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System for the collection, transmission and evaluation of data to identify specific and total F-Gas emissions from stationary refrigeration

and air conditioning equipment and heat pumps in terms of Art. 3 of the Regulation (EG) No 842/2006

Summary

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System for the collection, transmission and evaluation of data to identify specific and total F-Gas emissions from stationary refrigeration and air conditioning equipment and heat pumps in terms of Art. 3 of the Regulation (EG) No 842/2006

Summary

by

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UMWELTBUNDESAMT

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1 Background and Objectives

Regulation (EC) No 842/2006 of the European Parliament and the Council on certain fluorinated greenhouse gases[1] (in the following text referred to as EU F-Gas Regulation) came into force on 4 July 2006. The Regulation regulates the reduction of certain fluorinated greenhouse gas emissions, the use, recovery and destruction of certain fluorinated greenhouse gases as well as the labeling and the destruction of products and equipment that contain these gases.

The German Ordinance on climate protection against changes caused by the release of certain fluorinated greenhouse gases (Chemikalien-Klimaschutzverordnung – ChemKlimaschutzV)[2], which entered into force on on 1 August 2008, sets additional complementary and concretizing provisions in the area of the EU F-Gas Regulation at a national level. In the German ChemKlimaschutzV additional requirements are taken with regard to

- Leakage of stationary equipment (limit values regarding specific loss of refrigerant from stationary equipment during the normal operating phase),
- Provisions for take back and recovery
- Maintenance of records related to the recovery and destruction of F-Gases.

In the F-Gas Regulation as well as in the German ChemKlimaschutzV, requirements regarding the maintenance of records are defined for operators of stationary refrigeration, air conditioning and heat pump equipment, containing 3 kg or more of fluorinated greenhouse gases. Records include inter alia the quantity and type of F-Gases installed.

These records, which are maintained by the operators, shall be made available to the competent authority and to the Commission on request. There is no obligation to report to the competent authority.

The Federal States are responsible for the enforcement of the EU-F-Gas Regulation and the German ChemKlimaschutzV. A systematic control and evaluation of the records has not been executed so far.

The information obtained in the records, however, is essential in order to control and evaluate the effectiveness of the legal measures.

Specific data on existing stationary refrigeration, air conditioning and heat pump applications in Germany, containing 3 kg or more of fluorinated greenhouse gases, are currently not available. However, it is estimated that several 100,000 cooling circuits are installed. In consideration of this large quantity of applications the evaluation of all records would be very time-consuming and is therefore not feasible in the current form.

Against this background the project aims to identify already existing systems for the collection, transmission and evaluation of data regarding relevant refrigerants as well as other sources and to evaluate them whether they are adequate to get the desired data. Furthermore existing or planned

[1] Regulation (EC) No 842/2006 of the European Parliament and of the Council of 17 May 2006 on certain fluorinated greenhouse gases, OJ L 161 of 14 June 2006, last change by Regulation (EC) No 1137/2008 of the European Parliament and of the Council of 22 October 2008, OJ L 311 p. 1.

[2] Chemikalien-Klimaschutzverordnung of 2 July 2008 (Federal Law Gazette I p. 1139).

systems to collect and transmit data related to other reporting duties are evaluated with respect to their suitability for being assigned in the area of F-Gases.

Based on this information an adequate system should be developed which enables an overview on F-Gas emissions in the field of stationary refrigeration, air conditioning and heat pump equipment. If possible, the system should also enable the traceability of F-Gases from the producer to the destruction or reclamation facility. Moreover, the effort for both, the industry and the authorities should be as low as possible.

2 Data Requirements to the system

In a first step essential data for the system have been identified. With regard to the goals of the project the system for monitoring of refrigerant data should fulfil the following minimum requirements:

- Monitoring of the total refrigerant emissions in the area of stationary refrigeration and air conditioning equipment and heat pumps
- Monitoring of the specific refrigerant losses of stationary refrigeration and air conditioning equipment and heat pumps

Furthermore it would be desirable that the system allows the traceability of the refrigerants used in the sector of stationary refrigeration and air conditioning equipment and heat pumps from the production of the refrigerant to their final destruction. With regard to traceability two approaches are considered:

- Monitoring of the total amounts of refrigerants in the material flow for refrigeration and air conditioning equipment and heat pumps, consisting of the following mass flows:
  1. Annual amount of refrigerants newly fed into the sector of stationary refrigeration and air conditioning equipment and heat pumps
  2. Annually emitted amount of refrigerants
  3. Annual amount of destroyed or reclaimed refrigerants
- Traceability of single refrigerant movements from the producer to the destruction or reclamation company
  Within this approach each single refrigerant movement is monitored and documented.

