_2012	100	Error	Maximum CF value above numeric range.	Implicit from paramter type and unit.
856	Conformity	NUM_CF_MAX_2015_G3	100	Error	Maximum CF value above numeric range.	Implicit from paramter type and unit.
857	Conformity	NUM_CF_MIN_2009	0	Error	Minimum CF value below numeric range.	Implicit from paramter type and unit.
858	Conformity	NUM_CF_MIN_2012	0	Error	Minimum CF value below numeric range.	Implicit from paramter type and unit.
859	Conformity	NUM_CF_MIN_2015_G3	0	Error	Minimum CF value below numeric range.	Implicit from paramter type and unit.
860	Conformity	NUM_CLAY_MAX_2009	100	Error	Maximum CLAY value above numeric range.	Implicit from paramter type and unit.
861	Conformity	NUM_CLAY_MAX_2012	100	Error	Maximum CLAY value above numeric range.	Implicit from paramter type and unit.
862	Conformity	NUM_CLAY_MAX_2015_G3	100	Error	Maximum CLAY value above numeric range.	Implicit from paramter type and unit.
863	Conformity	NUM_CLAY_MIN_2009	0	Error	Minimum CLAY value below numeric range.	Implicit from paramter type and unit.
864	Conformity	NUM_CLAY_MIN_2012	0	Error	Minimum CLAY value below numeric range.	Implicit from paramter type and unit.
865	Conformity	NUM_CLAY_MIN_2015_G3	0	Error	Minimum CLAY value below numeric range.	Implicit from paramter type and unit.
866	Conformity	NUM_EC_MIN_2015_G1	0	Error	Minimum EC value below numeric range.	Implicit from paramter type and unit.
867	Conformity	NUM_EC_MIN_2015_G2	0	Error	Minimum EC value below numeric range.	Implicit from paramter type and unit.
868	Conformity	NUM_EC_MIN_2015_G3	0	Error	Minimum EC value below numeric range.	Implicit from paramter type and unit.
869	Conformity	NUM_EC_MIN_2015_G4	0	Error	Minimum EC value below numeric range.	Implicit from paramter type and unit.
870	Conformity	NUM_K_MAX_2009	1000000	Error	Maximum K value above numeric range.	Implicit from paramter type and unit.
871	Conformity	NUM_K_MAX_2012	1000000	Error	Maximum K value above numeric range.	Implicit from paramter type and unit.
872	Conformity	NUM_K_MAX_2015_G1	1000000	Error	Maximum K value above numeric range.	Implicit from paramter type and unit.
873	Conformity	NUM_K_MAX_2015_G2	1000000	Error	Maximum K value above numeric range.	Implicit from paramter type and unit.
874	Conformity	NUM_K_MAX_2015_G3	1000000	Error	Maximum K value above numeric range.	Implicit from paramter type and unit.
875	Conformity	NUM_K_MAX_2015_G4	1000000	Error	Maximum K value above numeric range.	Implicit from paramter type and unit.
876	Conformity	NUM_K_MIN_2009	0	Error	Minimum K value below numeric range.	Implicit from paramter type and unit.
877	Conformity	NUM_K_MIN_2012	0	Error	Minimum K value below numeric range.	Implicit from paramter type and unit.
878	Conformity	NUM_K_MIN_2015_G1	0	Error	Minimum K value below numeric range.	Implicit from paramter type and unit.
879	Conformity	NUM_K_MIN_2015_G2	0	Error	Minimum K value below numeric range.	Implicit from paramter type and unit.
880	Conformity	NUM_K_MIN_2015_G3	0	Error	Minimum K value below numeric range.	Implicit from paramter type and unit.
881	Conformity	NUM_K_MIN_2015_G4	0	Error	Minimum K value below numeric range.	Implicit from paramter type and unit.
882	Conformity	NUM_N_MAX_2009	1000	Error	Maximum N value above numeric range.	Implicit from paramter type and unit.
883	Conformity	NUM_N_MAX_2012	1000	Error	Maximum N value above numeric range.	Implicit from paramter type and unit.
884	Conformity	NUM_N_MAX_2015_G1	1000	Error	Maximum N value above numeric range.	Implicit from paramter type and unit.
885	Conformity	NUM_N_MAX_2015_G2	1000	Error	Maximum N value above numeric range.	Implicit from paramter type and unit.
886	Conformity	NUM_N_MAX_2015_G3	1000	Error	Maximum N value above numeric range.	Implicit from paramter type and unit.
887	Conformity	NUM_N_MAX_2015_G4	1000	Error	Maximum N value above numeric range.	Implicit from paramter type and unit.
888	Conformity	NUM_N_MIN_2009	0	Error	Minimum N value below numeric range.	Implicit from paramter type and unit.
889	Conformity	NUM_N_MIN_2012	0	Error	Minimum N value below numeric range.	Implicit from paramter type and unit.
890	Conformity	NUM_N_MIN_2015_G1	0	Error	Minimum N value below numeric range.	Implicit from paramter type and unit.

