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HOW CAUTIOUS SHOULD WE BE? THE ROLE OF THE PRECAUTIONARY PRINCIPLE IN THE REGULATION OF SEWAGE SLUDGE IN SWEDEN

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ABSTRACT

In this paper, the results from the most recent Swedish investigation regarding the use of sewage sludge as fertilizer is discussed from the point of view of its compatibility with EU law, Swedish legislation, and the precautionary principle. In keeping with most of the comments on the proposal, we conclude that, while it is possible for MS to implement stricter regulations than required by EU law, a ban on the use of sewage sludge as fertilizer would still require further investigation to ensure that it follows the EU principle of free movement. In relation to the precautionary principle, we find that a ban on the use of sewage sludge would not constitute a reasonable application of the precautionary principle, since 'being cautious' does not have to involve the avoidance of risks in general, but rather to enable an assessment of the risks on a case-by-case basis. The role of the precautionary principle in connection with the use of sewage sludge as fertlizer should thus rather be to ensure that, when there is a risk of harm, measures are taken to protect peoples' health and the environment in each individual case. In some cases, the risk of undue environmental impact will be greater than in others, e.g., if the area is extra sensitive. In such cases, an application of the precautionary principle might entail that the activity cannot be allowed, or, that it may be allowed on condition that far-reaching precautionary measures are taken.

1. INTRODUCTION

Drawing a line between what constitutes a potentially hazardous waste and what is instead a possible resource is complicated. A case in point is the utilization of sewage sludge. Sewage sludge, or biosolids[1], is the "result" of different kinds of wastewater treatments, thus consisting of residues collected at different stages of the wastewater treatment process. The sludge contains large amounts of biodegradable material and plant nutrients, such as phosphorus and nitrogen, as well as pollutants, including heavy metals and pathogens (Fijalkowski et al., 2017). The properties of the sludge, i.e., how "clean" it is, will depend on several factors, including the pollution level of the wastewater, its technical characteristics, and what treatments are carried out (Buta et al. 2021; Lamastra et al., 2018). Before disposal or recycling, the sludge is typically treated e.g., to reduce water content and or the presence of pathogens. Among the processes for treating the sludge are for example dewatering, stabilization and disinfection, and thermal drying, the most common treatment method being anaerobic digestion (Bauer et al., 2020:92; Lu et al., 2012). Depending on the characteristics of the sludge, several treatments may be necessary. In terms of recovery options, there are various ways of recovering sludge. It can be used as fertilizer and soil improver on arable land; in the production of construction soil; and in the restoration of landfills or mining areas. Thermal processing reduces the volume of the sludge, and the ash can be utilized in the production of cement and as ingredient in other building materials (e.g., Yoshida et al., 2018; Christodoulou and Stamatelatou, 2016).

Returning to the difficulties stipulated at the outset, the recovery of sewage sludge is thus, on the one hand, prompted by a politicial (and in some cases, legal) ambition of circular material flows. The recovery of nutrients, including the much-in-need phosphorous, by the spreading of sewage sludge on arable land can for example help substitute the extensive use of mineral fertilizers that characterizes modern agriculture (Gianico et al., 2021; Shaddel et al., 2019). On the other hand, not only phosphorus is returned to the soil, but also many other substances. The

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chemical composition of the sludge varies with treatment method, but the possible presence of pathogens, pharmaceuticals and heavy metals involves risks for human health and the environment (Gianico et al. 2021).

Besides the technological development, which is immensely important to reduce the potential adverse impacts of recovering the sludge, there are also other factors in play when it comes to if and how sewage sludge should be recovered. One such factor is how the sludge is perceived; to what degree is the use of (treated) sewage sludge accepted, for example as fertilizer on arable land? Since public opinion is not only influenced by environmental or economic aspects of sludge use, but also by social and cultural factors (Christodoulou and Stamatelatou, 2016; LeBlanc et al., 2008), vast differences can be expected despite dissemination of technological development in the form of novel or more efficient treatment processes. The actual disposal or recovery of the sludge differs significantly around the world. In some developed countries, land application of the sludge is widely used, for example Australia and USA (Lu et al. 2012; Christodoulou and Stamatelatou, 2016), while in others thermal processing for power, heat and fuel is the preferred method. This is the case in Japan and Germany (Christodoulou and Stamatelatou, 2016). Globally, landfilling of sewage sludge is still widely applied, and in some parts of the world wastewater treatment is lacking (LeBlanc et al., 2008). On a larger scale, these differences can be explained by factors such as economic development, population per capita, and the importance of agriculture, but also from a narrower perspective, large differences can be found, for example within the European Union (EU) or between the Scandinavian countries.

