



## **Market consultation**

**Relating to the pending call for tenders**

**“Renovation Measurement Information System KNMI ,  
RIVM and RWS”**

**by**

**Royal Netherlands Meteorological Institute (KNMI)  
National Institute for Public Health and the Environment (RIVM)  
Rijkswaterstaat (RWS)**

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## **1 Introduction**

### **1.1 Cause**

This market consultation takes place in preparation of the pending call for tenders, "Renovation Measurement Information System KNMI, RIVM and RWS". The Royal Netherlands Meteorological Institute (KNMI), the National Institute for Public Health and the Environment (RIVM) and Rijkswaterstaat (RWS) (jointly referred to below as: the Client), which hold the opinion of market parties in high regard, would like to see them actively involved at an early stage before the pending call for tenders is announced.

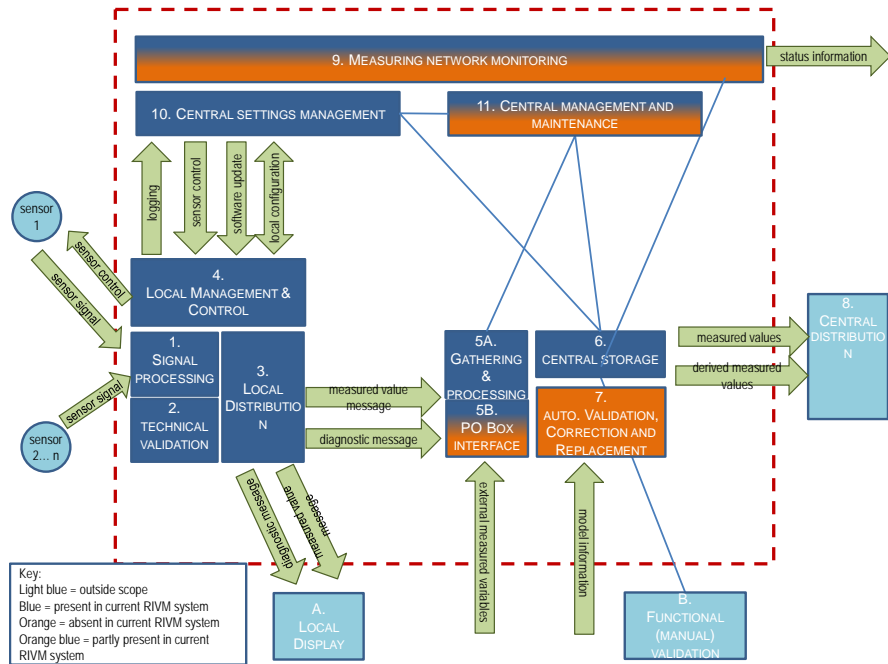
To provide continued guarantees and to improve the continuity of data deliveries, RWS plans to replace its "wet" measuring network, the national water-measuring network (Landelijk Meetnet Water - LMW). In the foreseeable future, the Royal Netherlands Meteorological Institute (KNMI) will also have to replace several building blocks of their measuring network, known as METNET. KNMI's meteorological measuring network also includes the measuring networks at civilian airports and military air bases. Recently, the National Institute for Public Health and the Environment (RIVM) commissioned the development of a new system for the measurement of national air quality (Landelijk Meetnet Luchtkwaliteit – LML).

RIVM, KNMI and RWS cooperate in the National Environmental Observation Centre (Nationaal Waarnemings Centrum Leefomgeving - NWCL). The NWCL decided to jointly develop generic building blocks that can be used for the measuring networks of each of the three partners. Besides the building blocks to be implemented at the measuring site itself, it also involves those to be used at central computer facilities. Based on these common building blocks, each organisation will renovate its own measuring network.

### **1.2 System contours**

The following functionalities are relevant for those common building blocks.

Figure 1. Measurement Information System Functions



Numbers 1 - 4 make up the local system: the local measuring computers that will be installed in the field. Numbers 5 - 11 comprise the central systems that will be installed at a central site at KNMI, RIVM and RWS. KNMI will also install (smaller) central systems at the airports. The red dotted line represents the perimeter of the common system. A further explanation of the above diagram can be found in Appendix 1. System contours.