CHECK			RANGE	SEVERITY	CHECK	RULE_SOURCE
ID	*Step*	*Label*	*Limit*	*Level*	*Message*	*Source*
891	Conformity	NUM_N_MIN_2015_G2	0	Error	Minimum N value below numeric range.	Implicit from paramter type and unit.
892	Conformity	NUM_N_MIN_2015_G3	0	Error	Minimum N value below numeric range.	Implicit from paramter type and unit.
893	Conformity	NUM_N_MIN_2015_G4	0	Error	Minimum N value below numeric range.	Implicit from paramter type and unit.
894	Conformity	NUM_OC_MAX_2009	1000	Error	Maximum OC value above numeric range.	Implicit from paramter type and unit.
895	Conformity	NUM_OC_MAX_2012	1000	Error	Maximum OC value above numeric range.	Implicit from paramter type and unit.
896	Conformity	NUM_OC_MAX_2015_G1	1000	Error	Maximum OC value above numeric range.	Implicit from paramter type and unit.
897	Conformity	NUM_OC_MAX_2015_G2	1000	Error	Maximum OC value above numeric range.	Implicit from paramter type and unit.
898	Conformity	NUM_OC_MAX_2015_G3	1000	Error	Maximum OC value above numeric range.	Implicit from paramter type and unit.
899	Conformity	NUM_OC_MAX_2015_G4	1000	Error	Maximum OC value above numeric range.	Implicit from paramter type and unit.
900	Conformity	NUM_OC_MIN_2009	0	Error	Minimum OC value below numeric range.	Implicit from paramter type and unit.
901	Conformity	NUM_OC_MIN_2012	0	Error	Minimum OC value below numeric range.	Implicit from paramter type and unit.
902	Conformity	NUM_OC_MIN_2015_G1	0	Error	Minimum OC value below numeric range.	Implicit from paramter type and unit.
903	Conformity	NUM_OC_MIN_2015_G2	0	Error	Minimum OC value below numeric range.	Implicit from paramter type and unit.
904	Conformity	NUM_OC_MIN_2015_G3	0	Error	Minimum OC value below numeric range.	Implicit from paramter type and unit.
905	Conformity	NUM_OC_MIN_2015_G4	0	Error	Minimum OC value below numeric range.	Implicit from paramter type and unit.
906	Conformity	NUM_P_MAX_2009	1000000	Error	Maximum P value above numeric range.	Implicit from paramter type and unit.
907	Conformity	NUM_P_MAX_2012	1000000	Error	Maximum P value above numeric range.	Implicit from paramter type and unit.
908	Conformity	NUM_P_MAX_2015_G1	1000000	Error	Maximum P value above numeric range.	Implicit from paramter type and unit.
909	Conformity	NUM_P_MAX_2015_G2	1000000	Error	Maximum P value above numeric range.	Implicit from paramter type and unit.
910	Conformity	NUM_P_MAX_2015_G3	1000000	Error	Maximum P value above numeric range.	Implicit from paramter type and unit.
911	Conformity	NUM_P_MAX_2015_G4	1000000	Error	Maximum P value above numeric range.	Implicit from paramter type and unit.
912	Conformity	NUM_P_MIN_2009	0	Error	Minimum P value below numeric range.	Implicit from paramter type and unit.
913	Conformity	NUM_P_MIN_2012	0	Error	Minimum P value below numeric range.	Implicit from paramter type and unit.
914	Conformity	NUM_P_MIN_2015_G1	0	Error	Minimum P value below numeric range.	Implicit from paramter type and unit.
915	Conformity	NUM_P_MIN_2015_G2	0	Error	Minimum P value below numeric range.	Implicit from paramter type and unit.
916	Conformity	NUM_P_MIN_2015_G3	0	Error	Minimum P value below numeric range.	Implicit from paramter type and unit.
917	Conformity	NUM_P_MIN_2015_G4	0	Error	Minimum P value below numeric range.	Implicit from paramter type and unit.
918	Conformity	NUM_SAND_MAX_2009	100	Error	Maximum SAND value above numeric range.	Implicit from paramter type and unit.
919	Conformity	NUM_SAND_MAX_2012	100	Error	Maximum SAND value above numeric range.	Implicit from paramter type and unit.
920	Conformity	NUM_SAND_MAX_2015_G3	100	Error	Maximum SAND value above numeric range.	Implicit from paramter type and unit.
921	Conformity	NUM_SAND_MIN_2009	0	Error	Minimum SAND value below numeric range.	Implicit from paramter type and unit.
922	Conformity	NUM_SAND_MIN_2012	0	Error	Minimum SAND value below numeric range.	Implicit from paramter type and unit.
923	Conformity	NUM_SAND_MIN_2015_G3	0	Error	Minimum SAND value below numeric range.	Implicit from paramter type and unit.
924	Conformity	NUM_SILT_MAX_2009	100	Error	Maximum SILT value above numeric range.	Implicit from paramter type and unit.
925	Conformity	NUM_SILT_MAX_2012	100	Error	Maximum SILT value above numeric range.	Implicit from paramter type and unit.
926	Conformity	NUM_SILT_MAX_2015_G3	100	Error	Maximum SILT value above numeric range.	Implicit from paramter type and unit.
927	Conformity	NUM_SILT_MIN_2009	0	Error	Minimum SILT value below numeric range.	Implicit from paramter type and unit.
928	Conformity	NUM_SILT_MIN_2012	0	Error	Minimum SILT value below numeric range.	Implicit from paramter type and unit.
929	Conformity	NUM_SILT_MIN_2015_G3	0	Error	Minimum SILT value below numeric range.	Implicit from paramter type and unit.