In this study, we focus on Sweden, where the debate regarding land application of sewage sludge has been ongoing for decades and, among other things, expressed itself in the appointment and implementation of a number of government investigations (Swe: Statens Offentliga Utredningar, SOU[2]). The issue has been examined four times in the last 20 years, and in the most recent of these, named Sustainable Sludge Management (SOU 2020:3), two options were finally presented:

a) a ban on all spreading of sewage sludge with as limited exceptions as possible. The starting point in this scenario is that the sludge is assumed to pose serious risks to health and the environment. The option includes a requirement for the recovery of phosphorus from the sewage sludge.
b) a principal ban on all spreading of sewage sludge except for the spreading of quality-assured sludge on productive agricultural land. Spreading on land where the phosphorus resource cannot be utilized by replacing mineral fertilizers is prohibited. In this scenario, significant weight is given to health and environmental risks, but these can be balanced in relation to other environmental- and societal goals. The option includes requirements for the recovery of phosphorus from the sewage sludge, either in the form of spreading on productive agricultural land or through material recovery.

With starting point in the principle of free movement of goods and the interpretations and implications of the precautionary principle, the aim of this paper is to highlight, discuss and analyze the compatibility of the option(s) with legal frameworks on both EU- and national Swedish level.

The article begins with an account of the legal framework that governs the handling and use of sewage sludge at EU level, including the precautionary principle, which is important in this context. Thereafter, the Swedish transposition of the relevant EU legislation is briefly described, followed by the results of the consultation responses regarding the two options/scenarios presented in SOU 2020:3. The results section ends with an account of the implications of the principle of free movement in relation to the utilization of sewage sludge. The article concludes with a discussion regarding the compatibility of the Swedish proposal with the analyzed legal framework.

2. MATERIALS AND METHODS

In order to identify the scope and meaning of the law, both in terms of the nature of the specific legislations and the meaning and significance of legal concepts and principles, a traditional legal method is applied. This implies qualitative studies of relevant legal material founded on positive analytical jurisprudence, defined here as the study of the concept or nature of law, i.e., the 'existing legislation' (Austin, 1832; Kelsen, 1941; and Hart, 1961). The selection of legal material is based on the theory of the sources of law, meaning legal text, case law, and, where applicable, legal preparatory works and legal literature (Rentto, 1996). The analysis is, in principle, limited to legislation currently in force. For the interpretation of EU law, which is particularly relevant in section 5 of the study, the EU legal method is used, which refers to the legal methodology and the interpretation methods used by the European Court of Justice (Hettne and Otken Eriksson, 2011).

3. LEGAL FRAMEWORK FOR THE USE OF SEWAGE SLUDGE

3.1 EU law

The treatment of wastewater – the process in which the sludge is collected – is subject to specific regulation on EU level in the form of the Urban Wastewater Directive (Council Directive 91/271/EEC) according to which Member States are required to ensure that towns, cities, and settlements properly collect and treat their urban wastewater. The Directive encourages recycling of sludge generated by water treatment, while stating that the practice of discharging sludge into surface water should cease. Management of sludge must imply that the adverse effects on the environment are reduced to a minimum. Wastewater, and residual sludge is also subject to the Waste Framework Directive 2008/98/EC (WFD) article 2(2a) & article 3(1) to the extent that it is not regulated elsewhere. Wastewater is partially excluded from the scope of the WFD, insofar that the Wastewater Directive guarantees the same level of environmental protection as the WFD. Because the Wastewater Directive does not guarantee the same level of environ-

mental protection as the WFD, wastewater is not excluded from the scope of the WFD (See Case C-629/19 Sappi paras 36-39). It is important to clarify that since article 2 WFD is exhaustive, the potential exclusion only covers the wastewater and not the sewage sludge derived from the treatment of wastewater. This means that the waste hierarchy (article 4 WFD) must guide the management of sewage sludge, where disposal and energy-recycling (incineration) are the lowest steps. This is a clear indication that other environmentally justified recovery options should be promoted and utilized when possible.

As a form of lex specialis the use of sewage sludge as fertilizer is instead separately regulated by the Sludge Directive (86/278/EEC). This Directive sets rules for a particular recovery operation, namely the use of sewage sludge as fertilizer in agriculture. It does not regulate other forms of recovery operations such as incineration. The overall purpose of the Sludge Directive is to prevent the use of sludge from harming human health and the environment by "ensuring that the nutrient needs of the plants are considered and that the quality of the soil and of the surface and ground water is not impaired." (Article 1 of the Directive). The Sludge Directive sets limit values as a means for controlling the concentrations of seven heavy metals that may be toxic to plants and humans: cadmium, copper, nickel, lead, zinc, mercury, and chromium. Use of sewage sludge that results in concentrations that exceed these limit values is thus prohibited by the Directive. It is furthermore not allowed to use sludge as a fertilizer on: "(a) grassland or forage crops if the grassland is to be grazed or the forage crops to be harvested before a certain period has elapsed. This period, which shall be set by the Member States taking particular account of their geographical and climatic situation, shall under no circumstances be less than three weeks; (b) soil in which fruit and vegetable crops are growing, with the exception of fruit trees and (c) ground intended for the cultivation of fruit and vegetable crops which are normally in direct contact with the soil and normally eaten raw, for a period of 10 months preceding the harvest of the crops and during the harvest itself." (86/278/EEC article 5 & 7).

