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Surveillance, Criminal Procedure, and Regulatory Connection: the Case of Sewage Monitoring

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Abstract

This paper analyses the implications of a new form of surveillance—sewage monitoring—for criminal procedural law. Current law has not been written with a view to covering novel, technology-enabled forms of covert data acquisition, posing a challenge of regulatory connection. To what extent are new surveillance methods, such as sewage monitoring to combat drugs production, covered by existing legal frameworks? This question is answered through analysing the shifting nature of criminal investigation, reflecting on how to interpret laws not written for new technologies, and assessing checks and balances needed when law enforcement employ sewage monitoring in criminal investigation. The analysis is illustrated with reference to the legal systems of Germany, Poland, and the Netherlands, using legal doctrinal research. The main findings are 1) that sewage monitoring is not particularly intrusive as such, but constitutes a new form of investigation that legally differs significantly from traditional surveillance powers, 2) that comparable methods do not provide unequivocal analogies that could serve to find a legal basis, 3) that functionality of evidence collection poses legal and procedural challenges, which may have implications for the covertness of the method, and 4) that even if only used as a diagnostic tool, some form of transparency and oversight will be needed to legitimate the non-negligible potential interference with fundamental rights and to enable those subjected to sewage monitoring to contest the usage in court.

Keywords

criminal investigation, surveillance, privacy, technology-neutrality, sewage monitoring, drugs

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Table of Contents

Abbreviations.....	3
1. Introduction.....	4
1.1. Background, aim and scope	4
1.2. Methodology.....	5
1.3. Outline.....	6
2. The shifting nature of criminal investigation.....	6
2.1. Increasing reliance on technology	6
2.2. Socio-technical changes.....	7
2.3. Paradigm shift?	9
2.4. Cumulative effect	11
3. Interpreting laws not written for new technologies.....	12
3.1. Interpretation strategies	12
3.2. Criminal law and constitutional protection	14
3.2.1. Privacy.....	15
3.2.2. Fair trial.....	17
3.2.3. Reflection on the constitutional framework	17
3.3. Technology neutrality versus legal certainty	18
3.4. Finding the legal basis for sewage monitoring: some considerations.....	19
4. Checks and balances for the 'new criminal investigation'?	21
4.1. Legal basis.....	21
4.2. Required legal suspicion.....	24
4.3. Oversight: ex ante, ex post or on-going?.....	26
4.4. Co-operation of private parties in the investigation	27
4.5. Evidence	28
5. Conclusion.....	31
5.1. New technologies alter criminal procedure – the need for more specific regulation	31
5.2. Legal basis in Germany and Poland.....	32
5.3. Practical considerations	33
5.4. Main conclusions	34
Bibliography.....	36

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Abbreviations

BGH	Bundesgerichtshof [German Federal Supreme Court]
BtMG	Gesetz über den Verkehr mit Betäubungsmitteln [German Narcotics Act]
BVerfG	Bundesverfassungsgericht [German Federal Constitutional Court]
BVerfGE	Bundesverfassungsgerichtsentscheidung [German Federal Constitutional Court Decision]
ECHR	European Convention on Human Rights
ICT	information and communication technologies
KPK	Kodeks postępowania karnego [Polish Code of Criminal Procedure]
LEA	Law Enforcement Agency
PA	Police Act
Rn	Randnummer [§]
StPO	Strafprozeßordnung [German Code of Criminal Procedure]

1. Introduction

1.1. Background, aim and scope

Technology frequently facilitates new forms of gathering information. These are relevant for law enforcement agencies as they may improve criminal investigation through better, more, or speedier intelligence and evidence collection. Especially (although not only) if it can be executed covertly, such new methods of surveillance raise normative questions about the conditions under which they can be employed, in view of their interference with privacy and other fundamental rights. Sewage monitoring is one such new possible investigation method.

Systems are being developed for sewage monitoring in the law enforcement context. For example, in the European μ Mole project,⁵ a sensor system is developed to track down the production of illicit substances. The system would be placed in the sewer, monitor waste flow, and take samples that could indicate, for instance, drugs production. The information retrieved by such a system could serve as evidence in itself (if it complies with forensic standards of evidence collection), but could also function as a trigger for follow-up investigation activities, such as search and seizure in particular premises identified as the likely source of drugs production.

Sewage monitoring for law-enforcement purposes needs to comply with existing requirements of criminal investigation and evidence. However, legal requirements are not always clear-cut, since new technological possibilities do not always fit neatly in existing laws and procedures, and sometimes, existing law provides unnecessary obstacles to technological innovation in law enforcement because existing rules did not foresee new or other forms in which the required result (sound evidence, legal protection against disproportional state interference) can be achieved. Thus, sewage monitoring provides an interesting example of the challenge of regulatory connection: how can law-makers keep the law up-to-date and connected to present-day circumstances?⁶ In that light, this paper aims to provide an overview of the implications of sewage monitoring for criminal procedure, questioning how this new method could be interpreted under the existing legal framework and what this implies for practitioners considering to use sewage monitoring as well as for law-makers to stay connected.

Sewage monitoring can have different use cases. One possibility is a targeted form, where sewage monitoring is part of an ongoing investigation. This implies that a Law Enforcement Agency (LEA), more specifically a local drug crime investigation unit, has a reasonable suspicion of an illicit drug lab being present within a certain area or location, and they have already started an investigation. The use of sewage monitoring here is not aimed at detecting the possible locations of drug laboratories, but to improve the information position in an on-going investigation, with a view to improving decision-making in the entire criminal investigation process, for example, deciding which follow-up investigative activities are most appropriate. A second possibility is to use a monitoring system to explore a wider part of the sewage system, to identify and narrow down possible areas where drugs might be being produced. This use case would be exploratory in nature, preliminary to actual criminal investigation based upon a certain level of suspicion of a crime, and the focus would be intelligence rather than evidence gathering. This paper is primarily focused on the first use case, but in view of the challenges of regulatory connection also discusses the broader issues raised by sewage monitoring in the law enforcement context, including the second, exploratory use case. We base our analysis on the possible affordances of sewage monitoring systems in general, including those in the foreseeable future.

Sewage monitoring technology needs a legal basis before it can be deployed, but since it is new and not clearly equivalent to other technologies, or tools, used in the context of law enforcement,⁷ it is not evident what the legal basis could or should be. A first approach to find a potential legal basis is to find similar technologies that are being used in similar contexts within an investigation and to see how these technologies/tools are dealt with in the law. However, this approach does

⁵ See <http://micromole.eu/>.

⁶ On the challenge of regulatory connection, see Brownsword 2008, p. 160-184.

⁷ See section 3.4 below, where we discuss similarities and differences between sewage monitoring and some existing forms of monitoring such as garbage searches and thermal imaging.

not guarantee a complete or full analysis, or legal basis: the particularities of a sewage monitoring system also might introduce new legal problems, that do not have a clear basis in law, or fall in between different forms of legislation (legal gaps). If a novel covert surveillance instrument such as a sewage monitoring system is to become a useful and usable instrument in the toolbox of LEAs, its needs to be able to have a legal basis. This legal basis is dependent on the role and the type of use it has within the entire operation of an investigation. Depending on the intended use, the tool could serve a) as an indicator, a sensor and b) as a collector of evidence. The legal basis for these two purposes, or functionalities, may differ and yield different types of safeguards and checks and balances within criminal procedure.

On a functional level, a consequence of the two different purposes is that sensor technologies in the sewage system should be able to detect signature waste and store a sample of this signature waste. This paper will discuss questions that arise if this sample was to be taken out of the sewage, stored, analysed and prepared for court as potential evidence. In order for evidence to be admissible in court, it needs to be relevant and useful (reliable content) and comply with the formal rules for evidence⁸. The latter relates to criminal procedure, an area of law that deals with rules and regulations for LEAs to follow. Although core principles of procedure might be quite similar in the countries of study, the implementation and exact rules differ per jurisdiction. This is important for developers of sewage monitoring systems: in one country, certain aspects or sequences of action within the system might be legal and correct, whereas in another they might not be. This paper will look into criminal procedure law in Germany and Poland as the main countries of study; in addition, for illustrative purposes, we will also where relevant refer to Dutch law. These countries were selected as the main countries involved in the project in the context of which the research for this paper was conducted. Based on these jurisdictions, we will analyse how a sewage monitoring system could be interpreted under the existing legal framework and where its legal basis could be situated.

1.2. Methodology

We have deployed a two-tier strategy to delve into legal questions that arise surrounding sewage monitoring systems. The first is to look at related technologies and instruments used by law enforcement systems in a similar context of use (use case 1: in which the system is part of an ongoing investigation). We have taken a closer look into criminal procedure law in Poland and in Germany. The legal analysis was based on doctrinal legal analysis methods, which combines desk research of literature with analysis of statutory law, case-law, and legal doctrinal literature, with a view to assessing how existing law applies to a certain activity (in this case, sewage monitoring). Since the critical conceptual analysis conducted within the doctrinal methods aims to reveal a statement of the law relevant to the matter under investigation,⁹ it is primarily concerned with understanding the meaning of legal rules and principles. Legal rules are normative, they dictate how an individual ought to behave.¹⁰ They make no attempt to understand or explain behaviour, they simply prescribe it, in natural language (which, by its nature, is open to interpretation). The process of formulating doctrines, therefore, relies on an (inter)subjective, argument-based methodology that differs from the empirical, data-based methods of social and natural sciences. As a result, the validity of the doctrinal method relies upon developing an interpretation of the law that is convincing to the legal community. This interpretation is based on arguments, rather than upon an appeal to some objective reality,¹¹ since the legal discipline is primarily an *argumentative* discipline.

The conclusions of the paper are based on the authors' desk research of legal literature in the field of law, regulation of technology, and criminal procedure (for the general analysis of the

⁸ Note that in Poland and Germany, even evidence that was obtained unlawfully is in principle admissible, except in some exceptional cases (see chapter 4, discussion of evidence). Formal *admissibility* is, however, not the same as practical *usability*: if evidence was obtained in an unlawful way, this may also affect the assessment of the evidence's reliability, since legal safeguards that aim at ensuring reliable evidence-gathering may not have been complied with.

⁹ Hutchinson 2014, p. 584.

¹⁰ Kelsen 1967.

¹¹ Chynoweth 2008, p. 30.

shifting nature of criminal law and of legal interpretation in light of new technologies) and on the doctrinal legal analysis of the criminal procedure law in Poland and Germany. The desk research was supplemented by an expert workshop (held in December 2016) with relevant experts from Poland, Germany and the Netherlands, where a sewage monitoring system was discussed within the context of criminal procedure in the respective countries. Since literature and case law on legal aspects of sewage monitoring is virtually non-existent, the expert workshop proved a useful additional means to identify more specific and precise arguments of criminal procedure in relation to the novel investigation method of sewage monitoring. Finally, to corroborate the correctness of the legal analysis in the draft final report, in June 2018, we invited experts in criminal procedural law in Germany and Poland to write a brief peer-review assessment of the paper's analysis and conclusions,¹² whose comments have been addressed in the final version of the paper.

1.3. Outline

In Section 2, a more high-level introduction is provided on the role of technology in law enforcement and criminal procedure and the challenges law faces in moving along with these technological changes. A sewage monitoring system consists of many new applications and new combinations of technologies, makes for a unique 'tool' in the toolbox of law enforcement, of which the legal basis is not straightforward. Both as an example and as a system in itself, a sewage monitoring system poses questions on how to regulate novel technologies for law enforcement. Since this is not unique for a sewage monitoring system, as several other technologies pose similar challenges, the high-level introduction aims to position sewage monitoring systems within the broader trend of an increasing reliance of criminal investigation on technology. We discuss how this trend not only poses questions on embedding a specific technology within criminal procedure, but also poses questions on possible shifts in the nature of criminal investigation, which need to be addressed both to find adequate safeguards for the new technology at hand and to keep the criminal law system as a whole coherent and sustainable.

In Section 3, we zoom in on a more specific, although still general, question, namely how to deal with a possible situation of regulatory disconnection, i.e., a situation in which a new technology needs to be accommodated in the criminal investigation system when the law has not been written for or foreseen this technology. This question requires going into interpretation strategies as well as the principle of technology neutrality in criminal law. This principle touches upon core discussions in (criminal) law, and in short begs the question whether and to what extent laws should be technology-specific. The implications of this for assessing the legal basis of sewage monitoring systems are briefly discussed.

In Section 4, the criminal law systems of Germany and Poland will be discussed, with additional comments for the Dutch system where relevant. The (level of) legal suspicion will be addressed and the necessary legal basis for deploying a sewage monitoring system in the specific national legal context. Lastly, the role and place of oversight will be discussed in relation to operational procedures and the process of gathering and securing evidence.

2. The shifting nature of criminal investigation

2.1. Increasing reliance on technology

Law enforcement increasingly uses technology. This is logical, since people and society in general are increasingly using technology to facilitate and enhance life, work, and leisure. And law enforcement has always used technology, from magnifying glasses through plaster shoeprint casts to fingerprint analysis, evolving into DNA forensics and cyber-investigations. What may be

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different, however, is that law enforcement has of old used technologies but still relied primarily on human observation, both of police officers and witnesses, whereas over the past decades, the practice of criminal investigation seems to increasingly rely on technologies of monitoring and recording rather than written or oral reports of what humans have observed. The latter is still relevant, of course, but technology has become an essential tool in criminal investigation.

The increasing reliance on technology implies several questions for criminal law. One of them is whether the police is basically just doing the same thing in new ways, or whether they are using substantially new ways of criminal investigation. In many legal systems, the legislator uses the distinction between technologies that merely enhance human perception (e.g., binoculars) and technologies that qualitatively change perception (e.g., infrared cameras). It is not always easy to see in which category a particular new technology falls. For example, if you use very strong binoculars or a strong microscope, one may argue this is still only enhancement, but it goes so far that one might also argue it fundamentally changes our natural abilities. Quantitative differences can pile up and eventually become qualitative differences.