Data communication between the local measuring computer and the central system is arranged using an IP connection via for instance LAN, ADSL or GPRS. The measuring network includes a limited number of measuring sites where no regular power supply or data communication link is available. Based on the number of measuring sites and the measured values of each site, the following numbers of measured values can be expected:

- RIVM: approx. 150,000 measured values per hour;
- RWS: approx. 180,000 measured values per hour;
- KNMI: approx. 2,500,000 per hour.

KNMI also has measuring networks at the airports, where timeliness requirements are extremely high. At Schiphol -the largest airport- some 200 measured values are registered over a period of 12 seconds and displayed on a screen in the central system 1 second later. Schiphol is equipped with a reliable high-speed LAN link between the measuring site and the central system. The availability requirements at the airports are also high. The maximum permissible downtime per year at Schiphol is 15 minutes. Within the RWS measuring network a limited number of sites provide data (every 1 and 10 minutes) for mission critical processes like the Maaslandtkering. High availability requirements apply here too.

The Client demands a properly integrated and modular solution that allows replacement of the functionalities (i.e. the boxes in Figure 1) at a later stage by a different product, possibly from a different supplier. It must also be possible to modify or add measuring modules without any risk of disturbing other measuring modules or the performance of the measuring chain as a whole.

KNMI, RIVM and RWS intend to use the current RIVM customised system as the basis for realising the common building blocks. In Figure 1 above, the blue blocks describe the functionality that is available within the current RIVM customised system. Some modifications will be necessary before it satisfies the requirements of all three partners. In addition, with regard to the functionalities within the local measuring computer, some 45 measuring modules must be developed for controlling the specific functionalities of the measuring instruments. The measuring computer must be able to function with existing instruments. About 15 measuring modules are already operational for RIVM. The local measuring computer consists of a framework that is identical for all types of measuring instruments, complemented with measuring modules for each type of measuring instrument. These measuring modules arrange the specific signal processing, technical validation and control of the measuring instruments.

The current customised system, which is written in C#.NET, uses an Oracle database. The local measuring computers that currently run on Windows XP Embedded will have to be upgraded.

The current customised system now uses rsync files to synchronise the local measuring computer with the central system. While this is satisfactory for RIVM, it is not adequate for the high timeliness requirements described above.

### **1.3 Quality of current RIVM customised system**

An independent party investigated the quality of the current RIVM customised system. The main conclusions from that investigation were as follows.

1. The local system is fit for reuse.
2. The system will have to be adapted for processing the vast data quantities necessary within the required period of time.
3. The new requirements in the field of performance and scalability will not be met without fundamental modifications.
4. The current data exchange speed between the local system and the central system is inadequate for the new partners (KNMI and RWS).
5. The current GUI is not easily customisable.
6. The system documentation is moderate to inadequate.
7. All system elements score just below the market average in the field of maintainability. The scores are between 2.7 and 2.8 under the SIG/TÚViT Evaluation Criteria<sup>1</sup>.

It has been remarked that reuse of the existing conceptual data model can be useful. This is not necessarily true for the technical implementation of that data model.

### **1.4 Preferred scenario**

Based on the investigation results described in the previous section and the various project preconditions, a preferred scenario has been drafted. In the call for

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<sup>1</sup>Refer to the description at <http://www.sig.eu/nl/diensten/Software%20Product%20Certificering/Evaluation%20Criteria/>

tenders, the Client is considering a stipulation that the basis of the current RIVM customised system should be reused. That basis is defined as follows.

- The software on the local measuring computer (function 1 - 4 in Figure 1). In this connection, the framework should preferably be reused -after the required customisation- so that also the current operational measuring modules will continue to function on the framework with minimum - preferably zero- modifications.
- The functionality of the interfaces between local measuring computers and the central system. Technical implementation is not prescribed.
- The conceptual data model of the central storage (function 6 in Figure 1). The underlying technical database structure can be used, but is not prescribed.

