



**Value generated by
the Chemical Code
List System
(Parameter list)**

Version 1.0



Table of contents

Executive summary	2
Analysis.....	3
Value estimation.....	3
Quantitative direct value impact.....	3
Quantitative indirect value impact.....	5
Qualitative value impact – direct and indirect.....	6
Perspectives.....	8
Feature description	10



Executive summary

Problem

It is unfeasible that the public administration can comply with future directives, whilst using handheld systems to identify and interpret chemical substances in their work. Chemical analyses performed for the public administration need extensive interpretation, due to a lack of uniformity in the data. Furthermore, the data is not interoperable at the time of creation, which narrows the ability to reuse it. This creates lengthy business processes¹ with ineffective resource allocation and large expenditures, which can be avoided.

Freeing up time spent on these expendable tasks is essential, as the public authorities currently must perform more tasks than the dedicated FTE allows for. The overarching purpose is to create value for the environment through faster, more effective actions and the prevention of avoidable damages.

Value impact

The analysis finds potential savings by using the Parameter list on two levels: direct value in administrative tasks (28-84 million DKK) and indirect value on a socioeconomic scale (15-88 million DKK).

This is the result of increasing interoperability and coherence of chemical data in the public administration, attained by using the standardised Parameter list.

Recommendations

1. Establish a uniform code list of chemical parameters and a governance framework for maintaining it
2. Ensure that various actors can use the list as input in their own systems
3. Ensure that new directives from the European Union (EU) and/or the national implementation of these use unique IDs for chemical parameters
4. Use the chemical code list as a conversion table for chemical parameters

Technical solution Parameter list

The Parameter list is a centralised system that displays and describes official codes for physical, chemical, virological and microbiological parameters. It provides unique codification and strengthens the validity of interpretation of environmental data. This is further described in the section *Feature description*.

Scope and future revisions

The analysis and value estimations presented in this report are not exhaustive. They serve as illustrative examples based on the best available information at the time of writing. As new data or contextual factors emerge, the findings and conclusions may be revised to reflect more accurate and updated insights.

¹ The analysis is conducted on the most significant business processes identified and is broached from the angle of operational cost.



Analysis

Value estimation

Though the need for a centralised list of chemical substances is widely acknowledged, there has yet to be produced an analysis which dares to take a quantitative approach on the matter. This report seeks to quantify and concretise the potential gains of using the Parameter list.

The analysis establishes quantitative baseline figures on time and costs and uses qualitative data to estimate a probable reduction in time and costs. In both the qualitative and quantitative analyses this is conducted on two levels: direct impact on administrative hours spent performing tasks related to chemical measurements, and an indirect impact on a socio-economic scale.

The analysis follows this two-level structure and is divided into three sections: direct value impact, indirect value impact and qualitative value impact. The latter offers an in-depth explanation of the need for interpretation of chemical data and describes the current challenges which are broadly acknowledged. This report does not assess the current status of benefit realisation in Denmark. Instead, it should be seen as a mid-process analysis that frames potential value creation rather than documenting achieved results.

Quantitative direct value impact

By identifying one substance with one unique identifier the Parameter list allows for employees in the sector to focus on other, more taxing and urgent duties.

It is likely that 5%-15% of full-time equivalents (FTEs) hours can be freed up entirely, saving between 28-84 million DKK, which are allocable to other tasks.

The value span is indicative of the varying degree of digitisation adapted by the organisations using the Parameter list, as well as the degree of implementation of national and European directives.