Both the EU waste-regime and the more specific sludge-regime is based on articles 191 and 192 in the Treaty of the Functioning of the European Union (TFEU) with the ulterior motive of environmental protection. EU law thus principally allows for the use sludge as a fertilizer provided that certain time frames are considered, limit values are not exceeded, and certain crops are avoided. Moreover, the Wastewater Directive stipulates that the sludge should be reused whenever appropriate (article 14(1)).

Article 191 also expresses the precautionary principle, which in this context means that the environmental policy of the EU "shall be based on the precautionary principle and on the principles that preventive action should be taken, that environmental damage should as a priority be rectified at source and that the polluter should pay." There is, however, no legal definition of the precautionary principle in EU law, although it is explicitly expressed in many of the environmental legal acts, for example Regulation (EC) No 1272/2008 (REACH) (Article 3), Directive 2008/98/EC (the Waste Framework Directive) (Article 4 and Preamble 30), and Regulation (EU) No 1143/2014 (Invasive Alien Species Regulation) (article 8 and Preamble 20)[3].

3.2 The management of sewage sludge in Sweden

To contextualise, roughly 210 thousand tons of sewage sludge was produced in Sweden in 2018. Of this, about 40% (82.3 thousand tons) was used in agriculture, primarily as either fertilizer of plant soil; 25% (54 thousand tons) was composted; 1% (2.3 thousand tons) landfilled; 1% (2.8 thousand tons) incinerated, and 27% (57.3 thousand tons) was disposed of by other means, for example as coverage for landfills (Svinhufvud, 2017; Bauer et al. 2020, EUROSTAT, 2022).

In Sweden, the limit values in the Sludge Directive are implemented through a regulation prohibiting or restricting the handling of certain substances (Ordinance 1998:944, s. 20 - Table 1). Accordingly, sewage sludge for agricultural purposes may only be marketed and transferred on condition that the metal content does not exceed the designated limits, and as a main rule, the sludge must be treated to minimize the risk of contamination. Untreated sewage sludge may be used if it is plowed down within 24 hours and does not lead to nuisances for people living nearby. Additional requirements are set by SEPA regulations (SNFS 1994:2 - Table 2), for example regarding sampling and reporting of sludge content, highest permissible metal content in the soil (on which the sludge will be used), and maximum allowable supply of metals to agricultural land[4].

However, according to the industry organization Swedish Water, both the sludge directive and the Swedish legislation are "completely obsolete" as they allow too high levels and emissions of heavy metals, has insufficient hygiene requirements, provide poor traceability and include

TABLE 1: Limit values (Ordinance 1998:944).

Metal	mg/kg dry substance
Lead	100
Cadmium	2
Copper	600
Chrome	100
Mercury	2,5
Nickel	50
Zinc	800

TABLE 2: Limit values (SNFS 1994:2).

Metal	mg/kg dry substance
Lead	40
Cadmium	0,4
Copper	40
Chrome	60
Mercury	0,3
Nickel	30
Zinc	100

no mechanisms for upstream work[5]. The stakeholders in water and wastewater treatment (including the trade association Swedish Water) have taken the matter into their own hands by establishing a certification system – Revaq – that provides higher environmental thresholds than the current regulatory framework.

From the point of view of the general Swedish environmental legislation, primarily the Swedish Environmental Code (SEC), the use of sewage sludge, e.g., as fertilizer on agricultural land, is a matter of (controlling) expected environmental impacts. Like all activities as well as non-negligible measures, the use of sludge (for any purpose) must conform to the requirements under the Code. This includes both substantive provisions, e.g., environmental and permit requirements, and specific regulations pertaining to the use of sludge, for example authority regulations and prescriptions. The requirements are based on the precautionary principle, meaning that precautions may be required even if scientific evidence that the activity is harmful to the environment is lacking, and to this effect, Best Available Technology (BAT) must be used (Ch. 2, s. 3, the Swedish Environmental Code).

The point of departure for allowing potentially harmful activities under both EU law and national law is thus the notion of caution. In the following section, the precautionary principle in relation to the use of sewage sludge is discussed with a starting point in the substantive meaning of the principle.