Similarly, for technology-assisted sewage monitoring, one could argue that this is just an enhanced form of using human olfactory perception. For example, police officers patrolling on the street can use their noses and follow suspicious smells; or if someone has reported that there may be a marijuana plant in a building somewhere, they can simply go to the building, and if they sniff the distinct smell of marijuana, this will be enough to create a reasonable level of suspicion that legitimates their requesting a warrant for searching the premises. Is a sewage monitoring system just an enhanced form of such smelling, or is it qualitatively different? One may relatively easily argue that it is substantially different, since the types of drugs identified by Sewage monitoring sensors cannot be identified by human olfactory perception – police officers passing an open sewer would not smell residues of amphetamine in the water, even if were there in large quantities. The technology at issue therefore does more than merely enhance human perception. This means that the technology cannot be readily qualified as ‘ordinary’ human surveillance that is conducted by the police in the regular course of their work, and therefore that a specific legal basis needs to be established (see *infra*, 3.4 and 4.1). The question of a legal basis also depends, however, on the question to what extent fundamental rights are infringed by the technology at issue, which is another question that needs to be answered when new technologies are used that do not have an evident precursor or analogue in existing law and practice (see *infra*, 3.2).

Other questions triggered by the use of a new technology in criminal investigation relate to evidence and checks and balances; these questions will be taken up in Chapter 4. However, they also raise more generic questions for criminal investigation and criminal law, such as to what extent the law can or should be technology-neutral and how laws should be applied to situations unforeseen by the legislator. These more general implications for criminal investigation will be addressed in Chapter 3. Before we delve into those questions, there is a need to ask even more fundamental questions, since the increasing reliance on technology also has implications for the *system* of criminal law and criminal procedure as a whole. The rest of this chapter offers as a reflection on the most general implications of sewage monitoring systems for criminal procedure, which serves as a signal that new technologies should not (only) be analysed in isolation, but studied in the broader context of socio-technical trends and longer-term shifts in the nature of criminal law.

2.2. Socio-technical changes

Certain major changes are occurring in the way that society functions, facilitated by developments in technology (particularly ICT), and which in turn shape the further development of technology, in a process that is referred to as the co-evolution or co-shaping of technology and society. Broad socio-technical changes taking place over a longer period, which are not always visible in that they cause radical changes or clear disruptions, but which nevertheless over time change the

nature of society and social interactions, also impact on crime and criminal investigation. Some megatrends that are relevant for the context of this paper are:¹³

- *datafication*: data has been called the ‘new oil’ that is (said to be) driving the economy—increasingly, data rather than physical goods gain value, both economically and socially. Moreover, everything is increasingly translated into data, through ever growing measurement and measurability. Sewage monitoring capitalises on this trend, by introducing sensors in the sewage systems and generating data that were not available before;
- *Internet of Things and connectivity*: the Internet of Things consists in ever more devices being equipped with sensors, connectivity, and IP addresses, allowing remote control and monitoring and also (fitting in the trend of datafication) affording the aggregation of data from different sources, which is used in profiling for various purposes. Although sewage monitoring does not target the Internet of Things as such, it is one of the many examples of sensing technologies that are increasingly used for monitoring purposes, and this fits in the broader trend of generating data and connecting data from different sources. It should be taken into account that sewage monitoring is likely not the only source of intelligence or evidence used by the police to investigate drug laboratories, but one of multiple sources of information that may well be connected with IoT-generated data in the near future;
- the *onlife world* and the *transformation of crime*: online and offline contexts are increasingly merging, with physical space being pervaded by online connections and people seamlessly moving around in physical space and cyberspace at the same time. This happens to an extent that the distinction between online and offline no longer makes sense, so that we are migrating to an ‘onlife’ world. And just as life is becoming onlife, it may no longer make much sense to distinguish between offline and online forms of crime, because ‘traditional’ crime and cybercrime are increasingly becoming intertwined. Groups focused on committing cybercrime can also commit traditional and possibly physical crimes, and people traditionally in the business of ‘classic’ crime such as drug crimes, are increasingly also committing cybercrimes or using cyber-platforms to meet other offenders.¹⁴ This has important implications not only for the ways in which (cyber)crime occurs, but also for the ways in which it can be combated. For sewage monitoring, it means that law enforcement has to be aware that a group under investigation of drug production may also be involved in some form of cybercrime, and that evidence may be gathered not only through physical sensing of the sewer and the home, but also through digital investigation of the group’s communications.

While the trends discussed so far are related to data and ICT, we should also realise that physical concepts may be changing under the influence of larger socio-technical trends. For the sewage monitoring context, a particularly relevant trend is the blurring or weakening of the distinction between private and public places. A primary question in sewage monitoring is whether and to what extent this affects the constitutional protection of the home (see *infra*, 3.2).¹⁵ However, the relevance of the answer to that question depends on the larger question whether the protection of the home has, or should have, the same value as it has traditionally had, and how it should be interpreted (see also *infra*, 3.2.1). The law traditionally tends to have a very strong reliance on the assumption that there are private spaces and public spaces; privacy is most important at home. Particularly important is the notion that when people moved outside their private space, they leave most of their private things behind in the home. The assumption that you have a private space that is the main element that needs protection, versus a public space that is not particularly privacy-sensitive, is now becoming outdated. A very detailed picture can be construed from someone based on observations of what the person does ‘in public’, both in physical space and on the Internet, as well as from data generated in social life that are not restricted to data stored in the home. This raises questions on the way in which privacy is safeguarded in criminal procedure, which currently relies to a considerable degree on the strict division in private places versus public places—which translates into high standards for the police to investigate activities inside the home, and significantly lower standards for investigating activities outside of the

¹³ Based on Koops 2016a, which provides a broader overview of megatrends relevant for (cyber)crime.

¹⁴ Leukfeldt, Kleemans & Stol 2016.

¹⁵ This topic will be further elaborated in a parallel working paper.

home.¹⁶ This does not mean that it becomes irrelevant whether and to what extent Sewage monitoring-type of sewage analysis infringes the protection of home life—under current law, this is a key question to address if law enforcement is to effectively and legitimately use such tools—but it does mean that, sooner or later, law-makers must also reflect on the implications of surveillance in an onlife world where the strict distinction between private places and public places can no longer be used for determining what are particularly privacy-intrusive investigation powers.

2.3. Paradigm shift?

Somewhat similarly to the broad socio-technical trends in society we have discussed in the previous section, criminal investigation and law enforcement are also undergoing a fundamental change. Traditionally, criminal law is reactive: it focuses on crimes that have been committed, gather evidence, identifying and prosecuting suspects, with the evidence being discussed and assessed during the criminal trial. In contrast to this classic approach to criminal investigation, we see policing increasingly being focused on prevention and pre-emption, aiming to intervene in early stages of crime, and not necessarily on gathering sufficient information to get a perpetrator convicted, but sometimes rather on gathering intelligence that can be used to disrupt crime. In a similar vein, instead of focusing on, largely physical, traces of committed crimes, policing is more and more involved in collecting and analysing large data sets to find intelligence on on-going and possibly future criminal activities, in a trend that is usually termed intelligence-led policing.¹⁷ Combined with other shifts in the approaches to criminal investigation, we might perceive this to constitute a paradigm shift, from reactive to pro-active policing (see Table 1).

<i>In the old paradigm, criminal law</i>	<i>In the new paradigm, criminal law:</i>
is reactive	is preventative
focuses on harm	focuses on risk
focuses on moral wrongs	backs up regulatory interventions
investigates individual suspects	scans groups
collects concrete evidence for single	collects and shares raw data for
relies on search and seizure	relies on statistics
centres on the criminal trial	centres on pre-trial
is enforced by the state	relies on public-private partnerships
aims at re-establishing order	aims at establishing order
follows society's architecture	shapes society's architecture
is a last resort	is a first resort

Table 1. *The paradigm shift in criminal law (source: Koops 2009)*

To be sure, criminal law has not completely migrated from the old paradigm to the new paradigm: many instances of criminal investigation still concern traditional forms of evidence-gathering to prosecute individual criminals in a criminal trial. The paradigm shift consists rather in a gradual shift in emphasis from elements of the old paradigm to elements of the new paradigm. Not all elements shift at the same time to the same degree; but overall, elements from the new paradigm can be seen to gain in importance in the practice and policy of criminal investigation.

This is also visible in sewage monitoring. The goal of such monitoring combat the production and consumption of drugs. Intervening at the production stage may be an easier point of combatting than at the sale, which may be too late, or too difficult to enforce. Another argument for sewage monitoring is that with traditional monitoring, the perpetrators usually take notice; existing policing methods lead to drugs producers adapting their process in order to circumvent detection, resulting in a cat and mouse game. In order to stay abreast of this, the police continuously has to develop new methods, and will resort increasingly to covert surveillance measures that are less visible and more difficult to circumvent. The move from a traditional focus on search and seizure,

¹⁶ See also Koops 2014.

¹⁷ Ratcliffe 2008.

which consists in overt forms of investigation, to using covert surveillance measures fits seamlessly in the paradigm shift mentioned above.

Another instantiation of the shift from repression to prevention is the criminalisation of preparatory activities.¹⁸ In Poland, preparation for drug production is difficult to prove in the early stages of the process. Although preparation for production is criminalized, it is often only when people start production and create a substance that is illegal, that they can be held liable for a violation of the law. Finding chemicals used for drug production is only an indication that something may be going on, but not sufficient proof of a crime. Therefore, it is important to find evidence of drug production itself. For example, substances used for producing drugs (or other illegal things, such as explosives) may have perfectly innocuous other uses, and therefore the possession of a substance (unless it is really uniquely used for the production of a particular drug and for nothing else, which is rarely the case) is not proof of criminal intent. (For example, in the Netherlands, people have been accused of preparing crime because they possessed both sugar and condoms (which can be used to make bombs), or cosmetics (which can be used for obfuscation when robbing a bank).¹⁹) For production of particular illicit substances, such as certain drugs, the situation might be simpler, since certain chemicals may only have a single use in the production of illegal substances. Possession of such chemicals might well be criminalised; however, new applications for those chemicals might be found, and perpetrators could find new chemicals to use for drug production, thus triggering another cat-and-mouse game where the legislator might often lag behind criminal practice (cf. also *infra*, 3.3, on technology neutrality). Altogether, it seems unlikely that changing substantive criminal law to criminalize possession of a wider set of chemicals would be both effective and legitimate, and it seems reasonable to focus investigation efforts instead on finding evidence of concrete drug production activities. Importantly, the sewage monitoring system should also focus on detecting substances which do not have a widespread legal use, since the detection of substances which have lawful applications would likely not meet the standard of suspicion required for follow-up investigation activities, or provide evidence of criminal activity.

Although the focus in criminal investigation on drug production is an instance of the shift to earlier stages of criminal conduct and illustrative of the shift towards prevention, we should also observe that the old paradigm retains validity: after all, the scenario we are primarily considering in this paper is one where sewage monitoring is used when there is concrete suspicion of criminal investigation, with a view to finding the right occasion for follow-up measures such as search and seizure. If the other scenario were considered, in which sewage monitoring is used for scanning the sewage system in order to find signs of drugs production, the shift to the new paradigm would become much more prominent.

For a sewage monitoring system, one major factor to be considered is that in both scenarios—particularly pertinent in the large-scale scanning scenario, but also relevant in the focused-investigation scenario—we should carefully consider the checks and balances. In the traditional paradigm, criminal law is reactive and the checks and balances are all targeted on finding and prosecuting a suspect, with the criminal trial being the core stage where evidence can be challenged and is tested. The judge determines whether investigation activities by the police were legitimate. In the new paradigm, however, many cases of criminal investigation do not end up in court, for example because they are focused on pre-emption rather than prosecution, or because profiling activities have not resulted in sufficient evidence to make a case against concrete suspects. There is therefore a gap in legal protection if criminal investigation primarily relies on elements of the new, preventative paradigm.²⁰ For sewage monitoring in the focused-investigation scenario (which resides perhaps still more in the traditional than in the new paradigm), the emerging gaps in legal protection may not yet be particularly relevant, as long as the use of the application can somehow be tested in court; notification of investigated subjects (in case sewage monitoring does not lead to a search of premises and a subsequent prosecution of suspects) is in that light a vital safeguard (see further *infra*, 4.3). However, since sewage monitoring is a form of sensing that relies on technical procedures that are seldom completely

¹⁸ Cf. Koops 2009, p. 114-115.

¹⁹ See Koops 2006b, p. 21, with references.

²⁰ Koops 2009, p. 119 et seq.

fool-proof, a point of attention is also how the LEAs will deal with false positives. It cannot be excluded that a sewage monitoring system indicates the presence of a detected chemical, but that this happens due to some malfunctioning of the system (or because in rare cases, another chemical might happen to trigger the same sensor as the sought-after chemical does); it can also happen that the chemical is correctly detected, but that some misinterpretation occurs of the connection between the water flowing through the sensor ring and the premises from which the water is thought to come. In both cases, innocent citizens may suffer from a search of their house or premises. This is not unique for sewage monitoring, of course, but it will depend on the frequency with which such false positives occur, and the way in which searches are conducted (e.g., overtly visible to neighbours, which may cause stigmatisation of the wrongfully investigated persons), whether the correction mechanisms (such as compensation for wrongful criminal investigation) are sufficient to address the risk of false positives in sewage monitoring operations.