Description	Baseline	Value span			
		5% reduction	10% reduction	15% reduction	
<i>Efficiency in administrative tasks directly related to chemical measurements - e.g. interpreting legislation or substance names, corrective actions etc.</i>					
Freed-up time - calculated in salary costs	562 m. DKK	28 m. DKK	56 m. DKK	84 m. DKK	28-84 m. DKK

Table 1 - Direct value in administrative tasks

The value span is visualised in *Table 1 - Direct value in administrative tasks* **Fejl!** **Henvisningskilde ikke fundet.** and derived from baseline numbers established by expert knowledge of the number of full-time equivalents (FTEs) whose tasks significantly comprises of conducting and interpreting analyses. They therefore spend a significant number of hours on, e.g., interpreting legislation, substance names, gathering data, correcting errors, etc. in state, regions, municipalities, advisors and utilities. These hours include the administrative effort used on producing chemical samples, which by itself constitutes a substantial task.



The experts combined estimates amount to approximately 750 FTEs. This combined with a yearly FTE cost of 750,000 DKK² gives a baseline of 561 million DKK. The value span numbers are within a reasonable degree of certainty and suggest average values, as the lower and higher extremities are unknown. The estimate may be further refined.

A simple use of the Parameter list without integration to other professional software or platforms is expected to free up time. However, this simply entails using the Parameter list as a form of translator and still leaves room for manual, handheld work resulting in potential errors. By introducing integrations to reporting and production systems, however, it is possible to ensure that data is only identified once. Not only does that secure correct data in every step of the relevant processes, but it also significantly increases the interoperability of data, thus reducing inefficient time spent.

“VanDa”, a tailored platform created by the Danish Environmental Portal, is an example of an almost fully digitised solution which highly reduces FTE hours spent on correctly identifying chemical substances.

The platform uses data on water chemistry from the Parameter to create a tool for employees in the municipalities and other professionals, to order samples directly from the laboratory. Because the ordering of samples is initiated on the platform, the chemical substances can be instantly identified and interoperable by both the laboratories and the receiver of the sample report. The value generated in this instance is therefore greatly increased.

The production of samples in its totality composes a large expenditure (2- or 3-digit annual million DKK amounts in each authority type) and covers a significant number of analyses. It is therefore important to ensure effective workflows around the analysis work. Oftentimes the chemical substances are not clearly identified, as different organisations use different terminology. This creates a high risk of error and low efficiency in time spent, as the necessity for iterative communication between organisations is high. A reduction in this expenditure alone suggests a concrete value generation by using the unique identifiers from the Parameter list.

² Source: Dansk Industri: <https://www.danskindustri.dk/arkiv/analyser/2024/12/offentlig-administration-vokser-trods-regerings-sparemal/>



Quantitative indirect value impact

It is estimated that even with minimal savings, ranging from 0,1%-0,5%, the societal benefits of a broader use of the Parameter list are considerable. Across the selected business processes and current investments, it is probable that the public administration can minimise costs by 15-88 m. DKK yearly.

Description	Baseline				Value span
<i>Business potential - indirect socio-economic value</i>					
Business processes					
		0,1% reduction	0,3% reduction	0,5% reduction	
Value of wastewater management in public utilities	5.735 m. DKK	5 m. DKK	17 m. DKK	28 m. DKK	5-28 m. DKK
Value of Protection of soil, groundwater and surface water in public authorities	1.480 m. DKK	1 m. DKK	4 m. DKK	7 m. DKK	1-7 m. DKK
	1.650 m. DKK	1 m. DKK	4 m. DKK	8 m. DKK	1-8 m. DKK
Value of drinking water operating costs in public utilities					
Investments					
		0,1% reduction	0,3% reduction	0,5% reduction	
Wastewater	6.500 m. DKK	6 m. DKK	19 m. DKK	32 m. DKK	6-32 m. DKK
Drinking water	1.730 m. DKK	1 m. DKK	5 m. DKK	8 m. DKK	1-8 m. DKK
Nitrogen-reducing efforts (part of the Green Tripartite)	1.085 m. DKK	1 m. DKK	3 m. DKK	5 m. DKK	1-5 m. DKK