The other functions are not part of the basis. User interfaces, with modifications defined by the Client, are stipulated. The software of the current RIVM system may be reused, with the necessary modifications, but that is not mandatory.

### **1.5 Purpose of the market consultation**

The Client published this market consultation document on TenderNed to reach as many market parties as possible, to arouse their interest and to encourage their contributions.

With this market consultation, the Client aims to:

- a) gain insight into the realistic feasibility of the project and the preconditions under which the project can be contracted out;
- b) gather input for the tendering strategy and the tender documents (to gain new and to test existing ideas);
- c) involve the market in the project at an early stage to fully align the tender documents with the market situation.

The Client emphasises that this market consultation is not part of the call for tenders and that no rights can be derived from it. The Client will use insights gained from the market consultation -where relevant- in preparing the call for tenders and the tender documents. The Client reserves the right not to use these insights at all or only partly.

### **1.6 Outline approach of the market consultation**

The market consultation is set up as follows. A round of written questions and answers will be held with all parties that have signed up and want to contribute. Based on the responses received, the Client will keep the option open to invite parties to personally explain their views. Section 2 provides a detailed description of the procedure and the approach of the market consultation.

## 2 Market consultation process

### 2.1 Procedure

#### 2.1.1 Schedule

The Client will observe the timetable shown below.

Activity	Date and time
Publishing Market Consultation Document on TenderNed	Tue 1 April 2014
Final date for asking questions regarding the Market Consultation Document	Tue 8 April 2014
Publishing Information Notice	Fri 11 April 2014
Final date for submitting answers in a written response to the questionnaire	Fri 25 April 2014
Individual invitations to various market parties for a personal explanation	Mon 12 May - Fri 16 May 2014
Publication report on TenderNed	Fri 23 May 2014

Interested parties cannot derive any rights from the above timetable. The Client reserves the right to modify the programme. Consequently, although the above agenda is indicative, every effort will be made to adhere to this timetable.

#### 2.1.2 Questions about the Market Consultation Document

Market parties will have the opportunity to ask questions about unclear language in the Market Consultation Document, to ensure transparent and unambiguous communication. Questions concerning the Market Consultation Document can be sent by email to: [inkoopcentrum-iv@rws.nl](mailto:inkoopcentrum-iv@rws.nl) before the "Ultimate date for asking questions about the Market Consultation Document" referred to in section 2.1.1. The Client will respond to (anonymous) questions from market parties in an Information Notice to be published on TenderNed.

#### 2.1.3 Submitting responses to the questionnaire

All interested market parties that wish to contribute to the market consultation are requested to submit their responses to the questionnaire in Section 3 of this Market Consultation Document by email to: [inkoopcentrum-iv@rws.nl](mailto:inkoopcentrum-iv@rws.nl) before the "Final date for submitting written responses to the questionnaire" referred to in Section 2.1.1.

The responses should be written in Dutch or in English.

#### 2.1.4 Personal explanation to the questionnaire

Based on the written responses received, the Client will keep open the option of inviting individual parties to personally explain their views. The Client will contact each of these parties and schedule a part of a day in mutual consultation, as referred to in Section 2.1.1. These meetings will take place at the Client's offices.

#### 2.1.5 Completing the market consultation and feedback results

Completion of the market consultation will take place on the date referred to in section 2.1.1. The report will be written in Dutch.

In the tender documents, the Client will clearly describe how the original ideas and/or questions have been adjusted or detailed in response to the market consultation and will include the outline conclusions in those documents.

## **2.2 Confidentiality**

The Client will treat the input from participating market parties as confidential. The Client will only make this information available to employees and consultants who are directly involved in the market consultation and/or the call for tenders, unless the Client has an obligation for further publication under legal regulations. The Client shall have the right to use information supplied for the purpose of drawing up the tender documents. The Client will not include any specific references to participants or any commercially sensitive information in the tender documents.

## **2.3 Other provisions with regard to the market consultation**

The market consultation is not part of the call for tenders. To avoid putting participants in the market consultation in a privileged position, the Client will publish the results of the market consultation in the tender documents. In addition, all information shared by the Client during the market consultation will be part of the tender documents.