3.3 The precautionary principle and sewage sludge

The precautionary principle is, in essence, a risk management tool. It is applicable to decisions under uncertainty, i.e., if there is reason to assume that something poses a serious hazard for peoples' health or the environment, but where the scientific evidence for this is insufficient or inconclusive. Conversely, the precautionary principle will not apply when e.g., the adverse effects of a certain activity are known and can be addressed with adequate precautionary measures, unless "the potential harms are known but the particular cause-effect relationship cannot be scientifically established." (European Commission, 2017).

Guidance as to when, i.e., in what situations, the precautionary principle is applicable is also provided by the European Commission: "Recourse to the precautionary principle presupposes that potentially dangerous effects deriving from a phenomenon, product or process have been identified, and that scientific evaluation does not allow the risk to be determined with scientific certainty". (COM (2000) 1 final). The Commission continues to explain that the application of the precautionary principle should begin with a scientific evaluation that is as complete as possible, and where the degree of scientific uncertainty is identified at each stage (ibid.) Since a precautionary approach is about making decisions under uncertainty, it is important that legislation based on the precautionary principle is continously reviewed in light of scientific development – new knowledge may both reduce and increase the level of uncertainty (Science for Environmental Policy, 2017).

In relation to sewage sludge, the uncertainty is primarily about what risks the spread of the sludge on agricultural land entails for human health; it is sufficient to ensure the quality of the sludge in accordance with limit values set in e.g., the Sludge Directive, or does the activity involve such great risks, despite precautionary measures, that it should be banned? In Butti (2015), the author referes to a judgement by the Italian Constitutional Court, stating that the "the parameter used to define priorities when applying the precautionary principle is the principle of proportionality". This, Butti argues, allows for an application of the precautionary principle that is "pertinent, balanced, motivated and consistent" with similar judgements (Butti, 2015:1076)[6].

In this context, it is important to emphasize that there is no scientific consensus regarding the dangers of using sewage sludge as fertilizer on agricultural land (Ekane et al., 2021; Hushållningssällskapet, 2021; Andersson, P.G., 2015). While the sludge contains undesirable substances such as heavy metals, it also holds valuable resources such as phosphorous and other nutrients. There is thus no doubt that there is uncertainty regarding, especially long-term, consequences of sludge spreading on agricultural land. The question is instead how cautious this means that we should be? Following Ekane et al., an issue seems to be that the standpoints on the use of sludge are guided not only by scientific facts, but also of the perception of the sludge as something unwanted. Even if some activities, such as using pesticides on crops may be more dangerous than spreading sludge, the risks of using pesticides are accepted, while the corresponding risks of sludge use are not (Ekane et al., 2021). Ekane et al. thus conclude that the perception of risks associated with sewage sludge "is a good example of psycological contamination from disgusting objects" (Ekane et al. 2021:9).

In the Swedish investigation (SOU 2020:3) two diverging scenarios for the future management and thus regulation of sewage sludge was presented. Both options are however said to be founded on the precautionary principle: "The precautionary principle is a starting point for long-term protection of health and the environment from harmful substances and effects that may occur/be discovered when spreading sewage sludge, but the application differs depending on the view of how risks can be managed proportionately. The risks also need to be weighed against other societal goals. [Authors' translation]" (SOU 2020:3, p. 29). In the first scenario, the risk of serious health and environmental consequences as a result of the spread of sludge is not considered controllable by limit values or quality demands, hence a general ban is seen as necessary. Under the second scenario, the role of the precautionary principle is instead to direct decisions or exceptions based on quality demands, thus a case-to-case application, guided by the precautionary principle.

Before the results of an investigation can form the basis of a possible legislative proposal/law amendment, the proposal must be sent for referral to the relevant authorities, organizations and municipalities[7]. In order for the government to take a position on the investigation proposals, especially when an investigation presents two different options, the referral is typically sent with instructions. For SOU 2020:3, the referral bodies' opinion on option (a) was explicitly requested (Regeringskansliet, 2020).

In the next section, the referral bodies' responses are presented, with a specific focus on stakeholders' opinions concerning the compatibility of the options with EU- and national law.

4. STAKEHOLDER OPINIONS ON THE INVESTIGATION

SOU 2020:3, Sustainable Sludge Management, was sent to 199 referral bodies. A total of 111 responses were received. Of these, 13 bodies (12 percent) expressed support for option a), i.e., a total ban with emphasis placed on the importance of such ban. Physicians for the environment and the Swedish Medical Products Agency were for example in favor of option a). Physichians for the environment meant that the investigation undermined the risks of sludge use through a superficial argumentation regarding the precautionary principle and proportionality. They further emphasized that the investigation's interpretation of EU law was purely speculative.