Table 2 - Indirect socio-economic value

This generation of socio-economic value is broached from two angles: operational costs and investment costs. Each of the budget items listed in *Table 2 - Indirect socio-economic value*, depends on chemical analyses and thus are likely to benefit from an increase in transparency in data and a decrease in need for interpretation thereof. E.g.: even with a cautious estimate of 0,5% reduction in cost, there is a potential to save 32 million DKK yearly on wastewater investment, simply by introducing standardised chemical data.³

The analysis is conducted on the most significant business processes identified, as locating every process in the public administration, which might rely on chemical data, is outside the scope of this analysis. Each of the business processes and investment areas have a high societal cost and are essential in the protection of the environment. Even a minor reduction in either one of these costs, therefore, is significant and proves valuable.

³ Sources for baseline numbers: Danmarks Statistik (<https://www.statistikbanken.dk/MREG22>), DANVA Vand i tal 2023 og 2024, Aftale om Implementering af et Grønt Danmark af 18. november 2024, Regionernes-arbejde-med-jordforurening-aarsrapport-2024.



Qualitative value impact – direct and indirect

From the production of samples in municipalities and laboratories to the translation of legal announcements in the state government, the workload of assuring correct use and understanding of a chemical substance is extensive. The following analysis is divided into direct value impact and indirect value impact and follows the same two-level approach as the quantitative analysis. It describes the challenges currently present in working with chemical data, both in employees' day-to-day tasks and in business processes which affect several areas of public administration.

Qualitative direct value impact

Qualitative research shows that interoperable and valid data can generate great value to existing and potential users. This is due to the manual character of the work that is currently required to interpret chemical measurements.

Every FTE allocated to tasks related to chemical measurements is dependent on the ability to identify each unique substance. Across different levels of the public administration and laboratories these substances are listed on multiple platforms and to some extent in pdf-files. The naming and identification on these substances therefore are not consistent and oftentimes require time allocated to translate, as documentation will travel across administrative bodies and laboratories with each their own standard for codification. Every organisation depends on each other and so the creation of interoperable data from the initial stages in the various processes is therefore essential.

Resources are currently used on long threads of communication between the public authorities who order sampling from laboratories and the laboratories themselves. The Parameter list ensures that the chemical substances are correctly identified from the first step and eliminates this use of resources entirely.

Examples of concrete workflows which require interpretation of chemical substances are shown in *Figure 1- Business processes with interpretational tasks* below.



Processes towards EU

Changes starting in EU



Reporting to EU



Work processes in Denmark

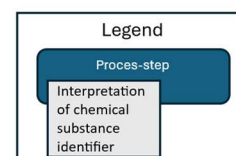
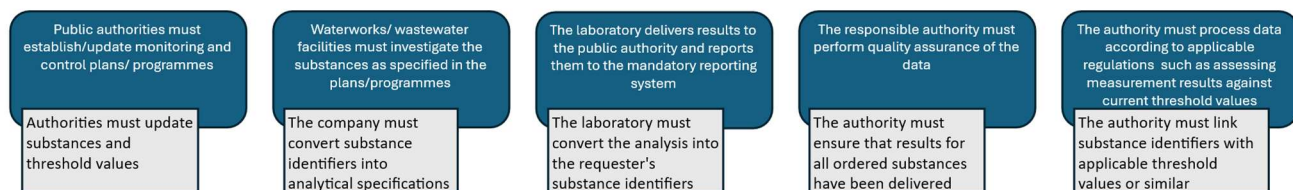


Figure 1 - Business processes with interpretational tasks

The blue boxes indicate generic workflows, which are present in many processes, while each grey box visualises the need for interpretation. These workflows are reduced in complexity by using the Parameter list, as it ensures there is no loss of meaning or need for new interpretation between each step.

Qualitative indirect value impact

The business processes listed below are all dependent on accurate identification of chemical substances. These are vast government tasks and involve various parties from different organisational bodies.