In the call for tenders, no distinction will be made between parties that did or did not participate in the market consultation.

Information in this market consultation could deviate from the information supplied at a later stage (in the framework of a call for tenders or other procurement process). No rights may be derived from information supplied in the framework of the market consultation. The information is indicative and purely intended to increase the quality of the market consultation. If this information is inconsistent with the information supplied later -in the framework of call for tender or other procurement process- the latter will prevail.

The Client will not award any indemnification to participants of the market consultation.

### 3 Questions

In general, The Client would like to know the following.

- 1) The Client intends to use the existing RIVM customised system described in section 1.4 for the new measurement information system.
  - a) On this basis, indicate if and how you could develop an operational solution from the components described in the new system outline.
  - b) Explain what in your view would be the best solution for the building blocks described outside this basis and explain why. Completely custom-made, off-the-shelf solutions or a combination of both?
  - c) Which functionalities from Figure 1 would you advise us to combine in the eventual call for tenders and why?
  - d) Explain which services you can provide with regard to the functionalities to be delivered.
- 2) In the current customised system, all measured values are still recorded in one physical database table. What kind of measures would you recommend to ensure full compliance with the timeliness and processing capacities indicated in the preconditions?
- 3) At airports, in particular, the availability requirements are extremely high. What kind of measures would you recommend to be able to comply with the availability requirements described?
- 4) Could you possibly present us with a better alternative that does not comply with the precondition of using the basis of the current customised system? Explain why you think that this would be a more suitable solution in view of our objectives. In that case, we would also like to know how you plan to handle the measuring modules for the measuring instruments to be acquired for KNMI and RWS and already in use at RIVM.
- 5) Which project elements would you recommend combining in a single package for the call for tenders and why?
  - a) with regard to realisation, implementation and management after commissioning;
  - b) with regard to the software and local hardware at the measuring site.
- 6) The degree of detailing in the specifications varies per element. For instance, for signal processing and technical validation for a specific measuring instrument, in many instances highly detailed descriptions are available while the description of user interfaces is concise. What project approach would you recommend on this basis?
- 7) The Client is contemplating marketing the order on a fixed-price basis. What major risks do you envisage? How do you think those risks could be mitigated?
- 8) What is the best way for warranting life-cycle management in the contract for realisation of the system and the required services in the management and maintenance stage?
- 9) During the realisation, test and management stages, the Client would like to minimise the integration and interface risks. That also applies to this project, as to integration of the new building blocks into the existing environments of KNMI, RIVM and RWS.
  - a) Explain what measures should be taken to minimise this risk?
  - b) What other risks do you anticipate?

- 10) Our objective is to finish the project completely within 3 years and to connect the first operational measuring site before the end of 2014. Do you consider this a realistic schedule and, if so, under what preconditions?
- 11) Do you have any other ideas, suggestions or remarks or do you anticipate any other risks or challenges for RWS, KNMI and RIVM with regard to the upcoming call for tenders?
- 12) What would be the reasons for you to decide whether to participate in the tendering procedure?

## **Appendix 1. System contours**

The functions from Figure 1 are detailed below.

### *Measuring instrument/sensor*

The measuring instrument is the device that sends signals to the local measuring computer. The measuring instrument is outside the scope of IMI because KNMI, RIVM and RWS each perform completely different types of measurements and, consequently, use different sensors. Signal processing does fall within the scope of IMI.

### *Signal processing (1)*

Measuring instruments are linked to the local measuring computer. The software in that measuring computer ensures that the signal or message from the measuring instrument is converted into a readable, measured value. There is a direct cable link between measuring instrument and signal processing. The various measuring instruments use protocols such as analogue, serial including RS232/RS422/RS485, and http and several formats. That processing may include a number of steps.