The following Figure 1 illustrates the two material flow based approaches

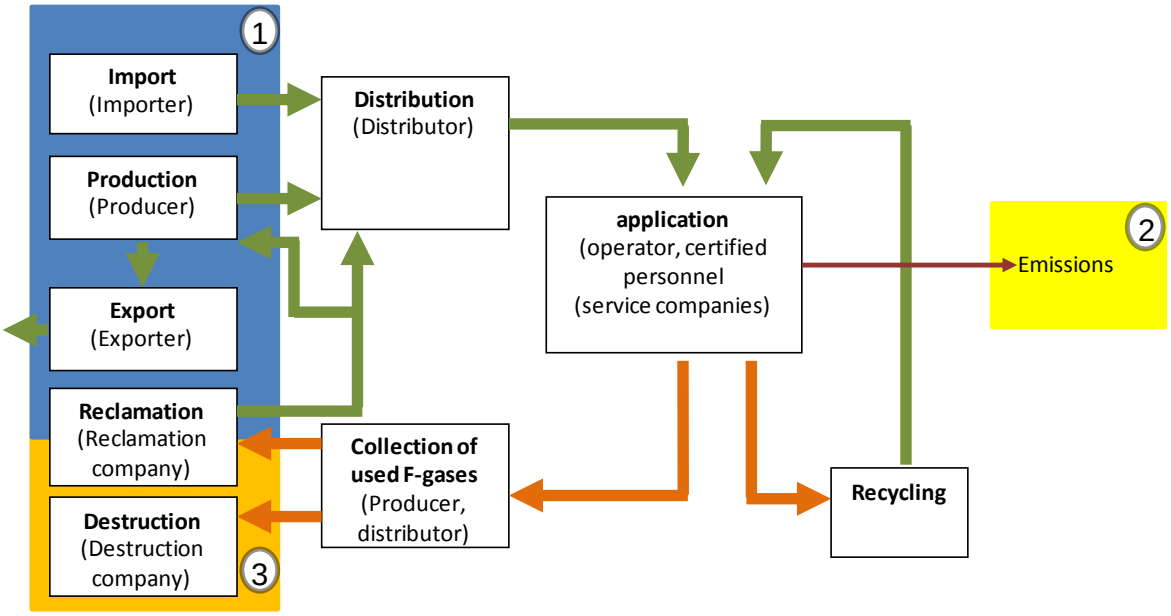

Figure 1: Material flow of refrigerants: Monitoring of total amounts of refrigerants (areas 1, 2 and 3) and traceability of particular refrigerant movements

Depending on the requirements the system should fulfil, specific data have to be gathered from the actors involved. For the monitoring of the total refrigerant emissions the primary filling quantities, the re-filled quantities and the reclaimed amounts are essential. According to the F-Gas Regulation, these data have to be recorded by the operator.

The following Table 1 shows an overview on the specific data to be collected depending on the requirements the system has to fulfil. Furthermore it is indicated whether these data are already covered by recording or reporting obligations resulting from the EU F-Gas Regulation or the ChemKlimaschutzV, and by whom.

Data requirements to the system	Which data are required? [3]	In which legislation are these data already comprised, and by whom?	Reporting obligation / Recording obligation
General information [4]	Type of refrigerant	EU F-Gas Regulation Operators, producers, importers, exporters	Recording
	Type of equipment (refrigeration, air conditioning, heat pump)		/
Total refrigerant emissions	Primary filling quantity (of refrigerant at first operation)	EU F-Gas Regulation Operators	Recording

[3] Data in each case refer to one year.

[4] General information was only recorded for reasons of completeness. In principle all information gathered should be recorded differentiated according to types of refrigerant and equipment.