State government

- Decisions on water plans
- Monitoring water quality
- Condition assessment
- Supervision of landfill sites
- EU – new legislation and reporting

Municipalities

- Plans for wastewater discharge
- Control of water quality
- Treatment plants
- Control of water quality

Utilities

- Operation, maintenance and reinvestment of Treatment plants
- Control of substance occurrences in treatment plants
- Applications regarding wastewater discharges



Regions

- Mapping and prioritizing soil contamination
- Preventing further contamination and/or cleaning up contaminated soil

Research institutions

- Research on the chemistry of water

Across authorities

- Entering into agreements with laboratories

There are high socioeconomic risks involved in identifying chemical data incorrectly in each of these processes. Incorrect identification may lead to inaccurate understanding of the state of the environment, as well as wasting resources on needlessly completing tasks in multiple iterations. By using a centralised list of chemical identifiers across different government bodies, the relevant parties are instead ensured accuracy and confidence in their understanding of the shared data. Not only does this increase transparency in the data, making it more accessible to a wider array of users, but it also heightens the ability to share the data and knowledge between governing bodies. All the while ensuring that the data remains identical. The centralisation of codes used to identify chemical substances therefore both allows for shorter business processes and reduces the need for validation on a large scale.

Perspectives

The introduction of the Parameter list in the overall European market would offer a significant impact on our collected ability to address environmental issues. The current political significance of the environment comes with a high demand for valid documentation, governance and research, both nationally and internationally. As the demands increase, so will expenditures to facilitate these. Green initiatives are expected to increase across the EU, placing greater responsibility on all member countries to monitor chemical substances accurately. It is therefore necessary to ensure that business processes are efficient, whilst securing valid reporting, interpretation and sharing of results.

To achieve this, the Parameter list is introducing more advanced qualitative support for its users in the form of rulesets. The rulesets will pair existing and new regulation to the translation of chemical substances, thus providing an extensive tool for administrative employees in the public sector. As an example, different chemical substances in the Parameter list will be grouped together in a ruleset under The Drinking Water Directive. A user is subsequently able to look up the directive and promptly locate all chemical substances named therein, including their individual description, past identifications and value limitations. This valuable support highlights the vast potential of the Parameter list, in its ability to help facilitate compliance with existing and future environmental directives.



Such facilitation of compliance is highly needed in the coming years, both nationally and internationally, as investments into the betterment and protection of the environment are set to increase across multiple sectors. There is therefore value in providing quick and concise understanding of the chemical data that each of these investments rely on, as well as a direct overview of potential directives the chemical substances are regulated under.

The investment shown in *Table 2 - Indirect socio-economic value* are paired with a prognosis for yearly investments between 2024-2069 in *Table 3* below.

	Yearly investments 2023 in DKK	Prognosis for yearly investments 2024-2069 in DKK
Wastewater companies	6,500,000,000	15,800,000,000
Water companies	1,730,000,000	2,300,000,000

Source: DANVA, "Vand i Tal 2024" publikation, p. 4 Source: DANVA/Envidan, "Prognose for investeringsbehovet i danske spildevandsselskaber 2024-2069" publikation, p. 3

Table 3 - Prognosis for yearly investments

Wastewater companies are set to increase their investments by 143%, while water companies are likely to increase their investments by 33% (flat average). The increase in work with chemical substances and data, therefore, must be assumed to increase in the coming years as well. It is worth noting that this analysis has used realized numbers in the calculations of value estimation and not used prognosis figures (which are expected to increase), in order to be conservative and cautious in our approach.

Another generator of work related to chemical data is the increase in publications of environmental directives and reports on the state of the environment. As an example, the newest passing of the Soil Monitoring Law demands improved and additional monitoring of the quality of soil across European countries, as well as enhanced sharing of knowledge and data. To achieve this, data on chemical measurements must be reusable and quick to identify. However, there exists no complete or agreed upon standard for the categorisation of chemical parameters for environmental purposes in the EU. As such there are currently no assurances that member countries can effectively share their observations between one another. Without a centralised nomenclature data is simply not interoperable and thus cannot be shared across governing bodies without extensive, potentially erroneous, manual translatory work. This illustrates the urgency in transparent and uniform identification of chemical substances, as compliance with new directives are otherwise unachievable.