Out of 28 responding municipalities only three expressed support for option a): Uppsala, Lund and Landskrona. The municipality of Lund was positive about the development of an up-to-date and clear legislation regarding the use of sludge and considered a ban on the spreading of sewage sludge on agricultural land, with very few exceptions, to be in line with an expedient application of the precautionary principle. The other two were less certain; the city of Landskrona thought that the issue should be further investigated, and Uppsala municipality held that it is positive that both options mean that "today's uncontrolled spread of sludge will stop. [Authors' translation]"

Among those who advised against a total ban (option a) were for example the Swedish University of Agricultural Sciences (SLU) and Swedish Municiapalities and Regions (SKR). SLU responded that it is important that "laws are based on science whenever possible [authors' translation]" and emphasized that a total ban "cannot be justified based on any of the scientific risk assessments that the inquiry has reviewed. [Authors' translation]." SLU also meant that the objections raised by the inquiry regarding the compatibility with EU law was a strong argument against a total ban. In addition, SLU pointed out that option a) would be devastating for the Swedish Water organizations' important upstream work, and SKR underlined that a ban on the use of sewage sludge on e.g., agricultural land "significantly impedes the possibility of receiving external organic waste at the treatment plants. [Authors' translation]"

All County Administrative Boards (CABs) (i.e., the regional authorities) were in favor of a partial ban in the choice between option a) and b). The CABs in Norrbotten and Västerbotten (in the North of Sweden) however emphasized that also this option was too limited, and that sludge should continue to be used to produce plant soil.

Of particular interest for this paper are the statements from the Land and Environmental Courts and the Land and Environmental Court of Appeal.

The Land and Environmental Court of Appeal provided a brief statement, stating that "based on the available information, it is not possible to decide if a restrictive ban on spreading [...] is in keeping with EU law." Since a measure that can affect the competitive conditions within the EU must be both necessary with regard to human health and the environment, and proportionate, the Court concluded that it is necessary to indicate more clearly the purpose of and need for such a ban. Similarly, the Nacka Land and Environmental Court pointed to the importance of compliance with EU law and emphasized that a ban in accordance with option a) may have "several negative consequences, e.g., regarding the overall environmental impact of sludge management". [Authors' translation] The Land and Environmental Court in Umeå highlighted that quality-assured sludge has important areas of use, including as a cost-effective and environmentally appropriate alternative for the after-treatment of landfills and mines.

The most comprehensive opinion among the Courts, was provided by the Växjö Land and Environmental Court. According to the Court, a total ban may counteract the objectives in the Urban Wastewater Directive encouraging the recycling of sludge. It was emphasized that the requirements must start from the local soil conditions, which differ for different uses. The court held that, in the assessment, the sludge's nutrients content and soil-forming properties should be considered. Risk should be minimized, in accordance with the precautionary principle, but the use of sludge should also be compared to alternative measures and risks associated with these. Overall, a total ban risks steering sludge producers to a certain system of disposal (i.e., incineration). This, the Court considered, is undesirable for several reasons, partly because of the uncertainty as to whether a ban is the best option from an environmental point of view, partly because it involves large costs and partly because there is a risk of locking in a particular technical solution. If the opportunities for disposal of the sludge decrease, the incentive for upstream work will also decrease as the strongest motivator for this work is the demand for sludge. Another issue brought up by the Court was the requirement for phosphorus recycling. If there is no market for the sludge, the requirement for 60 percent recycling of phosphorus may be difficult to achieve. For the phosphorus to be in demand, the price of the recycled product must be equivalent to, or lower than for alternative fertilizers.

Several stakeholders highlighted the option's potential incompatibility with EU law as a key issue. In the following, the foundations for the free movement of goods and services linked to the issue of the use of sewage sludge are therefore discussed.

5. THE FREE MOVEMENT OF GOODS AND THE USE OF SEWAGE SLUDGE

The compatibility of direct and indirect trade restrictions is continously assessed by the Court of Justice of the European Union (CJEU), While the Swedish investigation highlighted the potential conflict regarding a ban on sludge for agricultural use, this particular issue (whether a partial or complete national ban on agricultural use of sludge conforms with EU law) has not yet been assessed by the CJEU.

As a starting point, there is no definitive ban on the

use of sludge as a fertilizer within the EU environmental regime. Provided that certain conditions are met, Member States are, via article 193 TFEU, as a main rule, however, free to implement stricter national regulation, including bans or higher thresholds for the permissibility of various operations (i.e., gold-plating). It is thus entirely possible for member states to enact stricter national legislation, such as bans or higher (or lower) threshold values, on environmental grounds. The potential conflict a partial or complete ban poses instead lies with the provisions on free trade. At its core, the EU is a trade cooperation with deeply rooted principles of free trade (e.g., articles 2-3 Treaty of the European Union (TEU)). These 'principles' has time after time served as the basis for decisions from the CJEU. In short, the court generally upholds a meta-teleological approach, where the underlying foundations of the union is given priority to uphold the overall effectiveness of EU law (Lasser, 2009:230). For instance, the CJEU states in Case C-113/12 Brady that: "[t]he term 'discard' must be interpreted in the light of not only the essential objective of Directive 75/442 [...] but also of article 174(2) EC [now Article 191 Treay of the Functioning of the European Union (TFEU)]" (para 39).