Data requirements to the system	Which data are required? [3]	In which legislation are these data already comprised, and by whom?	Reporting obligation / Recording obligation
	Total quantity of refrigerants re-filled (independent on the reason for re-filling)	EU F-Gas Regulation (any possible quantities re-filled) Operators	Recording
	Quantity recovered for destruction or reclamation	EU F-Gas Regulation (Service, maintenance and final destruction of quantities recovered) Operators	Recording
Specific refrigerant losses	Primary filling quantity (of refrigerant at first operation)	EU F-Gas Regulation Operators	Recording
	Quantity of refrigerants refilled (except damage)	EU F-Gas Regulation (any possible quantities re-filled) Operators	Recording[1]
	Quantity of refrigerants refilled due to damage	EU F-Gas Regulation (any possible quantities re-filled) Operators	Recording[1]
	Start-up date or age of equipment		/
Traceability of refrigerants from production to destruction/ reclamation	Quantities of refrigerants produced	EU F-Gas Regulation (>1t) Producer	Reporting
	Exported/imported quantity of refrigerants	EU F-Gas Regulation (>1t, does not pertain to refrigerants within products and equipment) Exporters/importers	Reporting
	Stocks of producers/importers/exporters		/
	Reclaimed quantities of refrigerants placed on the German market		/
	Quantities of refrigerants emitted	See total refrigerant emissions	Recording
	Quantities of refrigerants reclaimed	ChemKlimaschutzV reclamation facility	Recording

Data requirements to the system	Which data are required? [3]	In which legislation are these data already comprised, and by whom?	Reporting obligation / Recording obligation
	Quantities of refrigerants destructed	ChemKlimaschutzV destruction facility	Recording
	Mode of destruction/reclamation	ChemKlimaschutzV destruction facility	Recording

[1] reporting duty under EU-F-Gas Regulation exists generally for possible quantities re-filled but it is not required to indicate the reason for re-filling

Table 1: Overview on data to be covered by the system and their legal recordation

As can be seen, most of the data to be surveyed for the system are already covered via the recording and reporting duties determined in the EU F-Gas Regulation and the ChemKlimaschutzV. However, only for some of the data reporting obligations are foreseen (see last column in Table 1). In addition, the F-Gas Regulation only stipulates reporting obligations for quantities of 1 ton and above, and e.g. imported refrigerants within products and equipment are not subject to the reporting obligation. Data required for the calculation of emissions and data with regard to destruction are currently only subject to a recording obligation, this means, data are available at the companies but are not actively forwarded to the authorities. An analysis of data is, therefore, only possible on site or upon request of documents on the part of the authorities. For some of the data required neither the F-Gas Regulation nor the ChemKlimaschutzV foresee an explicit recording obligation (e.g. reason for refilling, mode of destruction, start-up date or age of equipment).

Specifications regarding the form respectively format the records are to be kept in are neither defined in the EU F-Gas Regulation nor in the ChemKlimaschutzV.

Against this background it is checked in the next step which data are already available at the operators of stationary refrigeration and air conditioning equipment and heat pumps or at other actors involved, and in which form and to which degree of accuracy they are available. It has to be clarified whether further data which are presently not subject to an explicit recording obligation are already being gathered, and to which extent available data are on hand in a form that enables an analysis of these data.

3 Findings related to the current recording practice

The result of the evaluation of the actual recording practice was that all data which have to be recorded according to Art.3 of the EU F-Gas Regulation and which are suitable for the evaluation of specific and total F-Gas emissions are documented in a handwritten form or electronically in an internal data base or a data calculation program (MS-Excel) or in a specifically developed software system. Data are available at the operator's site and to some extent also at the certified personnel.

Most of the operators (especially those with a small number of applications) record the relevant data in a handwritten form (for example in logbooks). For an efficient and systematic evaluation these data has to be transferred to a suitable electronic system. This would result in an enormous effort as, at a guess, some 100,000 units of equipment are installed in Germany. Furthermore the manual transfer of data from handwritten documents into an electronic system is error-prone. Furthermore handwritten records may be to some extent unreadable or ambiguous, which hampers a transfer.

Transferring data from handwritten records into an electronic system for monitoring and analysis of refrigerant data, therefore, does not appear reasonable.

To facilitate recording and to comply with legal requirements, however, electronic systems for data collection and analysis are already implemented in many cases. Both, service companies and operators use systems available on the market or for company internal use to collect and record refrigerant data, amongst others those that have to be surveyed according to Art. 3 of the EU F-Gas Regulation. Currently this especially applies for larger companies or those operating a multitude of stationary refrigeration and air conditioning equipment and heat pumps.

Since data are already available in an electronic form when utilizing these systems, it is viable – after having determined uniform structures and definitions – to extract relevant data from the system to analyze them consistently.

Against this background in the next step the electronic data collection systems identified during this survey have been examined more thoroughly and assessed whether they are applicable for an integration into the system.