CHECK			RANGE	SEVERITY	CHECK	RULE_SOURCE
ID	*Step*	*Label*	*Limit*	*Level*	*Message*	*Source*
930	Conformity	REP_PH_CACL2_MAX_2009	10	Error	Maximum PH_CACL2 value above reporting range.	5.8.2.LUCAS_Final_Test_Plan.pdf
931	Conformity	REP_PH_CACL2_MAX_2012	10	Error	Maximum PH_CACL2 value above reporting range.	5.8.2.LUCAS_Final_Test_Plan.pdf
932	Conformity	REP_PH_CACL2_MAX_2015_G1	10	Error	Maximum PH_CACL2 value above reporting range.	5.8.2.LUCAS_Final_Test_Plan.pdf
933	Conformity	REP_PH_CACL2_MAX_2015_G2	10	Error	Maximum PH_CACL2 value above reporting range.	5.8.2.LUCAS_Final_Test_Plan.pdf
934	Conformity	REP_PH_CACL2_MAX_2015_G3	10	Error	Maximum PH_CACL2 value above reporting range.	5.8.2.LUCAS_Final_Test_Plan.pdf
935	Conformity	REP_PH_CACL2_MAX_2015_G4	10	Error	Maximum PH_CACL2 value above reporting range.	5.8.2.LUCAS_Final_Test_Plan.pdf
936	Conformity	REP_PH_CACL2_MIN_2009	2	Error	Minimum PH_CACL2 value below reporting range.	5.8.2.LUCAS_Final_Test_Plan.pdf
937	Conformity	REP_PH_CACL2_MIN_2012	2	Error	Minimum PH_CACL2 value below reporting range.	5.8.2.LUCAS_Final_Test_Plan.pdf
938	Conformity	REP_PH_CACL2_MIN_2015_G1	2	Error	Minimum PH_CACL2 value below reporting range.	5.8.2.LUCAS_Final_Test_Plan.pdf
939	Conformity	REP_PH_CACL2_MIN_2015_G2	2	Error	Minimum PH_CACL2 value below reporting range.	5.8.2.LUCAS_Final_Test_Plan.pdf
940	Conformity	REP_PH_CACL2_MIN_2015_G3	2	Error	Minimum PH_CACL2 value below reporting range.	5.8.2.LUCAS_Final_Test_Plan.pdf
941	Conformity	REP_PH_CACL2_MIN_2015_G4	2	Error	Minimum PH_CACL2 value below reporting range.	5.8.2.LUCAS_Final_Test_Plan.pdf
942	Conformity	REP_PH_H2O_MAX_2009	10	Error	Maximum PH_H2O value above reporting range.	5.8.2.LUCAS_Final_Test_Plan.pdf
943	Conformity	REP_PH_H2O_MAX_2012	10	Error	Maximum PH_H2O value above reporting range.	5.8.2.LUCAS_Final_Test_Plan.pdf
944	Conformity	REP_PH_H2O_MAX_2015_G1	10	Error	Maximum PH_H2O value above reporting range.	5.8.2.LUCAS_Final_Test_Plan.pdf
945	Conformity	REP_PH_H2O_MAX_2015_G2	10	Error	Maximum PH_H2O value above reporting range.	5.8.2.LUCAS_Final_Test_Plan.pdf
946	Conformity	REP_PH_H2O_MAX_2015_G3	10	Error	Maximum PH_H2O value above reporting range.	5.8.2.LUCAS_Final_Test_Plan.pdf
947	Conformity	REP_PH_H2O_MAX_2015_G4	10	Error	Maximum PH_H2O value above reporting range.	5.8.2.LUCAS_Final_Test_Plan.pdf
948	Conformity	REP_PH_H2O_MIN_2009	2	Error	Minimum PH_H2O value below reporting range.	5.8.2.LUCAS_Final_Test_Plan.pdf
949	Conformity	REP_PH_H2O_MIN_2012	2	Error	Minimum PH_H2O value below reporting range.	5.8.2.LUCAS_Final_Test_Plan.pdf
950	Conformity	REP_PH_H2O_MIN_2015_G1	2	Error	Minimum PH_H2O value below reporting range.	5.8.2.LUCAS_Final_Test_Plan.pdf

CHECK			RANGE	SEVERITY	CHECK	RULE_SOURCE
ID	*Step*	*Label*	*Limit*	*Level*	*Message*	*Source*
951	Conformity	REP_PH_H2O_MIN_2015_G2	2	Error	Minimum PH_H2O value below reporting range.	5.8.2.LUCAS_Final_Test_Plan.pdf
952	Conformity	REP_PH_H2O_MIN_2015_G3	2	Error	Minimum PH_H2O value below reporting range.	5.8.2.LUCAS_Final_Test_Plan.pdf
953	Conformity	REP_PH_H2O_MIN_2015_G4	2	Error	Minimum PH_H2O value below reporting range.	5.8.2.LUCAS_Final_Test_Plan.pdf
954	Conformity	LINK_SOIL_PARENT_2009	COUNT ALL = 0	Warning	DMT Soil Label without correspondence in Laboratory Soil ID data.	Requirement for reference to geograqphic co-ordinates and land cover.
955	Conformity	LINK_SOIL_PARENT_2012	COUNT ALL = 0	Warning	DMT Soil Label without correspondence in Laboratory Soil ID data.	Requirement for reference to geograqphic co-ordinates and land cover.
956	Conformity	LINK_SOIL_PARENT_2015	COUNT ALL = 0	Warning	DMT Soil Label without correspondence in Laboratory Soil ID data.	Requirement for reference to geograqphic co-ordinates and land cover.
957	Conformity	LINK_SOIL_VALID_2009	COUNT ALL <> 1	Error	Ambiguous link between DMT Soil Label and Laboratory Soil ID.	Requirement for reference to geograqphic co-ordinates and land cover.
958	Conformity	LINK_SOIL_VALID_2012	COUNT ALL <> 1	Error	Ambiguous link between DMT Soil Label and Laboratory Soil ID.	Requirement for reference to geograqphic co-ordinates and land cover.
959	Conformity	LINK_SOIL_VALID_2015	COUNT ALL <> 1	Error	Ambiguous link between DMT Soil Label and Laboratory Soil ID.	Requirement for reference to geograqphic co-ordinates and land cover.
960	Conformity	LNIK_SOIL_CHILD_2009	COUNT ALL = 0	Warning	Laboratory Soil ID without correspondence in DMT Soil Label data.	Requirement for reference to geograqphic co-ordinates and land cover.
961	Conformity	LNIK_SOIL_CHILD_2012	COUNT ALL = 0	Warning	Laboratory Soil ID without correspondence in DMT Soil Label data.	Requirement for reference to geograqphic co-ordinates and land cover.
962	Conformity	LNIK_SOIL_CHILD_2015	COUNT ALL = 0	Warning	Laboratory Soil ID without correspondence in DMT Soil Label data.	Requirement for reference to geograqphic co-ordinates and land cover.