2.4. Cumulative effect

It is important to look at the whole picture. This does not only apply to police investigating a case, but also to law-makers considering adapting the law or introducing new law to accommodate new investigation tools. Should there be an insufficient legal basis for sewage monitoring, then law-makers might well consider adapting the law to create a specific legal basis, and introduce safeguards necessary to make the application of sewage monitoring legitimate under article 8 ECHR (cf. *infra*, 3.2); in that case, it will be important for law-makers to look beyond the specific case of sewage monitoring. This is a particular challenge for law - makers, since law and policy typically develop through small, incremental, and individual changes rather than through systematic large-scale revisions. This practice of law-making involves a great risk, however, namely of the gradual erosion of privacy. Each single new tool that can be used for criminal investigation might well be worthwhile to accommodate in investigation practice and therefore to change the law accordingly; yet the accumulation of many such single measure might well have an overall effect on privacy—and possibly also on other fundamental rights such as freedom of expression, non-discrimination, or due process—that is much larger than the sum of its parts. Consider, for example, all the changes in criminal investigation that have taken place over the past fifteen years; in many countries, camera surveillance has become much more prevalence, DNA forensics has developed new applications such as familial searching DNA phenotyping (deriving a suspect's physical characteristics from crime-scene DNA), interception of communications has expanded not only through the enormous factual increase in communications but also through measures such as data retention and stealth sms or 'stealthy ping' (i.e., covert texting without the recipient being informed of an incoming message), open-source intelligence applied to Internet and social media can yield very precise pictures of people's lives compared to what was possible in 2002—and this list could easily be expanded. Each of these measures, taken in itself, would seem acceptable and could, in itself, be legitimated by the need to combat crime; yet it is questionable whether the cumulative effect of all the measures and developments, taken together, would also be acceptable and legitimate. If one would ask people in 2002 whether they would accept a future scenario in 2018 in which of all the mentioned developments had manifested themselves, it might well be that people would be hesitant or even downright opposed to such a scenario. But like the frog being boiled by slowly raising the temperature of the water, instead of throwing it in boiling water, people get used to slow, incremental changes. This is an example of what Nissenbaum calls the 'tyranny of the normal': the phenomenon of 'insidious shifts in practice that ultimately gain acceptance as "normal"', because the 'changes may be imperceptible moment to moment in real time, yet (...) over an extended period, imperceptible change may lead to inexorable ruptures. By the time these ruptures surface in public deliberation, protest, or court cases, the new normal may be comfortably entrenched'.²¹ This is why the regulation of sewage monitoring should not be discussed in isolation, but in the context of wider and longer-term developments in intelligence-led policing, remote sensing, and covert surveillance, in order to realise what the cumulative effect of all these developments are on privacy and other fundamental rights.

²¹ Nissenbaum 2010, p. 160-161.

On the more specific level of criminal investigation, rather than the general level of law-making, a similar challenge exists. The application of a single investigation method may in itself be little intrusive: in itself, monitoring sewage water to determine some specific chemicals, targeted at specific premises suspected of drugs production, is not particularly privacy-invasive. However, if the method of sewage monitoring (possibly going beyond the currently foreseen capabilities of a sewage monitoring system) is combined with other measures, the accumulation of several measures that are all in themselves little intrusive, might turn out to be quite intrusive. Thus, for instance, sewage monitoring revealing details about frequency of toilet use, or consumption of certain drugs, combined with monitoring of phone records or location data revealing contacts with medical professionals, could allow more specific inferences to be made about the health status of the person under surveillance than application of only one of these measures. This is recognised in the so-called ‘mosaic theory’, developed in US case-law and doctrine, which holds that the putting together of a sufficient number of pieces of information that in themselves reveal little or nothing of someone’s private life (mosaic stones), may result in a picture (the mosaic) that is quite revealing. In short, the ‘whole reveals more—sometimes a great deal more—than does the sum of its parts.’²² A somewhat similar concept is recognised in German law where courts consider whether the combination of investigative activities result in ‘total surveillance’ (*Totalüberwachung*), which can be disproportional,²³ and in Dutch law where the criterion of ‘systematicness’ is applied, which is the case when an investigation results in ‘a more or less complete image being obtained of certain aspects of someone’s [private] life.’²⁴ The application of the mosaic theory or the related criteria of total or systematic surveillance is, however, piecemeal and rather embryonic, being applied so far largely in the context of location tracking but not in all forms of surveillance. We think it is important that something like the mosaic theory is developed further in legal doctrine and applied more widely and consistently in legal practice, particular when covert methods are applied over longer periods of time, and particularly also in cases where multiple investigation methods are applied simultaneously or consecutively targeted at the same persons. This line of thinking has already manifested in the German doctrine, in which the need for the so-called overall warrants is debated, when a combination of measures that individually do not require a warrant has a potential for interfering with private life in a more substantial way (see further *infra*, 4.3).

3. Interpreting laws not written for new technologies

3.1. Interpretation strategies

Because law is embedded in natural language, and natural language is frequently polysemous (allowing for multiple meanings) or imprecise, interpretation is an intrinsic part of the law. This is both a strength and a weakness: it allows law-makers to formulate general laws that can cover multiple situations and that could address also unforeseen situations (and obviously, it would be impossible to write laws for each specific possible situation); but that also creates some uncertainty as to what is covered by the law. This tension is the core of the discussion on technology neutrality (see *infra*, 3.3).

Some laws may be more generic, and therefore require more interpretation in order to apply it to a concrete situation at hand, or more specific, making it relatively clear how the law applies to the concrete situation. Criminal law, in principle, should be more the latter kind (as opposed to civil law, which more frequently applies open norms), because of the particularly serious consequences that application of criminal law has for citizens (which may include use of violence and forced deprivation of liberty). The general *lex certa* principle, and the more specific *Bestimmtheitsgebot* in criminal law, require the law to be sufficiently precise so that citizens know what to expect—both which conduct of theirs is considered a criminal offence, and under which conditions the police is allowed to investigate their conduct. Law-makers therefore have to

²² United States v. Maynard, 615 F.3d 544 (D.C.Cir. 2010) at 558. See also United States v. Jones, 565 U.S. 400 at 417-18 (Sotomayor, concurrence), 428-31 (Alito, concurrence).

²³ BGH 24 January 2001 3 StR 324/00 (OLG Düsseldorf); BVerfGE 112, 304 (319); BVerfGE 125, 260 (329).

²⁴ *Kamerstukken II* [Parliamentary Documents Second Chamber, Netherlands] 1996/97, 25 403, no. 3, p. 26-27.

formulate substantive and procedural criminal law with particular precision. However, also criminal law needs to be abstract to a certain degree: it would not work to enumerate in the law of criminal procedure all the types of buildings for which the police requires a warrant if they want to search inside the building (a house, an apartment, a garage, a holiday home, etc.) because such a list would run the risk of being incomplete; moreover, even such a list requires interpretation (e.g., does the shared entry hall of an apartment building belong to ‘an apartment’?). The need for interpretation, which is thus always present in criminal law, is particularly poignant in relation to new technologies, which law-makers have often not foreseen when drafting the law, so that it will frequently be unclear, at least *prima facie*, how a situation involving a new technology should be qualified under existing law.

In Continental legal systems, the interpretation of criminal law is general based on the following strategies:²⁵

- *grammatical interpretation*: the meaning of words can be derived, if its literal meaning is not obvious or is possibly equivocal, from general linguistic sources, such as authoritative dictionaries or how a word is generally understood or used in a certain context; the *Wortlautgrenze* (boundaries of text) puts limitations on the room for interpretation;
- *legal-historical interpretation*: the legal history of a provision can give clear indications of how it is to be interpreted; the *travaux préparatoires* (preparatory documents) can give insight into the meaning that the law-makers attributed to words and clauses, and they often contain examples of situations intended to be covered by the law. This interpretation is therefore closely connected to:
- *teleological interpretation*, which looks at the intention of the law-maker for the provision at hand; where the legal-historical interpretation is based on concrete and explicit evidence in the legal history of the law-makers intention, the teleological strategy largely uses the same sources (legislative history) but, in the absence of concrete or explicit guidance, construes the apparent intention of the law-maker from the context; the apparent intention may also be derived using another strategy:
- *legal-systematic interpretation*: the structure of a law can indicate how a provision is meant to be interpreted, for instance by looking at the section in which a crime is included (which may contain a heading on the legal good protected by the criminalisation, such as ‘Offences against public health’) or the relation between a provision and similar provisions, with a view to ensuring coherence and consistency in the interpretation of the law as a whole;
- *jurisprudential interpretation*: although Continental systems do not use the doctrine of legal precedent that is a core principle in common-law systems, previous court cases are authoritative in the sense that, in the absence of clear guidance from the above-mentioned principles, a court judgement in a similar case will guide the interpretation of a second case. Particularly case-law from the higher courts, and more particularly from the Supreme Court, will often serve as a source of interpretation. However, this depends on the comparability of a case: no criminal case is exactly the same, and it therefore requires interpretation to see whether the case is sufficiently similar to an earlier case to warrant following the interpretation made in that case. Criminal law does not allow interpretation to be based on (mere) analogies—the *Analogieverbot*—because it is insufficiently foreseeable for citizens to know how analogies will be drawn. The borderline between ‘extensive’ interpretation (which is allowed) and ‘analogous’ interpretation (which is not) is not easy to determine.

While these interpretation strategies are firmly embedded in the theory and practice of criminal law, and generally function well to apply the law also to new and unforeseen situations, there is a caveat, relating to the finding that socio-technological changes take place slowly and often relatively invisibly, leading to a ‘new normal’ (*supra*, 2.2). While practitioners and courts can rely on interpretation the law based on grammar, legal history, and the system of the law, the world may have changed in fundamental ways. Therefore, the legal-historical method of interpretation needs to be applied with care: it will be more reliable to apply for relatively recent laws than for older laws.²⁶ A case in point is the Dutch Special Investigatory Powers Act (*Wet bijzondere*

²⁵ See De Hullu 2012, p. 98-101; Bohlander 2009, p. 15.

²⁶ De Hullu 2012, p. 99.

opsporingsbevoegdheden) of 2000, which was passed to create a comprehensive regulation of different types of surveillance powers. The Internet, of course, existed in the late 1990s when the law was prepared, and the law-maker made some references to the fact that the police can—like any Internet user—surf the Internet to gather information.²⁷ This explicit statement by the law-maker might be used to conclude that the police is allowed to gather information from the Internet without limitations, based on the task description of the police (art. 3 Police Act 2012), since this apparently was the law-maker's intention. However, the Internet as of now is fundamentally different from what it was in 1998: the amount of information on the Internet has increased enormously, the types of information (e.g., videos) have expanded, and the Internet plays a far more profound role in social life than it did in the 1990s. The result is that open-source intelligence can reveal a very intricate picture of someone's private life, in a way that was impossible, and likely unforeseen, at the time the Special Investigatory Powers Act was passed. This demonstrates that legal-historical and legal-systematic interpretations have to be applied carefully, taking into account also the wider socio-technical context in which a law is applied currently, in relation to the context in which it was passed.

For sewage monitoring, the caveat may, at first glance, not be relevant. After all, sewage monitoring is a physical type of observation that appears rather similar to many other types of physical observation that have been used by the police for a long time. Placing a sensor in a sewage system close to the sewage outlet of a house is rather similar to placing a camera targeted at the front door of a house to see who is coming in or out. And in contrast to the Internet, sewage systems have not really fundamentally changed over the past decades in terms of what flows through them. Although law-makers may not have thought of sewage monitoring as a method to find out what is going on inside a premises, one might reason that it is sufficiently similar to camera surveillance of the outside of a house that it falls under the same provision regulating visual observation (see further *infra*, 4.1). However, also such an interpretation strategy should be applied with caution. Socio-technical changes do not only alter the amount of information available, but also the nature of information available, and this may influence the way we perceive the world. Verbeek has shown how the emergence of ultrasound scans of pregnant women—which made visible what was not visible before, and what we didn't realise was invisible before the technology emerge to see it—has changed the way embryos in early stages of pregnancy are perceived and understood, and how this affects decision-making on abortion.²⁸ Technology therefore also influences perception in a hermeneutic way: it influences how we see the world. This may also be relevant for sewage monitoring: if new technologies show something in sewage waste that was not visible or otherwise perceptible before (and which we didn't realise had the potential to be made perceptible), it can affect the way we understand sewage waste. If law-makers have not foreseen the possibility of technically determining the presence in sewage systems of substance that are not perceptible with (possibly enhanced) human senses, one should therefore hesitate to assume that they have (implicitly) intended this possibility to be used by police under general powers of observation.

In summary, different interpretation strategies are available to apply existing criminal law to new forms of investigation such as sewage monitoring: grammatical, legal-historical, legal-systematic, teleological, and case-law-based. In the absence of explicit guidance by law-makers in legislative history and court cases, however, it is not straightforward to apply these strategies, given that the wider context of socio-technical change needs to be taken into account, as well as the affordances of technology to perceive the world in ways law-makers did not know were possible (and even did not know that they did not know this). In such circumstances, it is appropriate to turn to the constitutional framework, as this is the most fundamental and generic guidance we have on what police are allowed to do, and to see whether that offers guidance.

3.2. Criminal law and constitutional protection

Law enforcement has to function within the framework of constitutional protection. Although several constitutional rights may be at issue in sewage monitoring for law enforcement

²⁷ *Kamerstukken II* 1998/99, 26 671, no. 3, p. 35.

²⁸ Verbeek 2006.

purposes,²⁹ we focus here on the rights to privacy and the right to a fair trial, which are most clearly at stake.

3.2.1. Privacy

The European Convention on Human Rights (ECHR) provides a common framework for the countries considered in this paper. Article 8 ECHR formulates the right to privacy as follows:

- “1. Everyone has the right to respect for his private and family life, his home and his correspondence.
2. There shall be no interference by a public authority with the exercise of this right except such as is in accordance with the law and is necessary in a democratic society in the interests of national security, public safety or the economic well-being of the country, for the prevention of disorder or crime, for the protection of health or morals, or for the protection of the rights and freedoms of others.”

Under article 8, the first question to be answered is whether there is an interference with the right to privacy as meant in the first paragraph.³⁰ Depending on its sensors and the place of monitoring, sewage monitoring can interfere with the right to private and family life, since identifying substances in the sewage outlet of a private place (the one under investigation) will tell something about what people do there in the context of their private life; after all, it is the purpose of the monitoring system to find out whether people flush certain substances down the toilet in their private place. More generally, since sewage waste contains bodily excretions that can potentially reveal sensitive data (such as use of medicine or pregnancy), the fact that sewage waste is monitored—even if this is not concretely focused on analysing human excretions or retrieving such data—can be considered an interference with private life. The level of interference with the right to privacy will depend on the specific affordances of the sewage monitoring system. The interference can be relatively small, if only very specific substances connected to drugs production are detectable, and grow more serious with growing capabilities and enhanced detectability of a wider range of substances or collection of samples.