4 Evaluation of available electronic data collection systems

Three systems available on the market (Ecoklima, VDKF-LEC and Mobilec) have been identified which are utilised by a multitude of certified personnel and operators, as well as one data gathering and monitoring system developed by Dresdner Kühlanlagenbau for company internal use only. These systems have been examined against their suitability for determining specific refrigerant losses and total refrigerant emissions, and for enabling the traceability of total refrigerants along the total material flow. For this evaluation the following aspects and parameters have been taken into

account: Coverage of relevant data, flexibility, traceability of refrigerants applied in the sector of stationary refrigeration and air conditioning equipment and heat pumps from production to destruction, efficiency of data gathering and analysis, data security, data export function, documentation and data access rights.

The analysis of systems has revealed that all examined systems are very similar with regard to the way of data collection and their structure. All four systems gather the data relevant for the calculation of specific refrigerant losses and total refrigerant emissions. They are, however, not suitable to trace refrigerant movements. To achieve this, further actors (e.g. destruction companies) would have to be incorporated into the system, which is not possible in the present format of the systems.

All data collection systems under examination provide the possibility to collect data electronically right on site. The collected data are either available at the company operating the equipment, or they are administered centrally at the site of the service company or of another independent institution. In case the data are not stored at the operator, there is the possibility to see the data and to carry out calculations via corresponding login accounts.

Two systems guarantee a safe data transmission via https procedure. In addition all systems available on the market require a registration by password. These measures enhance the acceptance of data transmission via internet for the actors involved. Beyond that, additional functionalities of these systems offered are applied for company-internal calculations and appraisals, e.g. for an operational efficiency check of equipment, as well as reminder and alert functions indicating upcoming maintenance intervals or the exceedance of maximum permissible values.

All of these systems include export functions; therefore data can be extracted and brought together for analysis – under certain conditions of a voluntary consent of operators or a reporting obligation introduced. For this procedure it has to be guaranteed that data are not double counted. In addition consistent definitions have to set before bringing together data from different systems, in order to assure comparability of data. Due to a lack of exact definitions (e.g. for damage, normal operating state) some companies introduced definitions of their own that partly differ from one system to another.

As an excursus, the current situation with regard to the collection systems for refrigeration equipment data in the Netherlands and in Hungary was observed in detail. In both countries collection systems for refrigeration equipment data are already in operation. In the Netherlands the keeping and annual transmission of a register for refrigeration equipment is the prerequisite for receiving the certification according to Regulation (EC) No 303/2008, in Hungary the legal basis for an obligatory participation is yet to be established via amendment of law.

5 Suitability of other information sources for the monitoring of required data

In order to keep the time and effort as low as possible, both for the operators and for the governmental authorities, it was also examined within this project to which extent data for refrigerants are already being gathered, e.g. as a result of company-internal recording or other legal demands, and whether the system requirements for the collection of refrigerant data could be covered by these data.

For the purpose of internal statistics to some extent data collected at the sites of producers and distributors of refrigerants as well as at the equipment operators are available with regard to refrigerant movements and quantities. However, these data in most cases only cover a small share of the data required for the system, as having emerged from expert interviews with producers, distributors and operators of stationary refrigeration and air conditioning equipment and heat pumps.

Data currently surveyed according to existing legislation – the German Law on Environmental Statistics (UStatG) and the EU F-Gas Regulation – are not suitable as well for the identification and presentation of specific refrigerant losses and total refrigerant emissions and for tracing back the refrigerants from the producer up to the destruction company. This is due both to incompleteness and inaccuracy of data – incompleteness with regard to the quantity refilled due to damage, the start-up date of equipment and the reclaimed refrigerant quantities for destruction, inaccuracy because the reporting duty only holds for a quantity of 1 ton and above under the EU F-Gas Regulation and for 20 kg and above under the UStatG. In addition refrigerants contained in products and equipment are not taken into respect for the calculation of imports and exports.

However, data from existing reporting systems can be consulted as a plausibility check for the total refrigerant emissions and the quantity of refrigerants annually placed on the market.

6 Transferability of other systems for data collection and transmission

In Germany several systems have already been established for data collection and transmission within the framework of different legally regularized reporting duties (Regulation of Evidence, Law on Environmental Statistics, Packaging Regulation, 11. Federal Pollution Control Regulation and EU F-Gas Regulation). Therefore, it has been examined within the framework of this project whether the systems or system components developed would also be suitable with regard to their structure for a collection system of refrigerant data in order to benefit from already existing experience.

The analysis of these collection and transmission systems has shown that by now in most cases data are collected and transmitted solely on an electronic basis. Cost- and time-intensive intermediate steps from the data gathering up to the analysis are kept low in most of the systems, and systems

still providing manual data transmission have been replaced by electronic systems more and more. Electronic collection and transmission of data can nowadays be considered as the standard. Therefore, within the system to be developed any transmission should be carried out solely in an electronic way as well.