963	Conformity	VALID_GPS_EW	GPS_EW	Error	LUCAS DMT: Invalid code for E/W.	LUCAS Survey 2015 Record descriptor of CSV
964	Conformity	VALID_GPS_LAT_MAX	88.9	Error	LUCAS DMT: Invalid maximum x-coordinate of point.	Intrinsic requirement
965	Conformity	VALID_GPS_LAT_MIN	0	Error	LUCAS DMT: Invalid minimum x-coordinate of point.	Intrinsic requirement
966	Conformity	VALID_GPS_LONG_MAX	88.9	Error	LUCAS DMT: Invalid maximum y-coordinate of point.	Intrinsic requirement
967	Conformity	VALID_GPS_LONG_MIN	0	Error	LUCAS DMT: Invalid minimum y-coordinate of point.	Intrinsic requirement
968	Conformity	VALID_NA_GPS_LAT	CODE_NA	Warning	LUCAS DMT: Invalid code for N/A of point latitude.	LUCAS Survey 2015 Record descriptor of CSV
969	Conformity	VALID_NA_GPS_LONG	CODE_NA	Warning	LUCAS DMT: Invalid code for N/A of point longitude.	LUCAS Survey 2015 Record descriptor of CSV
970	Uniformity	CACO3_PH_M_2009	3	Warning	Unexpectedly low CACO3 value for mineral soil with high PH_CACL2.	ICP_Manual_2016_01_part16.pdf, paragraph 3.3.2.2.3
971	Uniformity	CACO3_PH_M_2012	3	Warning	Unexpectedly low CACO3 value for mineral soil with high PH_CACL2.	ICP_Manual_2016_01_part16.pdf, paragraph 3.3.2.2.3

CHECK			RANGE	SEVERITY	CHECK	RULE_SOURCE
ID	*Step*	*Label*	*Limit*	*Level*	*Message*	*Source*
972	Uniformity	CACO3_PH_M_2015_G1	3	Warning	Unexpectedly low CACO3 value for mineral soil with high PH_CACL2.	ICP_Manual_2016_01_part16.pdf, paragraph 3.3.2.2.3
973	Uniformity	CACO3_PH_M_2015_G2	3	Warning	Unexpectedly low CACO3 value for mineral soil with high PH_CACL2.	ICP_Manual_2016_01_part16.pdf, paragraph 3.3.2.2.3
974	Uniformity	CACO3_PH_M_2015_G3	3	Warning	Unexpectedly low CACO3 value for mineral soil with high PH_CACL2.	ICP_Manual_2016_01_part16.pdf, paragraph 3.3.2.2.3
975	Uniformity	CACO3_PH_M_2015_G4	3	Warning	Unexpectedly low CACO3 value for mineral soil with high PH_CACL2.	ICP_Manual_2016_01_part16.pdf, paragraph 3.3.2.2.3
976	Uniformity	CACO3_PH_O_2009	3	Warning	Unexpectedly low CACO3 value for organic soil with high PH_CACL2.	ICP_Manual_2016_01_part16.pdf, paragraph 3.3.2.2.3
977	Uniformity	CACO3_PH_O_2012	3	Warning	Unexpectedly low CACO3 value for organic soil with high PH_CACL2.	ICP_Manual_2016_01_part16.pdf, paragraph 3.3.2.2.3
978	Uniformity	CACO3_PH_O_2015_G1	3	Warning	Unexpectedly low CACO3 value for organic soil with high PH_CACL2.	ICP_Manual_2016_01_part16.pdf, paragraph 3.3.2.2.3
979	Uniformity	CACO3_PH_O_2015_G2	3	Warning	Unexpectedly low CACO3 value for organic soil with high PH_CACL2.	ICP_Manual_2016_01_part16.pdf, paragraph 3.3.2.2.3
980	Uniformity	CACO3_PH_O_2015_G3	3	Warning	Unexpectedly low CACO3 value for organic soil with high PH_CACL2.	ICP_Manual_2016_01_part16.pdf, paragraph 3.3.2.2.3
981	Uniformity	CACO3_PH_O_2015_G4	3	Warning	Unexpectedly low CACO3 value for organic soil with high PH_CACL2.	ICP_Manual_2016_01_part16.pdf, paragraph 3.3.2.2.3
982	Uniformity	CN_RATIO_MAX_M_2009	100	Warning	C/N Ratio unexpectedly high for mineral soil.	List_of_checks_2009_10_21_V2.pdf
983	Uniformity	CN_RATIO_MAX_M_2012	100	Warning	C/N Ratio unexpectedly high for mineral soil.	List_of_checks_2009_10_21_V2.pdf
984	Uniformity	CN_RATIO_MAX_M_2015_G1	100	Warning	C/N Ratio unexpectedly high for mineral soil.	List_of_checks_2009_10_21_V2.pdf
985	Uniformity	CN_RATIO_MAX_M_2015_G2	100	Warning	C/N Ratio unexpectedly high for mineral soil.	List_of_checks_2009_10_21_V2.pdf
986	Uniformity	CN_RATIO_MAX_M_2015_G3	100	Warning	C/N Ratio unexpectedly high for mineral soil.	List_of_checks_2009_10_21_V2.pdf
987	Uniformity	CN_RATIO_MAX_M_2015_G4	100	Warning	C/N Ratio unexpectedly high for mineral soil.	List_of_checks_2009_10_21_V2.pdf
988	Uniformity	CN_RATIO_MAX_O_2009	75	Warning	C/N Ratio unexpectedly high for organic soil.	List_of_checks_2009_10_21_V2.pdf
989	Uniformity	CN_RATIO_MAX_O_2012	75	Warning	C/N Ratio unexpectedly high for organic soil.	List_of_checks_2009_10_21_V2.pdf
