

DEVELOPMENT OF THE DISCHARGE CONDITIONS
IN THE FEDERAL REPUBLIC OF GERMANY

J. Lohmann

Niersverband, Freiheitsstr. 173, 4060 Viersen

ABSTRACT

To improve the effluent quality to a substantial higher level the concept of legal instruments was revised by the federal government in 1971. The new combined system of classic administrative and free-market-oriented instruments (i.e. polluter-pays-principle) proved to be very effective to improve continuously the technologies in use. Also these instruments showed to be very flexible to a further tightening of the discharge conditions which are expected in future. Details about the development of minimum requirements (standards) and the Sewage Charge Act are reported.

KEYWORDS

Wastewater, development of minimum standards in the FRG, legal instruments, Sewage Charge Act, polluter-pays-principle, nitrification denitrification phosphate precipitation.

INTRODUCTION

Within the framework of this paper I would essentially like to present a survey of the sewage-policy goals and requirements in the Federal Republic by which the future development will predominantly be influenced.

To me it seems important, to present particularly the subject of environmental policy in greater detail for once, because here a significant change is emerging in the instruments being applied to attain the goals set with regard to lake and river water quality. In the past years these new instruments have been put to the test in the instance of sewage treatment, and it can be quite expected that this will provide a signal for the solution of other ecological problems.

RETROSPECT AND PRESENT STATE

To be able to better assess the present state of automation technology and the future trend, it is helpful to look at the development in the field of sewage treatment over the past 40 years, because the demands placed on the effluent quality and the corresponding requirements placed on the technical installations are directly linked.

The development is characterized by three phases, which is illustrated

by the example of sewage treatment in the public sector (see Fig. 1). The development in the industrial sector runs mainly parallel to this.

The 1st phase, lasting until around 1970, is typified by extensive connection of the medium-size and larger towns and communities to biological sewage treatment plants whose rate of reduction at the time can be regarded only as partial biological treatment, however, according to present criteria.

In the 2nd phase almost complete biological treatment of all domestic and storm sewage was demanded as the goal of the environmental programme of the Social Democrat/Liberal coalition government in 1971. We have meanwhile come a large step nearer this goal. Today only a small proportion 7 % - of the entire population of the Federal Republic is still unconnected to a sewerage system. Some of them dispose of their night soil by way of sewage treatment plants.

As always, however, there is still a small percentage of sewage treatment plants - around 10 % - that even by today's standards can be regarded as performing only partial treatment. But by far the largest proportion - 85 % - provide full biological treatment.

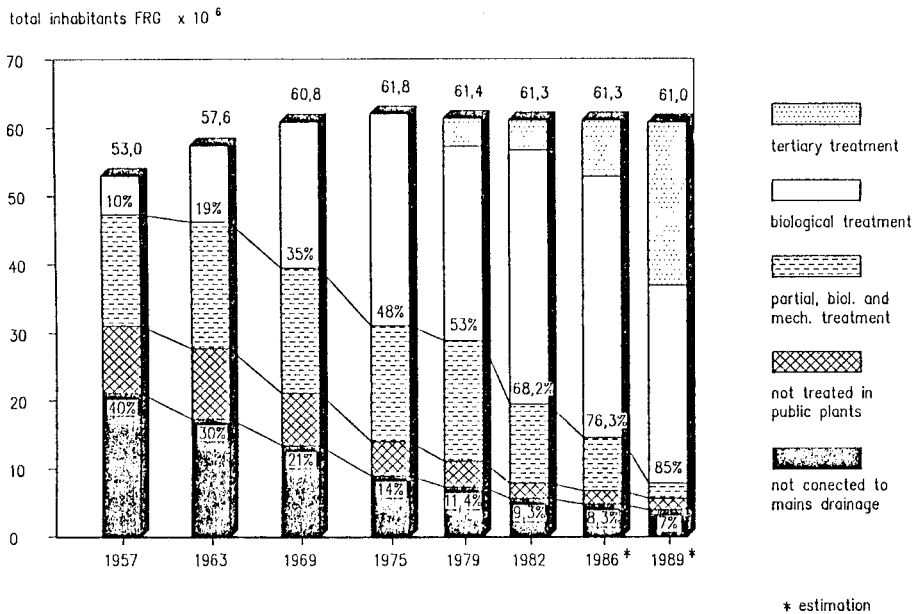


Fig. 1. Development of the treatment of domestic wastewater in the FRG (Gilles, 1987)

The critical situation in the North Sea and in the Baltic Sea in 1988 (dying seals and flourishing algae) prematurely initiated the 3rd phase. This phase is characterized by quality demands that have become considerably more stringent, and will also continue to become more stringent in future, now that almost every inhabitant is connected to the sewerage system and the discharged amounts are largely monitored. This applies, for example, to the main quality parameters, such as COD, P_{tot}, NH₄-N and N_{tot}, as is explained later on.