- Conversion from analogue to digital.
- Extraction of the measured value(s) from the sensor signal.
- Validation whether a technically correct signal is received from the sensor. That may also be a check whether the signal is within certain limits.
- Processing of sensor signals for a number of rapidly successive moments in time into an average measured value and/or extremes (or more complex operations).
- Grouping of different types of sensor signals into a single message (such as wind speed and direction).
- Processing any diagnostic data from the measuring instrument into a diagnostic message.
- Adding metadata such as identification of the measuring site, the measuring instruments and the moment of measuring.

### *Technical validation (2)*

Initial validation already takes place when processing the signal or central message. If that is approved, further validation may take place. That will mainly involve situations in which the signal or message is not incorrect, but possibly questionable on the basis of the circumstances, for instance shortly after calibration, if there is a warning from one of the sensors, during maintenance on a nearby sensor, etc. A measured value may also be questionable because it lies outside the expected range or deviates too much from the previous measuring values or, conversely, does not show any variation. In such cases a validation code is linked to the measured value message on the basis of diagnostic sensor data. Derived measured values may also be determined.

### *Local distribution (3)*

The measured value message and any diagnostic messages receive a timestamp and site identification. Subsequently, the message is made available for distribution to central processing and/or local presentation and/or external client. Diagnostic messages provide information on the measuring instrument itself or the environment in which it performs. In current practice, measured value messages are combined with diagnostic messages.

Local distribution also has facilities to prevent loss of data if the connection with central processing is temporarily lost. In some cases, local distribution also has an alternative data communication link with central processing.

#### *Local management & control (4)*

Local management is a functionality that can be instructed to implement modifications in software, firmware or configuration at that site. Configuration in this case involves both "technical" configuration for correct processing of sensor signals and "functional" configuration that controls for instance the number of measurements per unit of time. In addition, it is necessary to be able to remotely restart any components at that site. Components here are defined as either the computer that processes the data and the sensors themselves, or any components between them. If the sensor type permits it, it must also be possible to relay commands to the sensors, for instance for calibration. It must be possible to control this functionality from central settings management. However, this functionality must also be accessible on site. Locally performed modifications to the configuration must be synchronised with central settings management.

#### *Gathering and processing (5A)*

Gathering and processing ensures that all measured value messages and diagnostic messages are collected at a central site and made available for further processing.

#### *PO Box interface (5B)*

The PO Box interface is used to collect external data. That may be data from neighbouring countries or data from other institutes that carry out measurements in the same or comparable fields. Otherwise, these data are processed in the same manner as the regular measured values.

#### *Central storage g (6)*

Central data storage ensures the preservation of all data, both the original measured values and derived values, including the connected metadata and any diagnostic information. Only temporary data may be removed after a certain period of time. Central storage here covers both the operational data and the archives. Data in central storage may differ as to topicality and quality. A certain measured variable may also be present in several instances, each with different topicality and quality.

#### *Automatic validation, correction and replacement (7)*

This function arranges further data validation, in particular validations that require data from other measuring sites or external sources. There are organisation-specific rules for the manner in which validation must take place. It must be possible to configure these rules.

Various types can be distinguished.

- Determining the validation status (approved, rejected or questionable) of a measured value.
- Correction of measured values, for instance through application of specific correction factors.
- Automatic replacement of measured values by alternative values that, consequently, must be available. Rules for replacement are organisation-specific, so they must be configurable.
- Automatic addition of measured values (interpolation, extrapolation, etc.) if measured values are failing.

- Automatic replacement of rejected measured values. This process is identical to that of adding failing values.
- Determining derived measured values (e.g. salinity, draining and pumping flow rates etc.) that require data from various sites.

That may be done by combining data from a measuring site with those from other measuring sites or with data from external sources. Under certain circumstances, measured values may also be replaced by projections from models. In addition, specific correction factors may apply to certain measured values. Models for projected values have an important role in the validation of measured values as well as in possible replacement of failing measured values. In this function, certain operations may also take place, such as determining derived measured values. As with signal validation, these calculations and corrections are performed automatically, without human interaction.