This implies that is imperative that a national prohibition on sewage sludge for agricultural use does not only comply with the secondary sources of law directly enacted to manage environmental risk, such as the Sludge Directive, but also that it does not contradict the principles of free trade as expressed by articles 28-37 TFEU because legislation enacted based on environmental protection will also be assessed in the light of these. Articles 34 and 35 TFEU explicitly prohibit quantitative restrictions on both imports and exports and all similar measures of equivalent effect between Member States (abbreviated as MEQRs in the following text). Such measures can be various partial or exhaustive restrictions on trade (i.e., in some form directly restricting the movement of goods) or indirect measures through, for instance, restricting the use of certain goods.

There is however a derogation rule in article 36 TFEU, according to which Member States are allowed to impose restrictions if they are justified by grounds of public morality, public policy, or public security; the protection of health and life of humans, animals or plants; the protection of national treasures possessing artistic, historic or archaeological value; or the protection of industrial and commercial property. Restrictions may be inadmissible if the issue is harmonized at EU level as concluded by the CJEU in Case 190/87 Moormann. Since most secondary sources of environmental law are based on article 192 TFEU, which aims at establishing a minimum level of environmental protection, stricter national legislation should thus rarely be inadmissible due to the issue being completely harmonized on EU-level.

There has also been some debate about whether the grounds for exemptions in article 36 TFEU are exhaustive (See Craig & De Búrca 2020:736 et seq.). In a strict sense, environmental protection is not explicitly mentioned in article 36 as a ground for derogation. It has however previously been considered an acceptable basis by the CJEU in Case C-320/03 Commission v Austria. Regarding waste, the CJEU has accepted environmental protection as basis for a Belgian regional decree which banned waste imports to certain Belgian regions in Case 2/90 Commission v Belgium. In this case the CJEU especially considered the fact that waste should, as a main rule, be disposed of locally (paras 34-35).

To find out whether articles 34 or 35 TFEU constitute an obstacle to a ban on sewage sludge spreading, three questions need answering: (1) is sewage sludge a 'good' in the context of articles 34 and 35; (2) is a ban on the use of sewage sludge in agriculture a MEQR; and (3) could a ban be justified by the derogation regime in article 36?

As for the first question, trade in sewage sludge within the EU had a total turnover of 332,593 euro in 2021 (of which import constituted 168,468 euro and export 164,125 euro) (EUROSTAT, 2022). Generally, countries export more sludge than they import, with few exepctions (e.g., Austria, Estonia, France, and Spain). Sewage sludge thus has a certain economic value, and in the above-mentioned case 2/90 Commission v Belgium, waste was declared as a good regardless of the quality of the waste (i.e., recoverability), (para 28). This implies that sewage sludge can be considered a good within the meaning of articles 34 and 35, and that banning certain areas of use in individual Member States could be regarded as a restriction on trade of a good, thus disrupt the inner market.

As for the second question, if a ban on agricultural use is a MEQR, the CJEU has previously in Case C-142/05 Åklagaren, concluded that national provisions prohibiting the use of certain goods (in this case the use of watercraft in certain water areas in Sweden), regardless of any discriminatory conditions[8], constituted a MEQR (para 24)[9]. In particular the CJEU states in para 29 that "the national provision must be appropriate for securing the attainment of the objective pursued and not go beyond what is necessary in order to attain it." In this case, the national provisions were generally applicable, and essentially prohibited the use of jetskis on all water areas expect public waterways and especially designated water areas. According to the CJEU it was possible to envisage alternative solutions that would also guarantee a certain level of protection of the environment. However, Member States could at the same time not be denied the possiblity to introduce necessary rules which are generally applicable and easily managed and supervised by the national authorities (para 36). This implies that the feasibility of enforcing the provisions should be considered. The CJEU concluded that the prohibitions could be justified for the protection of the environment if certain conditions were met. First, the authorities must be obligated to designate areas for this purpose; second, they must excercise the powers conferred to them; and third, the measures must be adopted within a reasonable timeframe (para 44).