Sewage monitoring may also interfere with the right to respect of the home, particularly if the sensors are placed in a part of the sewer system that is considered part of the home environment.³¹ The boundaries of a ‘home’ are somewhat fuzzy, and do not exactly coincide with the walls of a house. Moreover, the interpretation of ‘home’ is increasingly broad, covering not only houses but also, for example, offices and, depending on the circumstances, garages or sheds. As the interpretation of ‘home’ is very context-dependent, and we are not aware of ECtHR or national case-law on the question whether or to what extent a sewage outlet is part of the home in the context of article 8 ECHR, this question cannot be answered in this paper.³² It is not

²⁹ To different degrees, several rights and freedoms from the EU Charter of Fundamental Rights might be affected by law-enforcement sewage monitoring: non-discrimination (if it were applied particularly in neighbourhoods populated by minorities), freedom of religion (if it would target drugs (also) used in certain religions), the right to property (by interfering with the sewage pipe), the right to health care (if it has a chilling effect on people’s intake of medicine, or on people’s willingness to go to the toilet), the right to environmental protection (if the system would pollute the environment by leaving sensors in the sewage pipe after use), freedom of residence (if it has a chilling effect on people’s choice to live in certain neighbourhoods), and the freedom to conduct a business (if the sensor would include chemicals that can also be used for legitimate business). We do not discuss these, as the argument for these rights and freedoms being affected is rather weak for the scenario discussed in this paper. Nevertheless, if sewage monitoring were used for other scenarios, including wide-scale, non-targeted scanning of the sewage system for multiple substances, the argument would become stronger, and such broader applications would need to be carefully scrutinised on the basis of other rights and freedoms than those discussed in this paper.

³⁰ It is important to emphasize here that a privacy ‘interference’ is not necessarily a ‘violation’ of privacy (that is only the case if the second question under article 8 is answered negatively, see below). The question here is whether privacy is *affected* in the first place by a certain activity, which is a relatively low threshold (and one that includes many activities that are perfectly legitimate since they comply with the requirements of the second paragraph of article 8).

³¹ A sewage monitoring system is to be located in the main tube line, which is considered public. However, other sewage monitoring technologies could foreseeably be placed beyond the public sewage system, so that the question is relevant to discuss here.

³² Cf. Van der Sloot 2015 (suggesting that at some point in time, the sewer might also be interpreted as falling within the scope of the notion of ‘home’).

evident that the part of the sewage outlet outside of private premises is part of the home, and the part outside of the area covered by private property will not be considered part of the home, so that it is not *prima facie* likely that sewage sensor systems will physically interfere with a part of the home.

There is, however, another way in which the right to respect of the home could be affected by sewage monitoring, if it uncovers information about what is going on inside the home and this would affect the 'home peace' (*Hausfrieden*) that the right to respect of the home aims at protecting. Whether it does so cannot be answered on the basis of existing case-law; there are simply no precedents for sewage monitoring in ECtHR or national case-law that are sufficiently analogous as to warrant being used as an interpretation strategy (cf. *supra*, 3.1). Under national law, the answer may be more straightforward; at least for Dutch law, monitoring what happens inside the home from the outside, without physically entering into the home, is not considered an infringement of the right to respect for the home, since the Dutch constitutional right is formulated as a right protecting against trespass (*binnentreden*). However, the German constitutional provision protecting inviolability of the home specifically protects not only against physical intrusions, but also against technical means of surveillance of the home.³³ Nevertheless, it is unclear whether sewage monitoring (which takes place outside the home and only indirectly allows the investigators to draw conclusions about persons in the home) would be considered to interfere with the inviolability of the home as guaranteed by Art. 13 GG. No case law is available that could resolve this issue.

While the question whether sewage monitoring interferes with the right to respect for the home cannot be clearly answered (it requires more in-depth analysis, that will be conducted in a parallel working paper), the fact remains that sewage monitoring interferes with the right to respect for private and family life.

The second question under article 8, then, is whether the interference is acceptable under the test indicated in the second paragraph. This test is threefold. First, the interference has to be in accordance with the law, which requires a legal basis that should be sufficiently precise (the above-mentioned *Bestimmtheitsgebot*) so that the interference is sufficiently foreseeable for citizens. The legal basis also has to be of sufficient quality, which may require the inclusion of particular safeguards in the statutory basis.³⁴ The degree of precision and foreseeability and of the quality of the law depend on the seriousness of the infringement. In light of the scenario in which the sewage sensor, in a targeted investigation, only monitors the presence of one or a few particular chemical substances, the privacy interference is not particularly serious, so that the legal basis does not have to be as precise as very intrusive measures such as interception of communications require, nor necessarily to include particularly strict safeguards. (See further *infra*, 3.4 and 4.1.)

The second element of the test is that the interference needs to serve one of the exhaustively enumerated aims in article 8(2); since these include the prevention of disorder or crime (as well as the protection of health, which is what criminalization of drug production also aims at), this prong of the test is easily passed.

The third element is whether the interference is necessary in a democratic society. There is clearly a 'pressing social need'³⁵ to combat the production of hard drugs, so that the enforcement of drug crime law warrants interferences with fundamental rights. Whether the interference is 'necessary', however, involves assessing whether it meets the requirements of proportionality and subsidiarity. This again depends on the seriousness of the infringement, but also on other factors, such as how the sewage monitoring is implemented exactly (e.g., which substances are sensed), on the intensity, duration, and frequency of the monitoring, as well as on the checks and balances that apply to the law-enforcement's operation in the national context (which may have to include, for example, legal obligations to notify people *ex post* of the surveillance measure and legal opportunities to contest the measure in court³⁶). The proportionality and subsidiarity

³³ Art. 13(4) Grundgesetz für die Bundesrepublik Deutschland (German Basic Law).

³⁴ *Kruslin v. France* (1990), App.no. 11801/85; *Huvig v. France* (1990), App.no. 11105/84.

³⁵ *Sunday Times v. the United Kingdom* (1979), App.no. 6538/74.

³⁶ *Klass v. Germany* (1978), App.no. 5029/71.

assessment is therefore also related to the question of the legal basis and the associated checks and balances under national law (see further *infra*, Ch. 4). Overall, it requires a very context-dependent assessment, and the lack of precedents that are sufficiently similar to sewage monitoring make it impossible to answer this question here.³⁷

3.2.2. Fair trial

The other main constitutional right relevant for law-enforcement sewage monitoring is the right to a fair trial, as stipulated in article 6 ECHR. This right includes many specific elements, such as the presumption of innocence (which is not especially relevant for the present case), the right to remain silent and the privilege against self-incrimination (which is not at issue here), and procedural rights, such as the defendant's right to examine or have examined witnesses against him. The latter might be relevant for the present case, if sewage monitoring yields information that is presented as evidence in court; the acceptability under article 6 might depend on the way it is presented, the way in which the reliability of the evidence is assessed, and the extent to which it may be challenged during the trial. (This is further discussed *infra*, 4.5.)

A relevant point is, if the data resulting from the sewage monitoring is not used as evidence as such, but as input for constructing a reasonable level of suspicion on which other investigation powers can be based, whether the defence has sufficient opportunities to contest the evidence resulting from the other investigation powers. This applies particularly to the alternative scenario in which the sewage monitoring system is used for broader scanning of the sewer to detect signs of possible illegal drug production activity, which is not the primary focus of this paper. It may, however, also play a role in the present scenario if a follow-up investigation activity is based (also) on the results of the sewage monitoring and this activity then yields evidence of illegal drug production. Although law enforcement could present only the evidence from, e.g., search and seizure in court, it will be important that the defence is notified of the activities leading up to the search (since evidence acquired subsequent to an unlawful act of investigation may be declared inadmissible, depending on the extent to which a national system applies the so-called 'fruits of the poisonous tree' doctrine for follow-up evidence). The fact of sewage monitoring and the resulting information used as a basis for the decision to conduct follow-up investigative activities will therefore have to be included in the criminal file, or otherwise notified to the defendant, so that they may contest the sewage monitoring in court (for example, claiming that it had no legal basis, or that it yielded unreliable information that should not have been used for the decision to search).

3.2.3. Reflection on the constitutional framework

The above discussion of the constitutional aspects of law-enforcement sewage monitoring was based on existing law (*lege lata*). Although that is the most relevant for law enforcement, at least in the shorter term, we also want to briefly point out that the constitutional framework needs to be analysed in itself (*lege ferenda*). Although Constitutions are a form of 'slow law', mirroring values that have crystallised over time in a certain legal culture and not easily changeable, also constitutional frameworks need periodic updating, in light of longer-term socio-technical changes (as discussed *supra*, 2.2). This is less relevant for the European Convention on Human Rights, which is a 'living instrument' that is interpreted by the European Court in light of present-day circumstances,³⁸ but it is for national constitutional frameworks. An example of this was already mentioned above: the Dutch framing of the constitutional protection of the home as a right against government trespass (art. 12 Dutch Constitution). This made sense in an age when the police could only acquire (in-depth) knowledge of what happened inside a home by entering it (given that people could draw the curtains if they wanted to prevent the police from looking in), but makes less sense in an age where the walls of a building no longer effectively shield against information collection. Now that much information on home life can be derived without entering the home, but through monitoring from the outside or ordering the production of data from service providers (such as smart metering data from energy companies), the protection of the home needs to be broadened if its aim—ensuring 'peace of the home' for its occupants—is to be fulfilled. More generally, also the Dutch Constitution's distinction of the right to privacy into five

³⁷ The question will be analysed further in a parallel working paper.

³⁸ *Tyler v. the United Kingdom* (1978), App.no. 5856/72.

different categories (general right to privacy, data protection, bodily integrity, the home, and letters and telecommunications), which have different clauses on the conditions for interferences with these rights, may need to be revised in the longer run, now that the various dimensions of privacy are collapsing.³⁹ The same might apply to the German Basic Law (distinguishing the home, correspondence and a variety of rights based on the general personality right and/or the protection of human dignity⁴⁰) and the Polish Constitution (distinguishing private and family life, communication, home, and personal information), although the presence of constitutional courts in these jurisdictions (in contrast to the Netherlands) may make revision of the Constitution itself less urgent since the constitutional courts can, to some extent, re-interpret constitutional rights in light of present-day circumstances or even establish new constitutional rights as part of the Constitution, as the German Constitutional Court has done with the right to confidentiality and integrity of information technology systems.⁴¹

3.3. Technology neutrality versus legal certainty

As observed in section 3.1, there is a tension between formulating general laws that can cover multiple situations and providing sufficient legal certainty on what is and is not covered by the law. In relation to this, it is often claimed that laws should be ‘technology neutral’, i.e., they should not refer to particular technologies or applications, in order to avoid that the law is too specific and too dependent on a certain technology and that it cannot be applied to emerging technologies for which the law has not been written. This issue has been analysed in academic literature on technology regulation, which points out that, although the desire for technology-neutral laws is understandable and should be addressed, it is not always a preponderant requirement: if a law intended to regulate technology does not refer to technology at all, it becomes almost meaningless and will not be able to offer any legal certainty. Therefore, a trade-off has to be made between technology neutrality and legal certainty.⁴²

Law-makers tend to have a preference for technology-neutral law, since it enables them to set relatively generic standards that apply in many possible situations, and therefore may also be able to be used in future cases with new technologies, so that they do not have to change the law for every new technological development. Courts will generally be able to apply existing law to new cases (which is, after all, their job), and while this is sometimes complicated in situations involving new technologies not foreseen by law-makers, they by and large are capable of applying the law using the available interpretation strategies (see section 3.1). For practitioners in law enforcement, however, technologically-neutral norms tend to be abstract and provide (too) little guidance on what is and is not allowed; from that perspective, there is a need for more specific legislation. Although the role of the court is still to interpret legislation, practice cannot rely only on judicial interpretations of general laws, if only because it may take considerable time before an emerging practice is tested in court with a sufficiently clear answer on the conditions under which the practice would be allowed. The law therefore needs to be sufficiently precise, in order to give police and public prosecutors guidance whether and to what extent they can use certain technological applications.

This is not only emphasised by practitioners. Also academics stress the importance of legal certainty and consequently of having sufficiently precise legislation.⁴³ In times where we observe on the one hand very rapid development of new technologies and, on the other hand, a traditionally slower development of regulation, it seems too tempting for law-makers to introduce general and sweeping legislation. Yet legislation that allows infringements to citizens’ rights and liberties must be worded as precisely as possible. This is not to say that (too) specific technologies should be mentioned in the law; the law still needs to be of a sufficiently general

³⁹ See Koops 2014 (discussing how home, body, communications, and data are becoming intertwined through socio-technological developments).

⁴⁰ Such as the right to informational self-determination, the right to one’s image, the privacy of the spoken word, the right to a private life outside one’s home, the right to the integrity and confidentiality of IT systems.

⁴¹ BVerfG, Judgment of the First Senate of 27 February 2008 - 1 BvR 370/07, http://www.bverfg.de/e/rs20080227_1bvr037007en.html.

⁴² Koops 2006a. Cf. also Ohm 2010 and Faure, Goodwin & Weber 2014.

⁴³ Koops 2006a.

level to prevent it having to be adapted every year with the latest technological application. Thus, the trade-off is recognised, but hard to resolve in general.

For sewage monitoring, this implies that it needs to be sufficiently foreseeable for citizens to know that, and under which conditions (for example, for the investigation of which types of crime), law enforcement is allowed to apply sewage monitoring for investigating crime, so that there has to be at least a clear legal basis for this investigation method that citizens associate with the possibility of their sewage outlet being monitored. At the same time, the law should at least not be so specific as to mention, for example, which sensors can be used and which substances can be monitored in particular. We should note, however, that the substances that can be monitored are related to the type(s) of drugs being investigated, and that the law on illegal substances can be (and has to be) very precise. This also implies that there is a trade-off between substantive and procedural criminal law: if substantive law (criminalisation of illegal substances) is more generic, it will be less proportional (given that it is likely to over-criminalise substance production), but the monitoring of sewage waste is likely to be more proportional (given that it can target a large group of substances). And vice versa: the more precise (and therefore proportional) substantive law on illegal substances is, the more the investigation of drug production using sewage monitoring will risk being disproportional as the sensed substances in the sewage waste will more likely be used also in production of lawful substances.