There exists widespread agreement that public authorities and private actors need to share, use and reuse data in a standardized way, but data sharing involves costs, which often deters both public and private organisations from taking the necessary steps⁴.

⁴ Water4All White Paper version 1.5 (MST Id nr.: 11533360)



There is therefore concrete value in making data interoperable already at the time it is being produced, so that it only needs to be produced once and simply shared after. Consequently, there is a need for a shared and centralised database, where the sectors who produce chemical samples can report directly, leaving their data readily available to all member countries in the same format and at the same time. Costs are hereby immediately reduced, and the knowledge is fully available to every member country.

Feature description

The Parameter list enables users to look up chemical substances, rulesets or substance groups and instantaneously read through unique descriptions. This allows for the users to reach an understanding quicker. Due to characterisation of the parameters and the substance groups, the Parameter list provides value for both researchers with extensive knowledge of chemical substances and other professionals with low-to-no chemical knowledge.

Each parameter on the list can be supplemented with metadata such as the International Chemical Identifier (INCHI), CAS registry numbers, Simplified Molecular-input Line-entry System (SMILES) structures and English names, making the system comprehensive and precise. The parameters can be organized into substance groups and via the ruleset linked to different regulatory frameworks and limit values for analytical quality and environmental standards. This detailed description makes it easier for researchers and authorities to handle complex data sets and ensure compliance with environmental regulations. The system also offers API access, which allows the Parameter list to be integrated into other systems for easier data management and analysis.

Key points:

- The Parameter list is an extension of Stan code list 1008 which is continuously synchronized with changes made to the Parameter list
- Currently 3013 uniquely identified and searchable parameters
- Currently 23 searchable substance groups such as "Drinking water - Mandatory pesticides and degradation products" with underlying parameters
- Currently 8 rulesets such as "Regulation on Quality Standards for Environmental Measurements"

Functionality to administer the Parameter list

- Create new, merge, delete and change names of parameters
- Add certain types of metadata on parameters
- Subscribe to changes made to the Parameter list

Functionality to create substance groups and summarised groups



- Substance groups are a way of grouping substances so there is a defined set of what e.g. PFBA's are
- Substance groups can be implemented in search tools to quickly find the correct parameters in the results
- Summarised groups are a sum of substances, for which there is a regulated limit
- API's return lists of substance groups including their containing parameter

Functionality to create "digital directives" with limitations and quality criteria

- Set of rules is named and defined for digitisation of the digital directives
- Versioning of the rules, so that changed announcements will be reflected in new versions of the specific rules
- API's returning lists of sets of rules and content of concrete set of rules

API's and CSV-files

- Potential to integrate with the national substance code
- Potential to manually download CSV-files
- Delivers correct results, i.e. both active and aggregated punch code values.

In stark contrast to other digital platforms in the public sector, the introduction of the Parameter list and its data structure does not require data migration with extensive data standardisation processes. Typically, comprising multiple identifiers into one unique data point will require a substantial use of resources, and is oftentimes exceedingly time consuming and costly. The Parameter list instead keeps existing typology of chemical substances, used in different laboratories and across public authorities, and translates them into a unique identifier. This approach ensures that any user can look up a chemical substance based on the historic use of subjective identification and locate the same description, value limitation, etc. This secures both transparency, interoperability and validity in the data.

Due to this method, users of the Parameter list are not required to agree on one terminology or change historic naming processes. The Parameter list is therefore quick to implement and does not create basis for reevaluating business processes in individual public authorities. The gains of using the Parameter list can be achieved without imposing on different public authorities or private laboratories to adopt the same practices.