990	Uniformity	CN_RATIO_MAX_O_2015_G1	75	Warning	C/N Ratio unexpectedly high for organic soil.	List_of_checks_2009_10_21_V2.pdf
991	Uniformity	CN_RATIO_MAX_O_2015_G2	75	Warning	C/N Ratio unexpectedly high for organic soil.	List_of_checks_2009_10_21_V2.pdf
992	Uniformity	CN_RATIO_MAX_O_2015_G3	75	Warning	C/N Ratio unexpectedly high for organic soil.	List_of_checks_2009_10_21_V2.pdf
993	Uniformity	CN_RATIO_MAX_O_2015_G4	75	Warning	C/N Ratio unexpectedly high for organic soil.	List_of_checks_2009_10_21_V2.pdf
994	Uniformity	CN_RATIO_MIN_M_2009	5	Warning	C/N Ratio unexpectedly low for mineral soil.	List_of_checks_2009_10_21_V2.pdf
995	Uniformity	CN_RATIO_MIN_M_2012	5	Warning	C/N Ratio unexpectedly low for mineral soil.	List_of_checks_2009_10_21_V2.pdf

CHECK			RANGE	SEVERITY	CHECK	RULE_SOURCE
ID	*Step*	*Label*	*Limit*	*Level*	*Message*	*Source*
996	Uniformity	CN_RATIO_MIN_M_2015_G1	5	Warning	C/N Ratio unexpectedly low for mineral soil.	List_of_checks_2009_10_21_V2.pdf
997	Uniformity	CN_RATIO_MIN_M_2015_G2	5	Warning	C/N Ratio unexpectedly low for mineral soil.	List_of_checks_2009_10_21_V2.pdf
998	Uniformity	CN_RATIO_MIN_M_2015_G3	5	Warning	C/N Ratio unexpectedly low for mineral soil.	List_of_checks_2009_10_21_V2.pdf
999	Uniformity	CN_RATIO_MIN_M_2015_G4	5	Warning	C/N Ratio unexpectedly low for mineral soil.	List_of_checks_2009_10_21_V2.pdf
1000	Uniformity	CN_RATIO_MIN_O_2009	3	Warning	C/N Ratio unexpectedly low for organic soil.	List_of_checks_2009_10_21_V2.pdf
1001	Uniformity	CN_RATIO_MIN_O_2012	3	Warning	C/N Ratio unexpectedly low for organic soil.	List_of_checks_2009_10_21_V2.pdf
1002	Uniformity	CN_RATIO_MIN_O_2015_G1	3	Warning	C/N Ratio unexpectedly low for organic soil.	List_of_checks_2009_10_21_V2.pdf
1003	Uniformity	CN_RATIO_MIN_O_2015_G2	3	Warning	C/N Ratio unexpectedly low for organic soil.	List_of_checks_2009_10_21_V2.pdf
1004	Uniformity	CN_RATIO_MIN_O_2015_G3	3	Warning	C/N Ratio unexpectedly low for organic soil.	List_of_checks_2009_10_21_V2.pdf
1005	Uniformity	CN_RATIO_MIN_O_2015_G4	3	Warning	C/N Ratio unexpectedly low for organic soil.	List_of_checks_2009_10_21_V2.pdf
1006	Uniformity	DIST_SOIL_POINT_2009	100	Warning	Distance between 2009 GPS co-ordinates and OBS_DIST exceeds limit.	Manual for Soil Component sampling.
1007	Uniformity	DIST_SOIL_POINT_2012	100	Warning	Distance between 2012 GPS co-ordinates and OBS_DIST exceeds limit.	Manual for Soil Component sampling.
1008	Uniformity	DIST_SOIL_POINT_2015_G1	100	Warning	Distance between 2015 GPS co-ordinates and OBS_DIST exceeds limit.	Manual for Soil Component sampling.
1009	Uniformity	DIST_SOIL_POINT_2015_G2	100	Warning	Distance between 2015 GPS co-ordinates and OBS_DIST exceeds limit.	Manual for Soil Component sampling.
1010	Uniformity	DIST_SOIL_POINT_2015_G3	100	Warning	Distance between 2015 GPS co-ordinates and OBS_DIST exceeds limit.	Manual for Soil Component sampling.
1011	Uniformity	DIST_SOIL_POINT_2015_G4	100	Warning	Distance between 2015 GPS co-ordinates and OBS_DIST exceeds limit.	Manual for Soil Component sampling.
1012	Uniformity	MICRO_COOR_2009	count all = 1	Error	Ambiguous link between 2009 LAB, DMT and Micro data.	Referential integrity.
1013	Uniformity	MICRO_COOR_2012	count all = 1	Error	Ambiguous link between 2012 LAB, DMT and Micro data.	Referential integrity.
1014	Uniformity	MICRO_COOR_2015	count all = 1	Error	Ambiguous link between 2015 LAB, DMT and Micro data.	Referential integrity.
1015	Uniformity	OC_LOD_CACO3_2009	2	Error	OC value below LOD of CACO3.	Implicit rule.
1016	Uniformity	OC_LOD_CACO3_2012	6	Error	OC value below LOD of CACO3.	Implicit rule.
1017	Uniformity	OC_LOD_CACO3_2015_G1	2	Error	OC value below LOD of CACO3.	Implicit rule.
1018	Uniformity	OC_LOD_CACO3_2015_G2	2	Error	OC value below LOD of CACO3.	Implicit rule.