The use of specifically designed, internet-based systems, consisting of software with a database attached, for data transmission and collection has increased. In most cases these systems are placed free of charge at the disposal of the agents which are subject to reporting. In case that questionnaires or data entry forms are applied, these are generally filled in and sent electronically and no longer by hand. When data are to be transmitted from company-internal systems to a central data collection authority, it has to be paid attention that interfaces and formats are defined unequivocally in order to enable a subsequent processing of data without problems.

Data security plays a crucial role for the cooperativeness of actors subject to reporting to enter their data into a system available via internet or administrated by third persons. Therefore, the establishment of appropriate security standards that guarantee a safe transmission and storage of data is a basic prerequisite for each system. The increasing number of users of the online system IDEV within the framework of the obligation to give information under the Law of Environmental Statistics shows that even without a legal obligation the acceptance of electronic transmission systems is at a very high level in the meantime.

In most of the examined cases data are surveyed and registered at the county (Bundesländer) levels via the competent county authorities. From there data are usually transmitted in an aggregated form to the respective Federal authorities. Only in the case of the F-Gas Regulation currently data are surveyed directly by a Federal authority.

It can be recorded that the structure and functionality of some systems would be absolutely appropriate for the purpose of gathering refrigerant data. A direct transfer of a system is, however, not reasonable, since single systems are always adapted in particular to the respective legal circumstance. However, some system components such as the solely electronic transmission of data, the application of a software with an attached database for data gathering, transmission and analysis, and the setting of high security standards – such as the HyperText Transfer Protocol Secure (https) procedure – can be transferred to a system for the collection, transmission and analysis of refrigerant data.

7 Conclusions on data collection

From the underlying results of the preceding analysis it becomes obvious that, although the operators or the certified personnel have data available for the calculation of total refrigerant emissions and of the specific refrigerant loss, these data are not at the disposition of the competent authorities, due to the lack of a systematic centralized collection and analysis. Data on refrigerants already collected and transmitted to authorities via other systems (e.g. under the UStatG) are not suitable for allocating the information required for the authorities with an adequate degree of precision.

Against this background it is recommended to develop a system of its own for the calculation of refrigerant data. For the development of the system the experience and to some extent also components of data gathering systems already established can be referred to.

8 Options and suggestions for a system suitable for the collection of refrigerant data in the sector of stationary refrigeration and air conditioning equipment and heat pumps

Based on the information gained suggestions and options were discussed how a system for the collection of refrigerant data should be assembled that fulfils the specified minimum requirements and, beyond that, if applicable the desired feature of traceability of the refrigerants employed. The aspect of a cost- and time-efficient data collection and analysis has also been taken into respect.

It seems a beneficial strategy to include as many actors involved into the system as necessary and as few actors as possible, in order to keep on the one hand the time and effort as low as possible, and to guarantee on the other hand the essential detail and quality of data.

Data for monitoring the specific refrigerant losses and total refrigerant emissions can be collected either at the operators of stationary refrigeration and air conditioning equipment and heat pumps or at the certified personnel (this means in general, at the service companies). Both options are examined as two alternative scenarios.

Collection and transmission of data via the equipment operator appears plausible, and the additional effort for the equipment operator justifiable, because a recording obligation already exists for the operator with regard to these data. The administrative effort for the authorities related to the coverage of all refrigerant circuits and equipment operators as well as the administration of all equipment operators and data would be very high; however, after a one-time collection of all equipment operators the authorities would be disencumbered by an automatic transmission of data.

Transmission via the certified personnel would imply a justifiable additional effort for the certified

personnel, because they in general have already taken over the recording obligations of the operators. However, it has to be kept in mind that the certified personnel for service of equipment unit may be substituted over time and therefore additional steps for a consistent traceability of data would have to be introduced. For the authorities this approach would imply less administrative effort, because the certified personnel has already been registered; however, the obligation of data collection would have to be regulated in a new manner.

Via electronic transmission (voluntary or obligatory) data could be placed at the disposal of the authorities in an adequate form.

An adaptation of legislation would be required in both cases examined, since at present no transmission of data to the authorities is scheduled.

In order to get – beyond the refrigerant emissions – also an overview on the material flow of refrigerants, apart of the operators and the certified personnel also the producers, importers and exporters as well as destruction and reclamation companies would have to be integrated into the system.