In any case, the trade-off between technology neutrality and legal certainty leaves a relatively large room for the question of the legal basis that is needed for sewage monitoring. Should sewage monitoring be regulated in law as a specific type of investigation power, with a dedicated set of conditions and checks and balances, or can or should it be regulated under a more general power of data collection using sensors that measure emanations from buildings? This question cannot be answered in general, but needs to be addressed by law-makers in each individual national system. In the next section, we provide a few general observations that may help law-makers in answering this question.

3.4. Finding the legal basis for sewage monitoring: some considerations

Based on all the above discussions, we can offer some considerations on where to find the legal basis in criminal procedure law for sewage monitoring. We observed that it has to be foreseeable for citizens when and under which conditions law enforcement might use sewage monitoring for criminal investigation, and that (in the scenario considered in this paper) the privacy infringement is not evidently so serious as to warrant a very precise statutory basis or safeguards. Law-makers can (and should) still consider the option of introducing a specific and fine-tuned regulation for law-enforcement sewage monitoring (given that it has no obvious precedents in criminal investigation), but absent new and case-specific legislation, we should consider whether and where a legal basis can be found in existing criminal procedure law.

The first question to consider is whether sewage monitoring can be based on the a general provision(s) on the tasks or general powers of the police (such as art. 3 Dutch Police Act, Sections 161, 163 and 163f of the German Code of Criminal Procedure (StPO), Art. 14 of the Polish Police Act) or whether it should be based on a specific investigation power. This largely depends on the level of intrusiveness that sewage monitoring is considered to have, but also on the extent to which the general task or power description of the police can be interpreted to encompass new investigation methods; this varies from country to country.

One investigation method that many countries assume can be based on the general task or power description of the police (or that is even considered not to infringe privacy at all, so that there is no need for a legal basis⁴⁴) is a garbage search, i.e., a search of the garbage that is put on the sidewalk to be picked up by garbage collectors. At first glance, this seems a relevant precedent for sewage monitoring. After all, what is flushed down the toilet is also a form of garbage that people discard and send into public space to be processed by public utility companies. At second glance, however, there are some potentially significant differences between the two methods. First, people can decide to put out the garbage just before the garbage

⁴⁴ This is the case in the Netherlands, see Koops 2016b, p. 43.

collectors come, to minimise the risk that others will go through it; this is not possible with sewage waste. Second, garbage collection is relatively more visible than sewage monitoring for citizens; they can, in principle, see who collects the garbage (and possibly note differences if this are not the ordinary garbage van or regular garbage collectors they see every week, whereas they cannot see who is collecting (or going through) their sewage waste. Third, garbage search is likely to be done by the investigator in person, while targeted sewage monitoring (presumably) is possible only through deployment of technical means. Fourth, and most importantly, people can decide what to put in the garbage bag and in which state; they may, for instance, dispose of certain goods elsewhere if they fear it might be searched by the police if put in their garbage bags, and, more relevantly, they can try to obfuscate sensitive information by destroying something before throwing it away (such as burning a letter and throwing away the ashes). Such obfuscation and alternative disposal methods are significantly more limited with toilet use, at least when it comes to people's natural needs of excretion. Overall, there seem to be sufficient differences, particularly in terms of covertness and in citizens' practical capacities to control the information derivable from their waste, to conclude that sewage monitoring cannot simply be equated with garbage searches, so that the case-law on garbage searches cannot be unequivocally transposed for the purposes of regulating sewage monitoring.

Another investigation method that is somewhat similar to sewage monitoring is thermal imaging (flying over an area with a thermal imager to detect which buildings radiate excessive heat patterns, which suggests the presence of a marijuana plantation or heated reaction vessels used in synthetic drug production). This can be considered a form of (an extension of) visual observation by police, which to some extent falls under the task or power description of the police or, where more intrusive applications occur, falls under a particular surveillance power (such as systematic observation, art. 126g Dutch Code of Criminal Procedure, observation using technical means under Section 100h(1,2) German Code of Criminal Procedure). Thermal imaging is often considered not to be a very intrusive type of investigation power, since it seems a functional equivalent of observing the outside of houses (and, in snowy climates in winter, it is easily observable for police that in certain snow-less buildings, excessive heat is generated).⁴⁵ This may be a more fitting analogy to sewage monitoring than garbage searches: the goal is similar (finding signals of drug production) and the method is similar to the effect that a sensor is used to measure a particular type of information (temperature and the presence of a particular chemical substance, respectively). One difference is that the type of information sensed is much more specific in the case of sewage monitoring; this makes it less intrusive (since it only provides a positive signal if the particular chemical is present in the sewage waste, whereas the thermal imager always measures a temperature) but at the same time also more intrusive (since the presence of a particular chemical yields more information about what is going on in a building than the temperature indicates). Another difference is that citizens can, up to a point, protect themselves from thermal imaging by increasing the isolation of the building, so that less heat is radiated to the outside; such obfuscation is not possible with toilet use (people can hardly install filters in their toilets that capture substances from their excretions that they do not want to be detectable in the sewer). Perhaps more importantly, thermal imagers are normally used for short periods, flying over a certain area, and it requires humans to carry and operate the imager. In contrast, sewage monitoring relies on an automated system and on sensing over a longer period of time. This implies that the practical obstacles for police may be higher for thermal imagers (require more human resources) than they are for sewage monitoring (although this may also depend on the cost of sewage-monitoring robots, which can be high at the initial stages of their development). Altogether, thermal imaging might be considered a useful possible analogy to consider in determining the legal basis for police to apply sewage monitoring, but the similarities and differences have to be more closely looked to know whether they can be considered sufficiently similar and equally intrusive measures to warrant applying the same legal basis and safeguards. This depends on the particular regulation of surveillance measures in national jurisdictions, given that the factors influencing the level of intrusiveness of surveillance power can

⁴⁵ Cf., however, the US case of *Kyllo v. United States*, 533 U.S. 27 (2001), where the Supreme Court considered thermal imaging to be an unreasonable search that requires a judicial warrant, partly because the technology used for it was not in general public use.

differ between legal systems. Therefore, a closer look at national law is required, which is included in the next chapter.

4. Checks and balances for the 'new criminal investigation'?⁴⁶

4.1. Legal basis

As observed *supra* in section 3.3, the trade-off between technology neutrality and legal certainty leaves a relatively large room for the question of the legal basis that is needed for sewage monitoring. Should sewage monitoring be regulated in law as a specific type of investigation power, with a dedicated set of conditions and checks and balances, or can or should it be regulated under a more general provision? Certainly, the present regulation of investigation powers in Poland and Germany does not include an explicit provision on sewage monitoring. This section will present the potential legal basis that would most likely be applied to sewage monitoring as conceived in use case 1. We cannot claim here that these legal bases are sufficient, in terms of specificity and safeguards, to cover sewage monitoring, as this can only be decided by a court; we can merely provide an argument as to which of the currently existing provisions are most likely to apply, based on arguments found in the literature and during the expert workshop. We also indicate reasons why the applicability of these provisions might be in doubt.

In German law, a legal basis does not need to consist of a single provision, but can, depending on the actual conduct, consist of several provisions.⁴⁷ Provisions 160, 161 and 163 of the StPO provide for the general rules regarding criminal investigation of all criminal offences by the prosecution office and/or the police carried out without special technical equipment (anything going beyond human senses) and without entering areas or rooms protected by fundamental human rights (e.g. home, body) for a length of no more than 24 hours; in other words, this only covers short-term and non-intrusive forms of observation. The legislator created Section 161 (basis for conduct of the Prosecution Office) and Section 163 (basis for Police or other investigative personnel's conduct) with the intention of providing a general legal basis for measures, which interfere with fundamental rights in a less substantial way.⁴⁸ In this context, section 163(1) allows police to conduct investigations of any kind, but only to the extent that such investigations are not covered by other, specific provisions; since sewage monitoring might fall under the use of technical measures for surveillance purposes in Section 100h (see below), it is questionable whether short-term sewage monitoring can be based solely on 163(1).⁴⁹

For sewage monitoring taking longer than 24 hours or occurring during two or more days, Section 163f of the StPO (*lex specialis*) is most relevant and applies when a "criminal offence of substantial significance" could have been committed. This type of investigation interferes with one's fundamental right in a more serious and intrusive manner. Although BGH case-law exists suggesting that Section 163f is broad enough to encompass surveillance using technical

⁴⁶ We gratefully acknowledge the input from Cihan Parlar and Maša Galič, which has been used in the writing of this section.

⁴⁷ BGHSt 46, 266: "If technical means within the meaning of Section 100c (1) (1) (b) StPO are used for longer-term observations, then the requirements of § 163 f StPO must also be observed." (own translation)

⁴⁸ Wohlers, before (vor)§ 94, Rn. 1.

⁴⁹ We observe that German law also includes special provisions for preventing damage under police acts of the Länder. Although an argument can be made that drug laboratories constitute imminent danger, since accidents can happen all the time, leading to explosions, fire or emission of hazardous gases, severely endangering the health and the safety of citizens living nearby. However, this argument cannot be made in the context of use case 1, in which sewage monitoring takes place in the context of an on-going investigation. This use case is focused on criminal investigation that includes a need for evidence-gathering that involves a certain period of waiting until sufficient information is collected to prove the case. In that situation, one cannot argue that there is imminent danger, which would imply that the police should simply intervene right away to prevent danger. In the context of criminal procedure, the term imminent danger generally refers to the danger of losing evidence and not danger to other legally protected values.

means,⁵⁰ some scholars raise doubts whether the provision provides a legal basis for such deployment of technical means, and whether a legal basis must be found elsewhere.⁵¹ Sewage monitoring may rely on the usage of several different technical devices and sensors for the purpose of detecting (and gathering evidence for prosecuting) narcotics laboratories. If Section 163f of the StPO, however, does not cover the use of any *special* technical instruments that do more than reinforce human sensory perception (thus, the use of GPS tracking,⁵² for instance, would require an additional legal basis), or conduct using force, the legal basis under Section 163f must be combined with provisions regulating the usage of such instruments (e.g. 100f, 100g, 100h and 100i of the StPO) for the legal basis.⁵³

Since sewage monitoring technology will be deployed in the public sewage system, thus outside of constitutionally protected homes and without interfering with communication, Section 100h paragraph 1 under 2 of the StPO can act as the additional legal basis. This Section gives the police the power to make pictures of suspects and other persons, or to use other technical means for their observations, for example ‘low-jacking’ a car, tracking a person via GPS, use of motion sensors, etc.⁵⁴

Doctrinal texts discuss what counts as a “Special Technical Devices Intended Specifically for Surveillance Purposes” (hereinafter “Technical Device”), according to Section 100h para. 1 under 2 StPO, largely in a negative sense, i.e., discussing measures that are not covered. Measures that are not covered include the taking of images (photographs and video) or even audio-recordings that still allow for observation, although not exclusively designed for this purpose.⁵⁵ Measures that *do* fall under this provision include: determining the location of a person by e.g. RFID⁵⁶ or stealthy ping,⁵⁷ investigating facts and circumstances by e.g. night-vision devices⁵⁸ or drones.⁵⁹ The scope of this provision is, thus, quite broad.

Since in the sewage monitoring first use-case, images, video or audio-recordings are not made, section 100h para. 1 under 2 of the StPO would likely cover the use of the technical observation. However, the requirement of legal specificity could render this technologically neutral provision inapplicable to sewage monitoring. Although the provision seems to cover a wide range of technological means, in some cases of new investigative technologies, the legislator, acting upon concerns of constitutional incompatibility, has created a separate, more technology-specific legal basis for the use of these investigative tools. This was for instance the case with the so-called “IMSI catcher”, the use of which has now been explicitly regulated in Section 100i of the StPO, since the use of Section 100h of the StPO would not satisfy the principles of legal clarity and certainty.⁶⁰ Since it is yet untested whether the German judiciary would find the existing legal basis sufficient for technological sewage monitoring, no clear conclusions on the matter can be made. The possible need of a new regulation therefore cannot be precluded, although it appears likely that Section 100h would cover it. It may, of course, depend on the actual capabilities of the sewage monitoring systems.

The Polish Code of Criminal Procedure (KPK), unlike the procedural codes of many other jurisdictions, does not provide the law enforcement authorities with covert investigation powers. The only exception is the surveillance and recording of phone conversations under Art. 237 KPK, which does not have relevance for the present paper. Nevertheless, various LEAs are equipped

⁵⁰ BGH 3 StR 324/00, 24 January 2001.

⁵¹ It should be noted that the practical significance of the distinction is limited to the question of sufficient legal basis, but has little impact on the procedural requirements that must be followed. Since Section 163f is a measure interfering with fundamental rights more intensively, if the procedural requirements for ordering the measure under Section 163f are met, they would also be sufficient for applying a measure under Section 100h (see below).

⁵² Eschelbach, § 100h, Rn 7.

⁵³ Zöllner, § 163f, Rn 2.

⁵⁴ For long-term police observations, § 163f. 107 MG § 100h Mn 2– 3.

⁵⁵ Hegmann, 2012, § 100h, Rn 6; similar BGHSt 46, 266, 271.

⁵⁶ Gercke, § 100h, Rn 4.

⁵⁷ Hegmann, 2012, § 100h, Rn 6.

⁵⁸ Schmitt § 100h Rn. 2.

⁵⁹ Singelstein 2014, 305-306.