In relation to Case C-142/05 Åklagaren another verdict by the CJEU bears mentioning. In Case C-110/05 Commission v Italy, the Commission argued that Italy had acted in breach of article 34 TFEU[10] by prohibiting two-wheel motor vehicles (motorcycles, mopeds, etc.) from towing trailers. Italy argued that article 34 only was applicable if the national provision prohibited all potential uses of the product or its only use. If there however were alternative uses, article 34 would not, according to Italy, be applicable (para

19). This argument was dismissed by the CJEU because, in line with their reasoning in Case C 8/74 Dassonville, all trading rules enacted by Member States, which are capable of hindering, directly or indirectly, actually or potentially, intra-community trade, should be considered as a MEQR and are thus prohibited by article 34 (para 33). As for the management of sewage sludge, this implies that, even though there are other areas of 'use' for the sludge, a ban of its use on agricultural land could constitute a MEQR.

As for the third question, the CJEU continues in the above-mentioned Case C-110/05 Comission v Italy to make a clear distinction between the necessity and the appropriateness of a provision (paras 59-69). It is possible that a prohibition is necessary while at the same time deemed inappropriate and vice versa. A potential prohibition of agricultural use of sewage sludge must thus be subject to a proportionality test, which consists of the following cumulative criteria: (1) the measure is appropriate for achieving the legitimate purpose; (2) the measure is necessary to achieve the purpose (there are no less restrictive alternatives); (3) the benefit of the measure is in reasonable proportion to the cost and inconvenience of the measure. Member States must prove that all criteria of the proportionality test are fulfilled. The burden of proof is however not so extensive that Member States must prove that no other conceivable options exist (para 66). Thus, although protectionism is a common argument by Member States to justify provisions that directly or indirectly restricts free trade, article 36 only allows for such restrictions if they pass the proportionality test.

Due to the scientific uncertainty regarding how harmful agricultural sludge spreading is, especially over time, the actual risk is hard to determine. Enacting MEQRs under scientific uncertainty was touched upon the CJEU in Case C-174/82 Officier van Justite v Sandoz BV where the Dutch authoritities had prohibited sales of food and beverages with added vitamins without prior authorization because such vitamins were deemed as possibly dangerous to public health. There was however, at the time, no scientific consensus on whether addition of certain vitamins was in fact dangerous. Although it was clear that excessive amounts of vitamins could be dangerous, it was not clear at what levels they were toxic (paras 9-11). In essence the Dutch legislator was faced with scientific uncertainty. The CJEU accepted the Dutch requirements for prior authorization, and concluded that, in the absence of harmonized rules on union level, and under scientific uncertainty, it is up to the Member States to decide on the degree of protection (para 16). The protection should nevertheless be restricted to what is necessary (para 18).

In relation to sewage sludge, the potentially harmful substances contained in the sludge warrant legislation that controls, for instance, its use in agriculture. At the same time, the scientific uncertainty regarding the harmfulness of the sludge, does not necessarily call for an unconditional prohibition. In the case of Sandoz BV, sale of food and beverages with added vitamins were not completely prohibited, but merely required prior authorization.

To summarize this section, the implications of articles 34-36 in relation to the proposed options for the management of sewage sludge is the following. First, the current state of scientific knowledge about the risks pertaining to the use of sewage sludge, is that option (a) is likely to be in breach of EU law, not least since the use of sludge is already harmonised on EU level. Second, also a partial ban (option b), may be found in breach of EU law if conditions for allowing the activity are deemed too exessive to attain the legitimate purpose.

6. DISCUSSION AND CONCLUSIONS

With this paper, our aim has been to highlight, discuss and analyze the consequences of the results of the most recent Swedish investigation into the use of sewage sludge as fertilizer on agricultural land. The investigation presents two alternative pathways for the future of sludge, where both allegedly are based on the precautionary principle. What is then the meaning of the precautionary principle; what does it mean to be 'cautious' in this context?

To exercise caution is to comply with the idea of "better safe than sorry" – when an activity poses a risk, e.g., threatens to harm human health or the environment, precautionary measures shall be taken. This is not to say that the precautionary principle can be invoked to justify arbitrary decisions. It follows from the Communication from the European Commission that "[r]ecourse to the precautionary principle presupposes that potentially dangerous effects deriving from a phenomenon, product or process have been identified, and that scientific evaluation does not allow the risk to be determined with sufficient certainty" (COM(2000) 1 final, p. 3). Measures taken in the name of the precautionary principle must be proportionate to the desired level of protection, be non-discriminatory, and consistent with similar measures taken in similar situations (Pettersson & Goytia, 2016).

In option (a) presented by the Swedish Investigation, i.e., a ban against the spreading of sewage sludge, the precautionary principle is placed on the legislative level. For this to be deemed "appropriate", the risks associated with the activity must be considered such that a general prohibition is warranted. In light of the above conclusions from CJEU case law, it is however unlikely that such a decision would be seen as compatible with EU law; the scientifically established risks pertaining to the use of sewage sludge does not warrant a ban of such general nature. It may, of course, in some instances be justified to apply the precautionary principle already in the legislative process. There are many examples of this, not least when it comes to the use of toxic substances. Not even in these cases, however, is it always the case that the use of the substance is completely prohibited, but rather that its use is (strictly) regulated and that the principle of substitution applies.