The collection and transmission of data at the producers, importers and exporters of F-gases would on the one hand generate only low additional administrative effort for the actors involved and the authorities, as already several reporting obligations exist for the actors involved. On the other hand also the additional benefit would be rather low, as long as data are not placed at the disposal to the required degree of precision.

The coverage of the destruction and reclamation companies would generate an additional benefit with regard to information on the amount of refrigerants destroyed and reclaimed. The additional effort with regard to reporting on the part of the actors involved, as well as the collection and administration of destruction and reclamation companies on the part of the authorities appears rather low, because these actors are already liable to recording and reporting duties. It has to be taken into respect that data are presently not collected to the desired and required degree of precision.

By means of an electronic reporting duty data could be placed at the disposal of authorities in a suitable form. An adaptation of legislation would be required in this case under examination as well.

To gain complete traceability of refrigerants from the producer up the destruction or reclamation company, all actors involved would have to be involved into the system. This would result in a high effort of collection, a considerable administrative effort on the part of the authorities and an additional administrative effort on the part of the actors involved. From the aspect of costs and benefits this measure under examination does not appear advantageous. In this case an adaptation of legislation would be required as well.

The analysis of recording practice and functionality of existing data collection systems has revealed that data transmission on an electronic way is already current practice and should be utilized for the

system to be developed as well.

For data collection it seems suitable to leave the choice to the actors involved whether they employ software that they have developed on their own, that is already available on the market, or, if applicable, “minimal software solutions” that are placed at the disposal by the Federal State and/or the counties (Bundesländer) for free or low cost.

The transmission has to be carried out via well-defined interfaces or formats that have to be defined by the collecting authority. For collection a central database or an appropriate calculation program could serve. Prior to bringing together the data some terms, such as normal operation and damage, should be defined fundamentally and consistently, in order that comparability of data is guaranteed.

To receive a complete overview over the total specific refrigerant losses and total refrigerant emissions, a reporting obligation for the actors involved would be required.

Finally, based on the scenarios under examination, three options of a system for collecting refrigerant data were derived and discussed.

In doing so, against the background of the minimum requirements to the system and the goal to keep the time and effort for authorities and operators as low as possible, the following system shown in Figure 2 has been identified as most suitable:

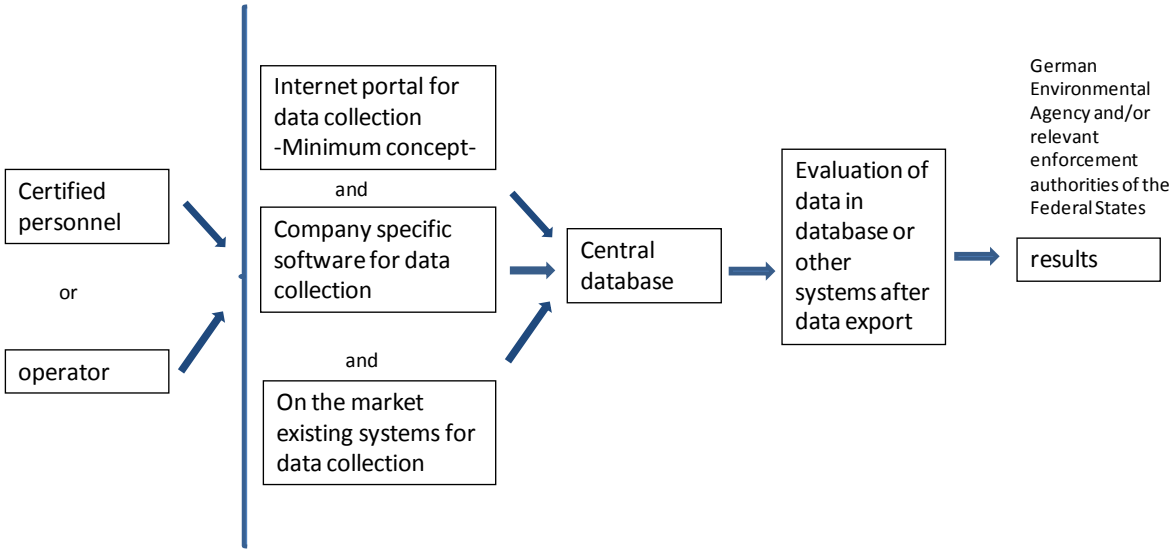

Figure 2: Proposed system for data collection, transmission and analysis of specific refrigerant losses and total refrigerant emissions

For implementation of the proposed systems adaptations of legislation are indispensable.