CHECK			RANGE	SEVERITY	CHECK	RULE_SOURCE
ID	*Step*	*Label*	*Limit*	*Level*	*Message*	*Source*
1019	Uniformity	OC_LOD_CACO3_2015_G3	2	Error	OC value below LOD of CACO3.	Implicit rule.
1020	Uniformity	OC_LOD_CACO3_2015_G4	2	Error	OC value below LOD of CACO3.	Implicit rule.
1021	Uniformity	MIN_TO_ORG_2009_2015_G1	15	Warning	Change from mineral soil to organic substrate.	Implicit rule.
1022	Uniformity	MIN_TO_ORG_2009_2015_G2	15	Warning	Change from mineral soil to organic substrate.	Implicit rule.
1023	Uniformity	MIN_TO_ORG_2009_2015_G3	15	Warning	Change from mineral soil to organic substrate.	Implicit rule.
1024	Uniformity	MIN_TO_ORG_2009_2015_G4	15	Warning	Change from mineral soil to organic substrate.	Implicit rule.
1025	Uniformity	ORG_TO_MIN_2009_2015_G1	15	Warning	Change from organic substrate to mineral soil type.	Implicit rule.
1026	Uniformity	ORG_TO_MIN_2009_2015_G2	15	Warning	Change from organic substrate to mineral soil type.	Implicit rule.
1027	Uniformity	ORG_TO_MIN_2009_2015_G3	15	Warning	Change from organic substrate to mineral soil type.	Implicit rule.
1028	Uniformity	ORG_TO_MIN_2009_2015_G4	15	Warning	Change from organic substrate to mineral soil type.	Implicit rule.
1029	Uniformity	PH_CACO3_M_2009	3	Warning	Unexpectedly high CACO3 value for mineral soil with low PH_CACL2.	ICP_Manual_2016_01_part16.pdf, paragraph 3.3.2.2.3
1030	Uniformity	PH_CACO3_M_2012	3	Warning	Unexpectedly high CACO3 value for mineral soil with low PH_CACL2.	ICP_Manual_2016_01_part16.pdf, paragraph 3.3.2.2.3
1031	Uniformity	PH_CACO3_M_2015_G1	3	Warning	Unexpectedly high CACO3 value for mineral soil with low PH_CACL2.	ICP_Manual_2016_01_part16.pdf, paragraph 3.3.2.2.3
1032	Uniformity	PH_CACO3_M_2015_G2	3	Warning	Unexpectedly high CACO3 value for mineral soil with low PH_CACL2.	ICP_Manual_2016_01_part16.pdf, paragraph 3.3.2.2.3
1033	Uniformity	PH_CACO3_M_2015_G3	3	Warning	Unexpectedly high CACO3 value for mineral soil with low PH_CACL2.	ICP_Manual_2016_01_part16.pdf, paragraph 3.3.2.2.3
1034	Uniformity	PH_CACO3_M_2015_G4	3	Warning	Unexpectedly high CACO3 value for mineral soil with low PH_CACL2.	ICP_Manual_2016_01_part16.pdf, paragraph 3.3.2.2.3
1035	Uniformity	PH_CACO3_O_2009	3	Warning	Unexpectedly high CACO3 value for organic soil with low PH_CACL2.	ICP_Manual_2016_01_part16.pdf, paragraph 3.3.2.2.3
1036	Uniformity	PH_CACO3_O_2012	3	Warning	Unexpectedly high CACO3 value for organic soil with low PH_CACL2.	ICP_Manual_2016_01_part16.pdf, paragraph 3.3.2.2.3
1037	Uniformity	PH_CACO3_O_2015_G1	3	Warning	Unexpectedly high CACO3 value for organic soil with low PH_CACL2.	ICP_Manual_2016_01_part16.pdf, paragraph 3.3.2.2.3
1038	Uniformity	PH_CACO3_O_2015_G2	3	Warning	Unexpectedly high CACO3 value for organic soil with low PH_CACL2.	ICP_Manual_2016_01_part16.pdf, paragraph 3.3.2.2.3
1039	Uniformity	PH_CACO3_O_2015_G3	3	Warning	Unexpectedly high CACO3 value for organic soil with low PH_CACL2.	ICP_Manual_2016_01_part16.pdf, paragraph 3.3.2.2.3

CHECK			RANGE	SEVERITY	CHECK	RULE_SOURCE
ID	*Step*	*Label*	*Limit*	*Level*	*Message*	*Source*
1040	Uniformity	PH_CACO3_O_2015_G4	3	Warning	Unexpectedly high CACO3 value for organic soil with low PH_CACL2.	ICP_Manual_2016_01_part16.pdf, paragraph 3.3.2.2.3
1041	Uniformity	PH_DIFF_2009	2.5	Warning	Unexpected difference between PH_CACL2 and PH_H2O.	List_of_checks_2009_10_21_V2.pdf
1042	Uniformity	PH_DIFF_2012	2.5	Warning	Unexpected difference between PH_CACL2 and PH_H2O.	List_of_checks_2009_10_21_V2.pdf
1043	Uniformity	PH_DIFF_2015_G1	2.5	Warning	Unexpected difference between PH_CACL2 and PH_H2O.	List_of_checks_2009_10_21_V2.pdf
1044	Uniformity	PH_DIFF_2015_G2	2.5	Warning	Unexpected difference between PH_CACL2 and PH_H2O.	List_of_checks_2009_10_21_V2.pdf
1045	Uniformity	PH_DIFF_2015_G3	2.5	Warning	Unexpected difference between PH_CACL2 and PH_H2O.	List_of_checks_2009_10_21_V2.pdf
1046	Uniformity	PH_DIFF_2015_G4	2.5	Warning	Unexpected difference between PH_CACL2 and PH_H2O.	List_of_checks_2009_10_21_V2.pdf
1047	Uniformity	CNG_CACO3_2009_2015_G1	20	Warning	Temporal change of CACO3 not within expected range.	List_of_checks_2009_10_21_V2.pdf
1048	Uniformity	CNG_CACO3_2009_2015_G2	20	Warning	Temporal change of CACO3 not within expected range.	List_of_checks_2009_10_21_V2.pdf
1049	Uniformity	CNG_CACO3_2009_2015_G3	20	Warning	Temporal change of CACO3 not within expected range.	List_of_checks_2009_10_21_V2.pdf
1050	Uniformity	CNG_CACO3_2009_2015_G4	20	Warning	Temporal change of CACO3 not within expected range.	List_of_checks_2009_10_21_V2.pdf
1051	Uniformity	CNG_CACO3_2012_2015_G1	20	Warning	Temporal change of CACO3 not within expected range.	List_of_checks_2009_10_21_V2.pdf