#### *Central distribution (8)*

Distribution ensures that measured values, including the connected metadata, are made available to authorised parties. Contents and format of these data vary widely. It involves current information that is supplied automatically or on request, as well as historical data. The information includes the measured values and derived variables, the connected diagnostic information and metadata of the measuring site, sensor and derived values. Central distribution is of vital importance within the total measuring network infrastructure, but remains outside the scope of IMI. IMI is only going to offer the interface to which the organisation-specific distribution function can be linked.

#### *Measuring network monitoring (9)*

Measuring network monitoring ensures a continuously up-to-date overview of the performance of the chain from sensor to distribution, both technically and as to contents. Overviews are available on the performance of the sensors, of data communication, access to distributed data etc. In addition, the data quality is monitored continuously. Data quality refers to the lack of measured values (that is whether the required number of measurements per unit time is realised) as well as to the data quality (on the basis of numbers of approved and rejected measured values). Monitoring takes place on the basis of current information as well as overviews, while warnings and alarms can be set at various levels.

#### *Central settings management (10)*

Central settings management records all settings for every local measuring computer. Settings management also covers the derived variables, the algorithms used and diagnostic data used locally in signal processing, technical validation and local distribution. Central settings management also offers the functionality to call the function "Local Management and Control" from the central system. That makes it possible to carry out software updates for one or several measuring sites simultaneously and to modify configurations. In addition, commands can be sent to the local measuring computer, for instance for calibrating sensors.

#### *Central management and maintenance (11)*

Central management and maintenance records all configuration items of the measuring network. That means it also registers which sensors were when at what sites, when maintenance was carried out, what malfunctions occurred and were solved, etc. Site information is also recorded, such as the measuring objective and relevant environment conditions.

*Local display and control (A)*

In some cases the measured values from local processing are directly used for display or to control a different device. Basically, the data used are identical to data used in central gathering and processing, optionally with a specific selection. Similarly, the measured values can also be consulted at on-site maintenance.

*Functional validation (B)*

In a variety of ways, functional validation must check the correctness/probability of certain measured values. In this respect, it must be possible to use models. The end user must have the possibility of modifying these models. Over time, this validation may sometimes take place several months after the measuring moment. Functional validation may also take place in (almost) real-time -at airports where a local observer or central meteorologist must be able to (almost) real-time complement and/or modify or reject specific observations and messages. In addition, it must be possible to temporarily interrupt the distribution/use of the measured values from an evidently faulty sensor.

*Data flows*

The data flows are presented in the diagram with green arrows. They are defined further below.

<b>Sensor signal</b>	The raw, digital or analogue, signals from the measuring instrument. That may be either a signal with measured values or diagnostic signal.
<b>Sensor control</b>	A signal to the measuring instrument to carry out a certain action, for instance a calibration or reset or the like.
<b>Measured value message</b>	In this message, the sensor signal has been converted into the standard format that can be handled by gathering and processing. The message comes with the relevant metadata, such as moment in time and identification of the measuring site and sensor. In many cases there are several variables in one message, for instance 1- and 10-minute average, maximum over the last 10 minutes, etc.
<b>Diagnostic message</b>	Any applicable diagnostic codes are attached to this message. The message comes with the same metadata as the measured value message. In current practice, diagnostic messages are added to the measured value message.
<b>External measured variables</b>	From a functional point of view, external measured variables are measured values from a different source. In addition to the required metadata, they also include information about the source.
<b>Model information</b>	Model information provides projected values on the basis of earlier measurements for certain sites and certain moments in time. This information is used for validation as well as for complementing failing measured values, where necessary.

<b>Software update</b>	This may involve updates for the software on the local computer as well as firmware updates for sensors or other components on site.
<b>Local configuration</b>	These are all settings for sensors or other components on-site that are used by the software or firmware present there.
<b>Logs</b>	This is the logging information of the local IMI application. It can be used for analysis and monitoring purposes.
<b>Measured values / derived measured values</b>	These are values converted on the basis of sensor signals for specific variables. That may also be derived measured values. Measured values may be validated to a higher or lesser degree. Some customers can only see the locally validated measured values.
<b>Status information</b>	This is information from measuring network monitoring about the measuring network performance. This information may be used in an umbrella monitoring system that is in use within the organisation.