⁶⁰ See Deutscher Bundestag Drucksache 14/9088, 7.

with covert investigation powers under specific laws, such as the Police Act.⁶¹ Under the Polish Police Act, the police is authorised to perform operational reconnaissance activities aimed at uncovering, preventing and detecting criminal offences, independently of the formal criminal proceedings.⁶² These powers are at the disposal of the police in the pre-procedural stage as well as concurrently with the preparatory stage and after it has been discontinued.⁶³ Even though there is a degree of disagreement in the literature about the relation of the operational reconnaissance activities to the criminal proceedings⁶⁴, the former are generally perceived as supplementary to the latter in the sense that the operational activity often serves as a basis for initiating the criminal proceedings or for further procedural measures.⁶⁵ The aims with which these activities can be conducted include the aim of uncovering, preventing and detecting criminal offences.⁶⁶

The Polish Police Act neither defines operational reconnaissance activities, nor does it provide a systematic typology of them.⁶⁷ Some of the more intrusive powers of the police fall within the scope of operational-exploratory activities are covered in Art. 19 (operational surveillance), Art. 19a and Art. 19b (“police provocation”). The operational surveillance under Art. 19, which previously included a technology-neutral legal basis for the use of technical means⁶⁸ in the covert obtaining of information and evidence, has recently been amended, and due to it being strictly limited now to visual and aural surveillance, cannot be applied to the types of sensing envisioned in sewage monitoring.

The legal basis for sewage monitoring in Poland could arguably be based on Art. 19b of the Police Act. This provision allows the police to conduct covert supervision of the preparation, handling, storage and trade in objects of criminal offences, for the purposes of documenting a selected list of criminal offences, or to determine the identity of persons taking part in these offences, or to acquire the objects used in these offences. This provision seems to provide a sufficient legal basis for the use of sewage monitoring. Although the provision itself is relatively vague, the manner in which it should be applied is further specified in a sub-statutory regulation of the Ministry of the Interior, as prescribed by Art. 19b(6) of the Police Act. In this regulation, it is specified that the supervision consists of observing parcels, immovable or movable property including vehicles, if a justifiable assumption exists that they are used for preparation, handling, storage and trade in objects of criminal offences.⁶⁹ The power is not limited to observation: the police can interfere with such objects of criminal offences, especially for the purposes of labeling, removing or exchanging them, or to discover and record forensic traces.⁷⁰ The police can use organoleptic methods (acting on or involving the use of sensing organs) to evaluate the traces, but can also collect samples for the analysis of physical or chemical attributes of the objects.⁷¹ As such, the provision seems to be applicable to monitoring sewage water, if there is a reasonable suspicion that traces of substances originating from drug manufacturing will be detected.

However, the provision itself lacks the mentioning of specific technical means that could be used for sewage monitoring, and any mention of technical means whatsoever. The Ministry Regulation and the literature mention that the observation can be conducted with the use of technical devices registering image and sound, or other technical devices⁷², suggesting this is the established practice. Nevertheless, doubts can be raised whether the text of the provision can be interpreted in this way. As discussed in section 2.1 above, sewage monitoring technology at issue does more than merely enhance human perception. This means that the technology cannot be readily

⁶¹ Szumilo-Kulczycka 2012.

⁶² Art. 14(1) PA.

⁶³ Gołębiewski 2008, 18.

⁶⁴ See e.g. Posytek 2011, 27; Kudla 2015, 98; Chrabkowski 2013, 186-187, Kmiecik, 6.

⁶⁵ See e.g. Szumski 2010, 196; Posytek 2011, 23.

⁶⁶ Art. 14 PA.

⁶⁷ Works on a special act setting out the framework of the operational-exploratory activities has failed to materialize into applicable law to this date.

⁶⁸ Pochodyła, Franc 2011, 199.

⁶⁹ Regulation of the (Polish) Ministry of Interior, nr. 23 nt. 239, 2002, §2(1, 1-2).

⁷⁰ Regulation of the (Polish) Ministry of Interior, nr. 23 nt. 239, 2002, §2(2, 1-2).

⁷¹ Regulation of the (Polish) Ministry of Interior, nr. 23 nt. 239, 2002, §2(3).

⁷² Opaliński, Rogalski, Szustakiewicz, 2015, 261.

qualified as 'ordinary' human surveillance that is conducted by the police in the regular course of their work. Furthermore, a number of provisions in the Police Act explicitly allow the use of technical devices⁷³, which can be seen (using a *contrario* reasoning) as an indication that provisions that do not mention the use of technical devices cannot be understood to implicitly assume that technical devices can be used (otherwise, the explicit mention of technical devices in the mentioned provisions would be superfluous). A more restrictive reading of the law relying on the requirements of legal specificity and certainty might therefore exclude the use of technical devices, making the provision inapplicable to technical sewage monitoring.

4.2. Required legal suspicion

In the previous section, the possible legal basis for the use of sewage monitoring by the law enforcement in Germany and Poland was discussed. Although, as indicated above, the provisions that were identified might potentially be inapplicable due to lack of specificity, for the purposes of the following sections we will assume that they do provide a sufficient legal basis and describe the requirements they set for the deployment of sewage monitoring.

In this section, the circumstances that justify the deployment of sewage monitoring in Germany and Poland will be discussed, both in terms of subject matter being investigated and the level of suspicion required. Also, the foreseen use of sewage monitoring as a supplementary measure to generate or confirm the suspicion required to conduct follow-up investigation activities, such as a house search, will be briefly outlined.

In Germany, surveillance under Section 163f StPO can only be deployed in investigating criminal offences of substantial significance. Unfortunately, the legislator gave no list of such crimes, although this kind of requirement is often used throughout the procedural code.⁷⁴ It can be claimed that the threshold is most likely met when the offence is related to organised crime.⁷⁵ It is therefore not so much the type of crime itself or even the associated maximum punishment, but the circumstances and wrongfulness (*die Verwerflichkeit*) of it in the context in which the crime is committed. Otherwise trivial offences could, thus, become significant when carried out by a criminal organisation. Generally, it can be assumed that criminal activities targeted by a sewage monitoring system will be of substantial significance under Section 30 of the German Narcotics Act (BtMG), since almost always more than a not small amount will be produced. Moreover, the focus of police investigation with sewage monitoring will usually be the operation of clandestine drug laboratories by organised crime groups, which is regulated by Section 30a BtMG, and which will meet the requirement of Section 163f.

In Poland, the power under Section 19b PA is limited to a list of the types of offences for which operational surveillance can be ordered under Art. 19 PA. Although the subject matter is more clearly specified than in Germany, it is still relatively open, and it includes violent crimes as well as economic and other forms of organised crime. The provision lists some specific criminal offences, but also mentions broader descriptions of the types of offences covered, such as all criminal offences related to child pornography or to the manufacture, possession or sale of weapons, ammunition, explosives or psychotropic substances and precursors. The latter type of specification of the subject matter gives a broad degree of discretion to use the power, even in cases of minor manifestations of offences, as long as they are related to the manufacture or possession of drugs.

It is clear that the manufacture of drugs involving setting up laboratories and running them has an organised nature, and would therefore fall in the category of criminal offences of substantial significance under German law, allowing the surveillance under Section 163f StPO. At the same time, by definition, the manufacture of drugs, even in non-organised and minor forms of such activity, is sufficient to justify the use of measures described in Art. 19b of the Polish PA.

Nevertheless, the suspicion related to these criminal offences must be of a certain degree. In Germany, Section 163f of the StPO uses the wording "*sufficient factual indications*." The same

⁷³ Art. 15(4a) PA; Art. 15(5a) PA; Art. 19 PA.

⁷⁴ Plöd § 163f Rn 5.

⁷⁵ Moldenhauer § 163f Rn 13.

standard of suspicion is required for the use of technical means under Section 100h of the StPO. This expression, found in several provisions of the StPO, stands for the lowest degree of suspicion and is the same as the standard of “reasonable suspicion” (*Anfangsverdacht*, Section 152 of the StPO).⁷⁶ As is the case with “reasonable suspicion”, *sufficient factual indications* means that a suspicion is based on factual indications that a prosecutable criminal offence (in this case a crime of substantial significance) has been committed. It is a relatively low standard, which means that the likelihood based on factual indications as interpreted on the basis of the experiences of police officers and the prosecution office can already count as sufficient.⁷⁷ Consequently, it does not necessarily require a concrete suspect and can be based on circumstances and acts emanating from the observation of the situation.⁷⁸

There exist, however, some concerns raised by prominent German academics regarding the degree of suspicion necessary in Section 163f of the StPO. The main argument is based on a comparison with the short-term observation legal basis found in Sections 161 and 163 of the StPO, in which the lowest degree of suspicion (reasonable suspicion) is also required. It is argued, since long-term observation constitutes generally a stronger intrusion into fundamental rights, that this should be justified with a higher degree of suspicion.⁷⁹ Although the wording of the current provision (§ 163f) is clear and cannot be disregarded, this argument can be considered during the mandatory proportionality test performed by the judge (first, by the investigative judge when issuing the warrant, and later during trial), in which the degree of suspicion, the investigated criminal offence and the period of the observation will be weighed against each other.⁸⁰

In Poland, the provision of Art. 19b of the PA does not explicitly specify the required level of suspicion. Considering that the provision only covers activities that aim at documenting criminal offences, the identity of their perpetrators and the acquiring of objects of these offences, the doctrine specifies that a justified assumption (*uzasadnione przypuszczenie*) must exist that the objects that will be observed have a relation to a criminal offence listed in Art. 19 of the PA. The commentary does not further specify the standard of “justified assumption”, but a similar wording is applied in Art. 219 KPK, which regulates searches of places and requires a justified basis to assume that items that can serve as evidence are located there. Here, the justified assumptions can be based only on circumstances obtained in a procedurally sound and properly verified manner. It cannot be based on mere rumours or otherwise questionable sources.⁸¹

Altogether, it does not appear that the standard of suspicion required to use sewage monitoring is very high in either Germany or Poland. Presumptive evidence, based on the observation and experience of the law enforcement officer, even in the absence of a concrete suspect would suffice. The use of sewage monitoring in a targeted way, directed at suspected locations, where the law enforcement have clear factual indications that criminal activity of drug manufacturing is taking place there, would meet the standard in both countries. Note, however, that the second use case, of non-targeted monitoring of a larger area without concrete suspicion or facts indicating specific criminal activity, cannot be based on the legal basis discussed here. In both countries, monitoring is not allowed for merely preventive purposes, and must be reactive to certain facts that indicate, with sufficient likelihood, that drugs are actually being manufactured. Such preventative use of sewage monitoring, in Germany, would have to be based on various police acts, which give the police surveillance powers for preventive purposes. Due to our focus on criminal procedure in this paper, we will not cover these here.

Another aspect related to the level of suspicion arises when sewage monitoring is used as a supplementary measure to a house search, for instance as a measure that can confirm or heighten existing suspicion that drug manufacturing activities are taking place in a particular building or premises, before such premises are searched. While the level of suspicion required for a search to take place is generally not higher in either Poland or Germany than the level of suspicion required for sewage monitoring, the content of the required suspicion is more specific in

⁷⁶ Plöd § 163f Rn 5.

⁷⁷ Weßlau § 152 Rn. 12.

⁷⁸ Weßlau § 152 StPO Rn. 13.

⁷⁹ Zöllner, § 163f, Rn 4.

⁸⁰ Moldenhauer § 163f Rn 12.

⁸¹ Skorupka 2015, 534.

case of searches. Observation measures can be ordered where reasonable suspicion exists that criminal offences have been committed. Such general suspicion is not sufficient to justify a search of a specific place, which is generally only permitted if it can reasonably lead to the obtaining of evidence or apprehending of certain persons. Thus in Poland, a search order requires a justified basis to assume that items that can serve as evidence are located in the place to be searched.⁸² In Germany, a search can be ordered where it may be presumed that it will lead to the discovery of evidence.⁸³

4.3. Oversight: ex ante, ex post or on-going?

Oversight and transparency of criminal investigation measures can be ensured by different means throughout the various stages of the criminal proceedings. In the *ex ante* stage, the oversight is ensured primarily by requirements of authorisation, i.e. who can authorise the measure and how the authorisation is organised. During the execution of the measure, oversight by an independent body may also be a requirement to check whether the grounds for conducting the measure still exist. Transparency, in deployment of covert surveillance measures, is usually not possible for practical reasons, but *ex post* notification of the objects of such surveillance may be required to enable them to challenge the measures (*ex post*) in court and seek remedies for possible wrongful actions. Furthermore, independent *ex post* review of the measures may be a requirement of accountability of law enforcement more in general.

In Germany, the observation measures in accordance with Section 163f of the StPO are subject to the warrant requirement (*Richtervorbehalt*) set out in paragraph 3 of the provision. In exigent circumstances, when delaying the measurement would harm the investigation to uncover a criminal offence, measures can be ordered by the prosecution office or the police (*investigative personnel*) but only if a warrant issued by the court is obtained within three days after ordering the measures.⁸⁴ If such an order is not confirmed by the court within three days, it will become ineffective.

Unlike Section 163f of the StPO, Section 100h has *no* warrant requirement, so that it can be ordered solely by the prosecution office or *investigative personnel* (police).⁸⁵ This, however, does not mean that a warrant is not required for the sewage monitoring first use-case investigative activities. As stated above, the legal basis of the sewage monitoring operations is comprised both of Sections 163f and 100h of the StPO taken together. It is quite common in German criminal law that different sections are combined for the purposes of the legal basis for certain investigation measures.⁸⁶ Although the provision allowing for the use of technical tools in the investigation does not have a warrant requirement, the general legal basis for longer-term *observation* in public regulated in Section 163f does. The investigative measures of the sewage monitoring first use-case, for which Sections 163f and 100h form a legal basis, will thus require a warrant. Nevertheless, in the case of such measures lasting less than 24h and falling under Section 163 (without a warrant requirement), the combined legal basis (Sections 163 and 100h) will not require a warrant. Part of the literature, however considers the option that in some circumstances even measures based on legal provisions not requiring a warrant should require an issue of the so-called overall warrant.⁸⁷ The main argument here is that sometimes *the whole is more than just the sum of its parts*.⁸⁸

The dispute whether an overall warrant is required or a consideration within the proportionality examination is sufficient, remains unanswered at this point, but it is advisable to consider all conducted observation measures within the sewage monitoring first case-use. In practice, this means that the investigative judge needs to be supplied with *all* relevant information when deciding on the issuing of a warrant (as required according for Section 163 of the StPO). If a combination of investigative measures takes place, special caution should be paid to measures

⁸² Art. 219 KPK.