1052	Uniformity	CNG_CACO3_2012_2015_G2	20	Warning	Temporal change of CACO3 not within expected range.	List_of_checks_2009_10_21_V2.pdf
1053	Uniformity	CNG_CACO3_2012_2015_G3	20	Warning	Temporal change of CACO3 not within expected range.	List_of_checks_2009_10_21_V2.pdf
1054	Uniformity	CNG_CACO3_2012_2015_G4	20	Warning	Temporal change of CACO3 not within expected range.	List_of_checks_2009_10_21_V2.pdf
1055	Uniformity	CNG_CEC_2009_2015_G1	20	Warning	Temporal change of CEC not within expected range.	List_of_checks_2009_10_21_V2.pdf
1056	Uniformity	CNG_CEC_2009_2015_G2	20	Warning	Temporal change of CEC not within expected range.	List_of_checks_2009_10_21_V2.pdf
1057	Uniformity	CNG_CEC_2009_2015_G3	20	Warning	Temporal change of CEC not within expected range.	List_of_checks_2009_10_21_V2.pdf
1058	Uniformity	CNG_CEC_2009_2015_G4	20	Warning	Temporal change of CEC not within expected range.	List_of_checks_2009_10_21_V2.pdf
1059	Uniformity	CNG_CEC_2012_2015_G2	20	Warning	Temporal change of CEC not within expected range.	List_of_checks_2009_10_21_V2.pdf
1060	Uniformity	CNG_CEC_2012_2015_G3	20	Warning	Temporal change of CEC not within expected range.	List_of_checks_2009_10_21_V2.pdf

CHECK			RANGE	SEVERITY	CHECK	RULE_SOURCE
ID	*Step*	*Label*	*Limit*	*Level*	*Message*	*Source*
1061	Uniformity	CNG_CEC_2012_2015_G4	20	Warning	Temporal change of CEC not within expected range.	List_of_checks_2009_10_21_V2.pdf
1062	Uniformity	CNG_CEC_212_2015_G1	20	Warning	Temporal change of CEC not within expected range.	List_of_checks_2009_10_21_V2.pdf
1063	Uniformity	CNG_CF_2009_2015_G3	10	Warning	Temporal change of CF not within expected range.	C1-Soil-3 (FL)_soil ring test 2009_report 4329_1006.pdf
1064	Uniformity	CNG_CF_2012_2015_G3	10	Warning	Temporal change of CF not within expected range.	List_of_checks_2009_10_21_V2.pdf
1065	Uniformity	CNG_CLAY_2009_2015_G 3	10	Warning	Temporal change of CLAY not within expected range.	C1-Soil-3 (FL)_soil ring test 2009_report 4329_1006.pdf
1066	Uniformity	CNG_CLAY_2012_2015_G 3	10	Warning	Temporal change of CLAY not within expected range.	List_of_checks_2009_10_21_V2.pdf
1067	Uniformity	CNG_K_2009_2015_G1	20	Warning	Temporal change of K not within expected range.	List_of_checks_2009_10_21_V2.pdf
1068	Uniformity	CNG_K_2009_2015_G2	20	Warning	Temporal change of K not within expected range.	List_of_checks_2009_10_21_V2.pdf
1069	Uniformity	CNG_K_2009_2015_G3	20	Warning	Temporal change of K not within expected range.	List_of_checks_2009_10_21_V2.pdf
1070	Uniformity	CNG_K_2009_2015_G4	20	Warning	Temporal change of K not within expected range.	List_of_checks_2009_10_21_V2.pdf
1071	Uniformity	CNG_K_2012_2015_G1	20	Warning	Temporal change of K not within expected range.	List_of_checks_2009_10_21_V2.pdf
1072	Uniformity	CNG_K_2012_2015_G2	20	Warning	Temporal change of K not within expected range.	List_of_checks_2009_10_21_V2.pdf
1073	Uniformity	CNG_K_2012_2015_G3	20	Warning	Temporal change of K not within expected range.	List_of_checks_2009_10_21_V2.pdf
1074	Uniformity	CNG_K_2012_2015_G4	20	Warning	Temporal change of K not within expected range.	List_of_checks_2009_10_21_V2.pdf
1075	Uniformity	CNG_N_2009_2015_G1	20	Warning	Temporal change of N not within expected range.	List_of_checks_2009_10_21_V2.pdf
1076	Uniformity	CNG_N_2009_2015_G2	20	Warning	Temporal change of N not within expected range.	List_of_checks_2009_10_21_V2.pdf
1077	Uniformity	CNG_N_2009_2015_G3	20	Warning	Temporal change of N not within expected range.	List_of_checks_2009_10_21_V2.pdf
1078	Uniformity	CNG_N_2009_2015_G4	20	Warning	Temporal change of N not within expected range.	List_of_checks_2009_10_21_V2.pdf
1079	Uniformity	CNG_N_2012_2015_G1	20	Warning	Temporal change of N not within expected range.	List_of_checks_2009_10_21_V2.pdf
1080	Uniformity	CNG_N_2012_2015_G2	20	Warning	Temporal change of N not within expected range.	List_of_checks_2009_10_21_V2.pdf
1081	Uniformity	CNG_N_2012_2015_G3	20	Warning	Temporal change of N not within expected range.	List_of_checks_2009_10_21_V2.pdf

CHECK			RANGE	SEVERITY	CHECK	RULE_SOURCE
ID	*Step*	*Label*	*Limit*	*Level*	*Message*	*Source*
1082	Uniformity	CNG_N_2012_2015_G4	20	Warning	Temporal change of N not within expected range.	List_of_checks_2009_10_21_V2.pdf
1083	Uniformity	CNG_OC2009_2015_G3	20	Warning	Temporal change of OC not within expected range.	List_of_checks_2009_10_21_V2.pdf
1084	Uniformity	CNG_OC2009_2015_G4	20	Warning	Temporal change of OC not within expected range.	List_of_checks_2009_10_21_V2.pdf
1085	Uniformity	CNG_OC2012_2015_G3	15	Warning	Temporal change of OC not within expected range.	List_of_checks_2009_10_21_V2.pdf