Option (b) also prohibits the spreading of sewage sludge, but this time with the addition: "that does not meet quality and recycling requirements". Thus, in this case, precautions are built in the provision in the form of conditions, and the assessment of whether the activity can be allowed will take place on a case-to-case basis. Since EU law allows for Member States to implement stricter requirements than what follows from Union legislation, this option is not nec-

essarily in breach of the free movement, on condition that the higher thresholds, i.e., measures of equivalent effect between Member States, are deemed appropriate according to Article 36, TFEU.

In conclusion, the role of the precautionary principle in connection with agricultural use of sewage sludge should be to ensure that, when there is a risk of harm, measures are taken to protect human health and the environment in each individual case. In some cases, the risk of undue impacts on human health or the environment will be greater than in others, e.g., if the area is extra sensitive. In such cases, an application of the precautionary principle might entail that the activity cannot be allowed, or, that it may be allowed only on condition that far-reaching precautionary measures are taken. In other words, a proportionality test for the two options for regulating agricultural use of sewage sludge presented in this paper must be performed. For option (a), the result of such a test would likely imply that the measure, i.e., to ban the use of sewage sludge in agriculture, is not considered to be in reasonable proportion to the risks that the use entails for human health and the environment. For option (b), on the other hand, a proportionality test may well result in the measure being considered proportionate to the risks.

The presented options are representative of the way of thinking that has characterized the sewage sludge discussion for many years, referred to as the precautionary versus the proof-first approach (Bengtsson and Tillman, 2004). The differences in the two approaches are significant from a legislative point of view as there is a considerable difference between regulations based on risk assessment, i.e., where the ban is based on an actual, proven, risk, and regulations where the main rule is prohibition and exceptions are only allowed under specific conditions.

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[1] The term biosolids was created in 1991 by the USA Name Change Task Force at Water Environment Federation (WEF) to "distinguish treated sewage sludge from raw sewage sludge and facilitate land application of processed sewage sludge that would be more acceptable to the public." (Lu et al., 2012).
[2] Statens Offentliga Utredningar is an official series of reports by committees appointed and convened by the Government to investigate issues in anticipation of a proposed legislation.
[3] As a principle of environmental law, the precautionary principle was first recognised in the UN World Charter for Nature in 1982 and has since been enshrined in number of international legal acts, including the perhaps most famous version from the Rio Declaration: "where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation." (Article 15, Rio Declaration 1992). The precautionary principle is also expressed in the Convention of Biological Diversity (CBD), the Climate Convention (UNFCCC) and, to some extent, also in the Word Trade Organizations Sanitary and Phytosanitary Agreement (SPS).
[4] Gram/hectar and year (average for a seven-year period): lead 25, cadmium 0.75, copper 300, chromium 40, mercury 1.5, nickel 25, zinc 600.
[5] To enable a trustworthy recycling of the nutrients in the sludge, Swedish Water together with LRF and Livsmedelsföretagen developed a certification system called Revaq. https://www.svensktvatten.se/om-oss/europeiska-unionen/slamdirektivet/. There are currently 41 Revaq certified treatment plants mainly located in southern Sweden. (https://www.svensktvatten.se/globalassets/avlopp-och-miljo/uppstromsarbete-och-kretslopp/revaq-certifiering/certifierade-revaq-verk--2021-09-04.pdf).
[6] The principle of proportionality is well established within EU law and can be operationalised using three steps of inquiry: (a) Is the measure appropriate for achieving the legitimate purpose; (b) Is the measure necessary to achieve the purpose (or is there a less restrictive alternative); (c) Is the benefit of the measure in reasonable proportion to the cost and inconvenience of the measure? (See e.g., Craig and de Búrca, 2020:583). All European Constitutional Courts have since developed expertise in assessing proportionality (Butti 2007; Lang 2020; Butti and Toniolo 2018).
[7] Chapter 2, section 7, Swedish Instrument of Government (Constitutional Act). Authorities under the government are obliged to respond to the referral. However, it is up to the authority itself to decide whether it has any views to report in the response. For other referral bodies, the referral shall be seen as an invitation to submit views.
[8] Advocate General Jacobs has however argued that national measures that apply equally to all goods and services regardless of origin should fall outside the scope of article 34, see Craig & De Búrca (2020) pp. 724-725.
[9] The CJEU reached the same conclusion in Case C-110/05 Commission v Italy.
[10] At the time, the provisions of article 34 TFEU were found in article 28 EC. For the sake of this paper, we will refer to the current provision, article 34.