⁸³ Section 102 StPO.

⁸⁴ BGHSt 44, 246; see especially Zöllner, § 163f, Rn 7.

⁸⁵ BVerfGE 112, 304, 318; Eschelbach § 100h Rn 19.

⁸⁶ Jan Steinmetz 2001, 344.

⁸⁷ Jens Puschke, 2004.

⁸⁸ *Ibid.*

that also involve the interception or monitoring of (private) speech, since they bear an intrinsic risk to infringe the core of privacy.⁸⁹

The Polish provision of Art. 19b of the Police Act, which we identified as the potential legal basis for sewage monitoring, is not subject to a warrant requirement. It can be ordered by high-ranking police commanders, and the prosecution office has to be notified without delay. Thus the prosecutor is not involved *ex ante*. Nevertheless, the prosecutor can order the police to stop the activity at any time. The police commanders are also obliged to regularly inform the prosecutor about the results of the activity. Importantly, while in criminal procedure the prosecutor is a party responsible for investigation – and can delegate it to police officers –, the standing of the prosecutor under the Police Act is different. The prosecutor does not have powers equivalent to those of the police under the Police Act and cannot undertake operational reconnaissance activities. The police are not bound by prosecutors' orders in conducting these activities, unless explicitly provided otherwise by the law. Therefore, although the authorisation by the prosecutor cannot be considered equivalent to the authorisation by the court, in the exercise of operational activities by the police under the Police Act, the prosecutor's role is more similar to an independent oversight authority than in investigations regulated under the KPK. That said, the overall transparency and oversight in sewage monitoring by the police in Poland appears to be of a much lower degree than the oversight requirements in the German provisions discussed above. The Polish provision of Art. 19b of the Police Act, owing to the highly secretive nature of the operational activities, for instance does not include notification requirements with regard to the persons that have been monitored, and in contrast to operational surveillance under Art. 19, Art. 19b also does not require the annual reporting on the conduct of this power to the chambers of parliament.

In contrast, in Germany, according to Section 101 I, IV No. 7 and 12, “the person targeted” and “other persons significantly affected” by the conducted measures must be notified of the measures taken against them. The notification should also mention the option of subsequent court relief and the applicable time limit. According to Section 101 I, V, the “notification shall take place as soon as it can be effected without endangering the purpose of the investigation(...).” In case notification is delayed, the reasons must be documented in the file. Since it is essential for the investigative measures of the sewage monitoring to remain secret while they are in operation (and possibly longer, if it is necessary to keep the investigation in general secret), the notification can be delayed for that time. Paragraph 6 of the provision sets a maximum delay of the notification at 12 months after completion of the measure; any further delay of notification can only take place by an approval of the court.

4.4. Co-operation of private parties in the investigation

For purposes other than oversight and accountability, other parties might have to be notified or asked to collaborate in certain investigation measures. Interceptions of communications, for instance, usually require cooperation of private parties responsible for telecommunications networks or the postal service. Similarly, sewage monitoring would likely require some degree of cooperation from the sewage companies, primarily in giving the police access to the sewage pipes and also to its own expertise relating to the infrastructure in which the measures shall take place.

In Poland, Art. 15(6) of the Police Act empowers the police to request assistance from the sewage company, which is a company conducting activity with public utility and thus obliged to provide assistance to law enforcement upon request. Since the main task of the sewage company is to ensure the capacity of the sewage facilities enabling continuous and reliable discharge of waste water, as well as the required quality of the discharged waste water,⁹⁰ and it is obliged to ensure regular internal control of the quantity and quality of domestic waste water and the conditions of its discharge into the sewage system,⁹¹ discovering dumping of chemicals into

⁸⁹ Especially the interception of private speech on private premises according to section 100 c StPO: Moldenhauer, § 163f Rn. 9.

⁹⁰ Art. 5(1) Water and Sewage Act (Poland).

⁹¹ Art 5(1) and Art. 7(5,6) Water and Sewage Act (Poland).

the sewers is also in the interest of the sewage company's ability to fulfil its legally prescribed purpose.

Since every German Land has its own law concerning sewage water (and the federal laws in this area are not useful for our analysis), this area might be regulated differently across the country and falls outside the possible scope of the research for this paper. Most likely, sewage companies would grant access to the sewage water voluntarily to the investigation personnel in situations covered by use case 1, since they also have an interest in preventing drug-production-related chemicals discharge in the sewage system. For use case 2, however, in which there may not be concrete suspicion of actual drug production going on, voluntary cooperation by sewage companies might be more questionable. It may then depend on the specific law on sewage water in the Land whether and to what extent a company can be required to co-operate with law enforcement, if this were needed to install or operate the system.

4.5. Evidence

Although the primary aim of developing a sewage monitoring system may not be the collection of evidence for the purposes of use in a criminal trial, such functionality is possibly useful. Current technology enables identification of certain chemicals in the wastewater from which it is possible to conclude that sewage flow originates from a drugs production site. However, if several producers have different methods of production, and all dump into the sewer, then analysing the water may become more difficult. This raises the question how we can establish trust in the development of certain tools. Can we be sure that such tools are trustworthy and provide accurate data, and eventually also evidence? There are many different technical elements at work, which altogether influence the end result; the more technical steps, tools and experts are involved in the process, the higher the chance becomes of error or uncertainty in the process of collecting evidence. In sewage water analysis, there are some uncertainties in the current methodologies. As noted in section 2.3, the possibility of false positives must be precluded to the largest degree possible. If the system wrongly indicates the presence of a detected chemical due to malfunctioning, or wrong premises are identified as the place of origin, innocent citizens might suffer negative consequences, and unreliable evidence might be created.

It also needs to be considered what type of evidence the sewage monitoring should generate. There are basically two options. First, the system can collect samples of sewage water, which can serve as physical evidence and allows for later (re-)analysis. Second, the evidence collected can have a different nature, namely records of measurements done by detection sensors. If the evidence should consist of the latter, how would we classify this? Arguably, the evidence itself in that case is not the sample: the wastewater is converted into something else, which is the end result. The evidence is therefore the recording of the process of this conversion process, but this is a non-reversible and unique process. Because it cannot be repeated, the whole process must be technically reliable and also should be documented very clearly. Experts must be able to confirm that the results, the changed material, could only be brought about by this specific chemical causing this transformation. This would possibly create a requirement to involve the defence or engage other types of oversight much sooner, since in cases of a non-repeatable experiment, the practical ability to confirm that the correct process has been followed is impossible after it has been completed. Possibly, standard-setting and testing or certification of technical devices should be made mandatory. Dutch law may serve as an example here: according to art. 126ee Dutch Code of Criminal Procedure, relevant covert surveillance measures that rely on technical devices have to comply with the requirements of the Technical Devices Decree⁹² to ensure reliability of the resulting evidence. The situation is significantly different in the former case, that is, if a sewage monitoring system collects and retains a sample of sewage water, since in this case, the sample (assuming it to be of sufficient volume for this purpose) can be (re-)analysed subsequently in a lab, including in a counter-assessment in another lab at the request of the defence.

⁹² Decree on Technical Devices in Criminal Procedure (*Besluit technische hulpmiddelen strafvordering*) (Netherlands).

Due to a number of legal and practical considerations, the effective use of sewage monitoring as a tool of collecting evidence might be challenging. If sewage monitoring is primarily a “diagnostic tool”, to be used in operational activity, the interest in secrecy of the measure would be compromised for future investigation, if the sewage monitoring methods are described in the criminal file and thus available to the defendants. However, if the understandable preference for secrecy would always be followed, it is questionable whether there can be sufficient oversight, transparency and guarantees for the procedural rights of the persons subjected to the monitoring. We argue that also when the results of sewage monitoring are not used as evidence, but only as a basis for further investigation measures (e.g., a house search to obtain physical evidence), or not used at all, there is a need for transparency, since otherwise, no oversight would be possible to check whether the operation of the sewage monitoring has been legitimate.

Nevertheless, the stated challenges do not preclude the use of sewage monitoring for obtaining evidence. In principle, all facts and means of proof relevant to the decision can serve as evidence⁹³ and the courts evaluate the evidence freely, based on their own rationality, knowledge and experience.⁹⁴ Under German law, the application to take evidence may be rejected if the matter is common knowledge, and expert evidence may be rejected if the court itself possesses the necessary specialist knowledge.⁹⁵ Considering the specialist nature of chemical analysis involved in the sewage monitoring, it is unlikely that it would be common knowledge or fall within the scope of the judge’s expertise. In Poland, if special knowledge is required to determine the facts, opinion of an expert must be sought, which can be an individual or an educational institution, or a specialist institution; this includes not only registered experts, but any person who is known to possess expertise in the field.⁹⁶

Thus, the reporting and evaluation of technological results requires expert knowledge, which lawyers are usually not equipped with. Reporting of the results of sewage monitoring, as well as the interpretation of the physical evidence, must be done by expert witnesses. It is indeed important to properly convince the judge with a thorough explanation of the subject matter at hand, but how does a judge get convinced that the expert truly has the necessary knowledge and expertise to draw the right conclusions? Is the expertise based on regular publications and training of the expert, is the expert registered in the register of forensic experts, and to what extent are the fields of chemical substance analysis and sewage scholarship generally recognised scientific disciplines (as visible, for instance, in peer re-viewed journals and conferences, and an intellectual debate within a broader international community)? In case of sewage monitoring and analysis of chemical samples originating from drug production, the expert must be a chemist with a license to even have the chemicals in their lab. In the Netherlands, this requires an accreditation from the government, and there is only a limited number of such accredited labs in the entire country. The situation may be different in other countries, depending on whether or not they acquire accreditation of labs and on the number of (where relevant, accredited) labs in the country; some countries will have substantially more labs available than the Netherlands.

While it is clear that the evidence must be presented by experts in the field, what form can the evidence itself take? The Polish provision of Art. 19b Police Act, which would likely serve as legal basis for sewage monitoring, regulates the process to be followed, if the findings of observations conducted under this article are to be used in criminal proceedings. If the police, during such observations, obtains evidence allowing for initiation of criminal proceedings or having other use in the criminal proceedings, the police have to provide all the collected materials to the public prosecutor. In the trial, these are presented in the form of reading out of the records. Thus, although the provision, which is based in literature, allows collection of samples for analysis⁹⁷ (the use of samples collected under this provision as evidence might be seen as avoiding the stricter requirements for seizure of evidence), it appears that the documentation created by the police in the exercise of such surveillance would need to be presented as evidence. This would be similar

⁹³ Section 244 StPO.

⁹⁴ Art. 7 KPK.

⁹⁵ Section 244(3,4) StPO

⁹⁶ Art. 193, Art. 195 KPK.

⁹⁷ Opaliński, Rogalski, Szustakiewicz, 2015, 261.

to reading out of the documentation of house searches, expert opinions, or of the examination of a crime scene.⁹⁸ In Germany, reading out documents⁹⁹ and reading out records are also means of evidence in the criminal trial and can under specific cases replace the examination of experts.¹⁰⁰

Under use case 1, collection of physical evidence is also considered. We will provide a brief discussion of the potential legal basis for such collection of physical evidence. In Germany the general provision regulating the collection of samples for the purpose of providing evidence in court is found in Section 94, which provides the relevant legal basis. Whether such use as evidence in court is actually possible depends on the technical implementation of the process to gather evidence, including issues such as: are the collected samples reliable, uncontaminated, and can they be proven to be non-manipulable; can they be correlated in a credible manner with the samples found after the raid; and does the technical functioning of the sensors in the rings hold up in court? These complicated and technical themes cannot be assessed here, since they require particular technical-scientific analysis. The following analysis therefore only describes the legal basis based on which samples can be collected and which formalities must be complied with. As in the previous sections, we will look at all the relevant features of the legal provision.

In Germany, even if the sewage water in the sewage monitoring first use-case need not be formally seized by the investigative personnel (but only informally secured otherwise), not every object can be secured on the basis of Section 94 I of the StPO. The object must be “of importance as evidence for the investigation” in order to be secured (without being seized) without a court-issued warrant. The required “importance as evidence” is assumed, when from an *ex ante* (prior) perspective the investigative personnel genuinely assumes that the object will somehow provide additional insight into the investigation.¹⁰¹ It is sufficient that the object gives insight relevant for the subsequent investigation procedure, such as determining the location of the perpetrator.¹⁰² The object also does not necessarily have to be used as evidence during the trial stage.¹⁰³

Considering the sewage monitoring first use-case, substances collected for later analyses will most likely have sufficient evidentiary character, if they reliably indicate whether narcotics are produced. The usage of the substances as evidence during trial will, nevertheless, highly depend on the technical implementation and a scientific assessment of its reliability (as mentioned at the beginning of this section).

In Poland, the collection of samples could rely on Art. 217 of the Code of Criminal Procedure. Under this provision, objects that may constitute evidence in the case, are to be surrendered on demand of the court or the prosecutor, and in cases not amenable to delay also on demand of the police or another authorised organ. Persons having the objects subject to seizure in their possession are invited to surrender it voluntarily. The objects that may constitute evidence in the case are in particular objects that 1) served or were designed to commit a criminal offence, 2) contain traces of the criminal offence, 3) originate directly or indirectly from the criminal offence, and 4) can serve as a means of evidence to detect the perpetrator or explain the circumstances of the criminal offence or the possession of which is unlawful.¹⁰⁴ If such objects can be collected in the public part of the sewers, they would be in the possession of the sewage company after the person discharging them surrendered them. It can be reasonably assumed that the sewage company would surrender these samples voluntarily. Nevertheless, the invitation to surrender the object might pose a practical problem, since the collection by the system would happen within seconds after it entered the sewage pipe controlled by the sewage company. In practice, prior permission of the sewage company to collect the samples by the device would be impossible. The objects to be seized also need to be specified in the issued decision beforehand, which poses another difficulty since the collected samples would not yet be in existence at the time of

⁹⁸ Art. 393 KPK.

⁹⁹ Section 249 StPO.

¹⁰⁰ Section 251 StPO.

¹⁰¹ Wohlers § 94 StPO Rn. 28.