1086	Uniformity	CNG_OC2012_2015_G4	15	Warning	Temporal change of OC not within expected range.	List_of_checks_2009_10_21_V2.pdf
1087	Uniformity	CNG_OC_2009_2015_G1	20	Warning	Temporal change of OC not within expected range.	List_of_checks_2009_10_21_V2.pdf
1088	Uniformity	CNG_OC_2009_2015_G2	20	Warning	Temporal change of OC not within expected range.	List_of_checks_2009_10_21_V2.pdf
1089	Uniformity	CNG_OC_2012_2015_G1	15	Warning	Temporal change of OC not within expected range.	List_of_checks_2009_10_21_V2.pdf
1090	Uniformity	CNG_OC_2012_2015_G2	15	Warning	Temporal change of OC not within expected range.	List_of_checks_2009_10_21_V2.pdf
1091	Uniformity	CNG_PH_CACL2_2009_2015_G1	10	Warning	Temporal change of PH_CACL2 not within expected range.	List_of_checks_2009_10_21_V2.pdf
1092	Uniformity	CNG_PH_CACL2_2009_2015_G2	10	Warning	Temporal change of PH_CACL2 not within expected range.	List_of_checks_2009_10_21_V2.pdf
1093	Uniformity	CNG_PH_CACL2_2009_2015_G3	10	Warning	Temporal change of PH_CACL2 not within expected range.	List_of_checks_2009_10_21_V2.pdf
1094	Uniformity	CNG_PH_CACL2_2009_2015_G4	10	Warning	Temporal change of PH_CACL2 not within expected range.	List_of_checks_2009_10_21_V2.pdf
1095	Uniformity	CNG_PH_CACL2_2012_2015_G1	10	Warning	Temporal change of PH_CACL2 not within expected range.	List_of_checks_2009_10_21_V2.pdf
1096	Uniformity	CNG_PH_CACL2_2012_2015_G2	10	Warning	Temporal change of PH_CACL2 not within expected range.	List_of_checks_2009_10_21_V2.pdf
1097	Uniformity	CNG_PH_CACL2_2012_2015_G3	10	Warning	Temporal change of PH_CACL2 not within expected range.	List_of_checks_2009_10_21_V2.pdf
1098	Uniformity	CNG_PH_CACL2_2012_2015_G4	10	Warning	Temporal change of PH_CACL2 not within expected range.	List_of_checks_2009_10_21_V2.pdf
1099	Uniformity	CNG_PH_H2O_2009_2015_G1	10	Warning	Temporal change of PH_H2O not within expected range.	List_of_checks_2009_10_21_V2.pdf
1100	Uniformity	CNG_PH_H2O_2009_2015_G2	10	Warning	Temporal change of PH_H2O not within expected range.	List_of_checks_2009_10_21_V2.pdf
1101	Uniformity	CNG_PH_H2O_2009_2015_G3	10	Warning	Temporal change of PH_H2O not within expected range.	List_of_checks_2009_10_21_V2.pdf
1102	Uniformity	CNG_PH_H2O_2009_2015_G4	10	Warning	Temporal change of PH_H2O not within expected range.	List_of_checks_2009_10_21_V2.pdf

CHECK			RANGE	SEVERITY	CHECK	RULE_SOURCE
ID	*Step*	*Label*	*Limit*	*Level*	*Message*	*Source*
1103	Uniformity	CNG_PH_H2O_2012_2015_G1	10	Warning	Temporal change of PH_H2O not within expected range.	List_of_checks_2009_10_21_V2.pdf
1104	Uniformity	CNG_PH_H2O_2012_2015_G2	10	Warning	Temporal change of PH_H2O not within expected range.	List_of_checks_2009_10_21_V2.pdf
1105	Uniformity	CNG_PH_H2O_2012_2015_G3	10	Warning	Temporal change of PH_H2O not within expected range.	List_of_checks_2009_10_21_V2.pdf
1106	Uniformity	CNG_PH_H2O_2012_2015_G4	10	Warning	Temporal change of PH_H2O not within expected range.	List_of_checks_2009_10_21_V2.pdf
1107	Uniformity	CNG_P_2009_2015_G1	20	Warning	Temporal change of P not within expected range.	List_of_checks_2009_10_21_V2.pdf
1108	Uniformity	CNG_P_2009_2015_G2	20	Warning	Temporal change of P not within expected range.	List_of_checks_2009_10_21_V2.pdf
1109	Uniformity	CNG_P_2009_2015_G3	20	Warning	Temporal change of P not within expected range.	List_of_checks_2009_10_21_V2.pdf
1110	Uniformity	CNG_P_2009_2015_G4	20	Warning	Temporal change of P not within expected range.	List_of_checks_2009_10_21_V2.pdf
1111	Uniformity	CNG_P_2012_2015_G1	20	Warning	Temporal change of P not within expected range.	List_of_checks_2009_10_21_V2.pdf
1112	Uniformity	CNG_P_2012_2015_G2	20	Warning	Temporal change of P not within expected range.	List_of_checks_2009_10_21_V2.pdf
1113	Uniformity	CNG_P_2012_2015_G3	20	Warning	Temporal change of P not within expected range.	List_of_checks_2009_10_21_V2.pdf
1114	Uniformity	CNG_P_2012_2015_G4	20	Warning	Temporal change of P not within expected range.	List_of_checks_2009_10_21_V2.pdf
1115	Uniformity	CNG_SAND_2009_2015_G3	10	Warning	Temporal change of SAND not within expected range.	List_of_checks_2009_10_21_V2.pdf
1116	Uniformity	CNG_SAND_2012_2015_G3	10	Warning	Temporal change of SAND not within expected range.	List_of_checks_2009_10_21_V2.pdf
1117	Uniformity	CNG_SILT_2009_2015_G3	10	Warning	Temporal change of SILT not within expected range.	List_of_checks_2009_10_21_V2.pdf
1118	Uniformity	CNG_SILT_2012_2015_G3	10	Warning	Temporal change of SILT not within expected range.	List_of_checks_2009_10_21_V2.pdf

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