¹⁰² Wohlers § 94 StPO Rn. 30.

¹⁰³ Eschelbach § 94 Rn 15.

¹⁰⁴ Skorupka 2015, 527.

such decision and their specification would depend more on the technical programming of the device than on the specification issued in the decision of the judge or the prosecutor.

Notwithstanding the practical difficulty in legally seizing such physical evidence from the sewer pipes, it is not clear what added value presenting such physical evidence would have in court. Although Art. 395 KPK allows presenting physical evidence in court, the value of presenting sewage water samples to the court and the parties would be limited; after all, the sample is important for enabling (re-)analysis, and possible counter-investigation on behalf of the defence, but it will be the expert witness statement, or reading of the report of the lab analysis – the procedural experiment under Art. 212 KPK – that would have evidentiary value, not the physical sample as such.

Finally, the rules of admissibility of evidence in Germany and Poland need to be considered. In certain cases, evidence may be deemed inadmissible and cannot be presented at the trial.¹⁰⁵ Nevertheless, the standards of admissibility are not very strict in these jurisdictions, which do not follow the principle of the fruits of the poisoned tree (which holds that not only evidence from an unlawful activity (the ‘poisoned tree’) itself, but also evidence acquired from follow-up activities that are based on the initial (unlawful) activity (‘fruits’), is unlawfully acquired).

In Germany, only evidence that reveals the core area of private life of the person and evidence obtained by prohibited methods of examination are in principle prohibited. In other cases of unlawfully obtained evidence, it will be up to the judge to decide whether it is admissible or not, on a case-by-case basis. Prohibited methods include ill-treatment, induced fatigue, physical interference, administration of drugs, torment, deception or hypnosis. Coercion may be used only as far as this is permitted by criminal procedure law. Threatening the accused with measures not permitted under its provisions or holding out the prospect of an advantage not envisaged by law is also forbidden, as are measures that impair the accused’s memory or ability to understand.¹⁰⁶ In Poland, evidence cannot be considered inadmissible solely because it has been obtained unlawfully, or even by committing a criminal offence, unless the evidence was obtained in the exercise of public authority as a result of murder, intentional causing of bodily harm or unlawful imprisonment.¹⁰⁷ Nevertheless, if on the case-by-case assessment unlawfully acquired evidence is considered formally admissible, the usability of the evidence for convicting the accused will still depend on an assessment of its reliability.

5. Conclusion

5.1. New technologies alter criminal procedure – the need for more specific regulation

This paper analysed the implications of sewage monitoring for criminal procedure law. One of the key questions addressed in the paper is how technologies such as a sewage monitoring system challenge current frameworks of criminal procedure law and how to qualify this new application under current legal provisions. Using a sewage monitoring system as an example, the paper first discussed how our legal system can deal with new technologies for law enforcement in general. The argument is that, while law enforcement has more or less always been making use of technologies to perform their work, we are living in, and moving towards, a time in which technological advancement is permeating all corners of society, also crime and law enforcement. This means that LEAs increasingly rely on technological tools, which are often used covertly in on-going surveillance, as opposed to classical methods of one-off physical search and seizure. The latter might have consequences for the checks and balances in criminal procedure, the assessment of proportionality and subsidiarity, and the choice of ‘tools’ to use in a particular criminal investigation that has to be assessed in combination.

¹⁰⁵ Section 244 (3) StPO.

¹⁰⁶ Section 136a StPO.

¹⁰⁷ Art. 168a KPK.

Not only is the amount of sensors used by law enforcement increasing (e.g. the number of CCTV cameras), so are the *types* of sensing (infrared cameras, different forms of DNA forensics, and now also sewage monitoring). Moreover, the quality of these sensors may differ from traditional devices used by law enforcement (e.g., a drone camera is able to see more than the human eye; a sewage sensor system can detect substances in sewage water that cannot be perceived by the human senses). Technological advancement has consequences for the law, in the first place in how to classify such tools – often, regulation of surveillance is measured against ‘what a human can sense’ – sewage monitoring tools clearly go beyond that. More importantly, new technologies do not only produce new and more sophisticated data, they also—particularly when we consider the broader context of intelligence-led policing—tend to shift police work from a reactive to a preventive system. This paradigm shift is also relevant for the analysis of a sewage monitoring system, as it challenges the way checks and balances are embedded in the criminal procedure system.

From a regulatory perspective, sometimes more general regulation is adequate to deal with novel surveillance tools used by LEAs. The reason for filing a new technology under an existing law stems from the tension that exists between, on the one hand, formulating general laws that can cover multiple situations and, on the other, providing sufficient legal certainty on what is and is not covered by the law. A legal pitfall would be to create different legislation for each new technology; at the same time, the law does need to be able to specifically cover a new technology if it is to offer legal certainty. One way of interpreting a new technology from a legal point of view is to find analogous technologies or tools to base the legality of the new tool on. However, due to technological trends described in the paper and the specificity of novel technological tools, often the strategy of finding analogous technologies and to use the associated provisions no longer suffices. In this paper, garbage disposal and thermal imaging have been analysed, but found to be not clearly usable as analogies because of some significant differences, highlighting the novelty of sewage monitoring from a legal perspective. It might prove difficult to classify sewage monitoring under any existing regulation that is specific enough to grant use of these tools for law enforcement to do a better job on the one hand, while keeping proper safeguards to protect citizens’ human rights on the other. Besides the right to a fair trial (which raises issues of testability in court of covertly acquired scientific evidence), privacy is the main human right that is at stake.

The protection of the home in relation to privacy (infringements) is of specific relevance in this case, partly because it might physically intrude on the home (depending on the positioning of the robot and how and where ‘the home’ stops and public space begins in relation to sewage water, which will differ between jurisdictions, and may not be completely clear as this form of intrusion is new in the context of law enforcement). More importantly, sewage monitoring systems are an example of a tool that can measure ‘things’ (matter translated into data) that emanate from the home, and adds to the situation that LEAs increasingly have possibilities to “look inside” the home without entering. This raises the challenge that the multitude of tools that can monitor the home from the outside, may slowly but surely be eroding rights such as privacy of the home. Therefore, not only does the law need to provide specific checks and balances for specific tools or techniques, there is also a need to look at the effects of surveillance technologies from a broader, overall viewpoint. The ‘mosaic theory’ holds that the putting together of a sufficient number of pieces of information that in themselves reveal little or nothing of someone’s private life (mosaic stones), may result in a picture (the mosaic) that is quite revealing. In short, the ‘whole reveals more—sometimes a great deal more—than does the sum of its parts’.¹⁰⁸

5.2. Legal basis in Germany and Poland

In answering the question whether there is a legal basis for using a sewage monitoring system, this paper cannot provide a clear legal answer, because this will depend on how the system will be used exactly in practice (which is not predictable with the current stage of technological development, and may moreover differ from case to case) and how national courts will assess such use (which cannot be predicted with certainty, in the absence of similar prior cases). Having

¹⁰⁸ See note 22.

analysed both Poland and Germany, there are considerable differences between these countries when it comes to regulating general surveillance. In general, we can conclude that currently, the standard of suspicion required to use sewage monitoring is not very high in Germany or Poland. A reasonable assumption based on the observation and experience of the law enforcement officer, even in the absence of a concrete suspect, would suffice. The use of sewage monitoring in a targeted way, where the law enforcement have clear indications that criminal activity is taking place, would meet the standard in both countries. However, the second use case of non-targeted monitoring of a larger area, without concrete suspicion or facts indicating criminal activity, may be more problematic if there are no sufficiently concrete indications that criminal activity is actually being conducted. Monitoring is not allowed for merely preventive purposes, but must be reactive to certain factual indications that crime has been, or is being, committed.

Regarding the conditions for using sewage monitoring as a diagnostic tool or evidence gathering, the main aspects in both countries can be found in the criminal procedure law. In terms of authorisation, in Poland, no specific warrant would be necessary for deploying sewage monitoring, but the public prosecutor does have the power to stop the investigation at any time. In German criminal law, it is common that different sections of the criminal code are combined for the purposes of the legal basis for certain investigation measures. The investigative measure of sewage monitoring in the first use-case will require a warrant, unless the period of observation is less than 24h. We also found that part of the literature states that in some circumstances even measures based on legal bases not requiring a warrant should require a so-called overall warrant, given that the whole is more than just the sum of its parts (see above).

There are other considerations besides authorisation as well, such as the ownership of wastewater and how cooperation by the sewage company could be acquired (voluntarily or mandatorily) to (help) collect samples. Another, more important, aspect that follows from the above is that, although evidence will usually be officially admissible in court, if evidence is also to be usable in court (in terms of the procedure for presenting evidence during the trial and assessing its reliability), the process of how this evidence was gathered needs to be documented and presented in some way. If sewage monitoring-derived evidence would be used in a case, the documents describing how the evidence was generated would have to be read out loud in court, through which the read statement becomes evidence. It is not clear at which level of detail all the procedures surrounding the sewage monitoring operation would have to be documented and presented for evidence to be usable; this will depend on how courts assess the reliability of the evidence given the particular circumstances of the case, having heard possible experts called by the prosecution and/or the defence, and whether or not (and on which basis) the defence will challenge the evidence. Nevertheless, it is quite possible that the way in which a sewage monitoring system operates, and some technical details of how the sensors are triggered by certain chemicals, may have to be presented in court, in order for the information derived from the system to be accepted as reliable evidence that a chemical was actually flushed through the sewer outlet of the particular premise under investigation. This might make a sewage monitoring system less useful as a covert surveillance tool. The envisioned use of the system in law enforcement practice will therefore have to be considered not only in the context of a particular investigation, but also in general from a strategic perspective of how the system is to be used in investigation of drug laboratories in general.

5.3. Practical considerations

Besides a detailed legal analysis that can be found in the paper, which focuses on 'law in the books', during the desk research and during the expert workshop, we also encountered some practical considerations relating to 'law in action' that we deem valuable to mention here. A first consideration is that the added value of using the tool for evidence collection seems marginal in relation to the evidence acquired by an actual search of premises where drugs are being produced, and may bring about more challenges than benefits. Nevertheless, also in the scenario of using sewage monitoring only as a diagnostic tool, its use and results may still need to be tested in court to some extent, if they are used to ground or strengthen the need for a search warrant of the premises at a particular time.

Obtaining a warrant

Whether used for evidence collection or as a diagnostic tool, in many specific situations of use case 1, such as observation of sewage waste for a certain period, a warrant will be necessary under German law. In that case this means that the investigative judge needs to be supplied with all relevant information in order to decide on the issuing of a warrant. A problem of requesting a warrant for taking a sample of the sewage system is that the sample does not yet exist at the time the warrant would be issued; it does not see to collecting existing traces of a crime, but to collecting possible future traces. This means that a search warrant (which sees to existing evidence) is not usable, so that the legal basis will need to be found in a surveillance power, most likely Section 100h StPO (observation with technical means). It is, however, as yet untested whether the German judiciary would find this provision a sufficiently clear legal basis for technological sewage monitoring.

Classification and expertise

The evidence collected will need to be categorised as a specific form of evidence, since it is not the waste-water, but the data of an analysis of the waste-water that will be considered as evidence. This generation of the data from the sample needs to be verified by an expert witness and needs to be contestable by the defence. Depending on the configuration of a sensor system, the generation of the data may be non-repeatable (if the system does not allow securing a sample that can later be re-analysed in a counter-assessment), in which case it remains to be seen whether the expert testimony will hold up in court. If, however, a sample is taken of sufficient volume so as to allow counter-assessments in another lab, then the lab results and the expert-testimony are significantly more likely to hold up in court. Nevertheless, the absence of legal-technical standards for technical devices such as sewage monitoring sensor systems may still be a complicating factor.

Documentation and transparency

If the monitoring system is being used for evidence collection, not only do legal roles and responsibilities need to be assigned, also every step in the process needs to be documented. Where transparency is not possible for practical reasons, *ex post* notification of the people subjected to such surveillance is required to enable them to challenge the measures or seek remedies if they consider the application of the measure to have been unlawful. Furthermore, independent *ex post* review of the measures may be a requirement of accountability of law enforcement more in general.

Notification

The last and connected point is that also if nothing was found, the suspects under observation still need to be informed that they have been subjected to a surveillance measure, since the sewage monitoring constituted an infringement with their right to respect of private life under article 8 ECHR. Although such notification does not have to go into details of the operation, the fact that sewage waste has been monitored with technical means has to be acknowledged.

Together with the earlier-mentioned need for documentation if a sewage monitoring system is to be used as evidence or as a diagnostic tool on which to ground the application for a warrant to employ follow-up investigation powers, this implies that the fact that law enforcement possesses and operates the sewage monitoring tool can hardly be kept secret for any substantial period of time. Instead of intending to keep the possibilities of sewage monitoring secret for as long as possible, so as not to make offenders aware of this new investigation tool, it might therefore be a wiser strategy for LEAs to anticipate that transparency is needed sooner rather than later, and therefore to proactively develop a policy on what can be publicly disclosed on the operation of the system and which operational details must really be kept secret.

5.4. Main conclusions

The main conclusions in this paper, based on legal-doctrinal analysis, are that, in general, sewage monitoring in use case 1 (targeted monitoring in an on-going investigation) might not be considered more intrusive than many other current surveillance tools and methods used by LEAs. However, there are concerns about the cumulative effect of sewage-monitoring tools in combination with other and existing surveillance methods and powers, both at the general level of

legislation (if law-makers would introduce a specific legal basis for sewage monitoring) and at the operational level of use of such tools (where the privacy impact has to be assessed in relation to other investigation methods used in the case at issue). From the perspective of legal procedure, the legal basis needs to be established, which is not straightforward. It has to be established what a sewage monitoring tool such as a sewage monitoring system actually *is* and *does*, and what kinds of data and evidence it can produce, in order to establish its exact qualification under existing legal provisions and the conditions applicable to using it as an evidence-collecting tool. Even if only used as a diagnostic tool, still some form of transparency and oversight will be needed to legitimate the non-negligible potential interference with fundamental rights and to enable those subjected to the sewage monitoring to contest the usage in court.

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