INSTRUMENTS FOR ENFORCING THE REQUIREMENTS

The development until 1971 was typified essentially by the classic administrative instruments of imposition and prohibition. It was found, however, that a significant improvement in lake and river water quality could be achieved only with difficulty in this way. Consequently, the concept was fundamentally revised; indeed:

- the range of legal instruments was made much more severe (Water Resources Act),
 - the pollution of lake and river water was made a criminal offence, and additionally
 - an economic incentive was created (Sewage Charges Act)
- in order to encourage the most far-reaching sewage treatment possible.

Minimum Standards for the Effluent of Domestic
Sewage Treatment Plants

Size of sewage treatment plants	COD	BOD ₅	NH ₄ - N	P _{tot}	Valid since
	mg/l	mg/l	mg/l	mg/l	
	Random Sample or 2-h average sample				
Size 1 < 60 kg/d BOD ₅ < 1 000 PE	180*	45*	-	-	1.01.85
	150	40	-	-	1.01.89
Size 2 60 - 300 kg/d BOD ₅ 1 000 - 5 000 PE	160*	35*	-	-	1.01.85
	130	30	-	-	1.01.89
	110	25	-	-	1.01.90
Size 3 300 - 1200 kg/d BOD ₅ 5 000 - 20 000 PE	160/140*	35/30*	-	-	1.01.85
	130	30	-	-	1.01.89
	90	20	-	-	1.01.90
			10**	-	1.01.92
Size 4 1 200 - 6 000 kg/d BOD ₅ 20 000 - 100 000 PE	140*	30*	-	-	1.01.85
	130	30	-	-	1.01.89
	90	20	-	-	1.01.90
			10**	2	1.01.92
Size 5 > 6 000 kg/d BOD ₅ > 100 000 PE	140*	30*	-	-	1.01.85
	130	30	-	-	1.01.89
	75	15	-	-	1.01.90
		10**	1	1.01.92	

* Value for the sedimentized sample /
all others non-sedimentized sample

** Denitrification as far as possible

Tab. 1. Development of minimum requirements for the effluent of domestic sewage treatment plants

The Water Resources Act stipulates, among other things, that any permission to discharge may be given only if the amount and harmfulness of the sewage are kept as low as possible in keeping with the generally recognized rules of engineering. The Federal Government lays down these rules in the form of standards for the municipal and all relevant industrial sewage dischargers. These standards (minimum requirements) are revised on a regular basis. Table 1 shows, for example, the development of these standards in the case of domestic sewage since 1985. These standards, which may not be exceeded, are formulated as a function of the plantsize.

When comparing the standards it has to be born in mind that since 1st January 1989 no longer the sedimentized, but solely the raw sample - in other words, including the settleable substances - is taken, and that at the same time sampling can be changed from the hitherto 2-hour average sampling to random sampling. Both changes are leading to an additional tightening of the requirements.

From 1992 onwards, nitrification and phosphate precipitation will be made binding also upon all sewage treatment plants with a capacity of more than 5,000 respectiv 20.000 PE.

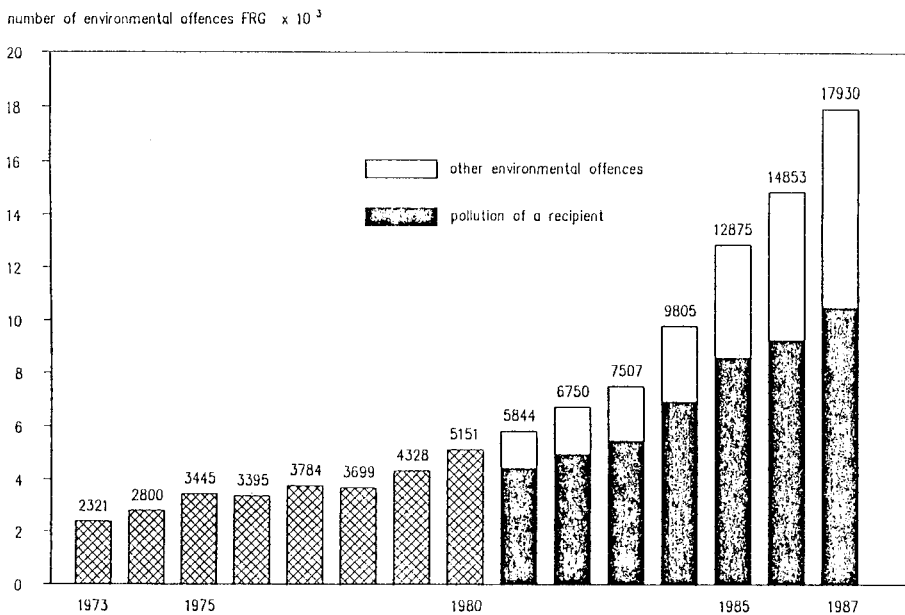


Fig. 2. Development of environmental offences in the FRG (Umweltbundesamt, 1989)

Particularly serious is the introduction of phosphate precipitation to values of less than 1 mg/l for sewage treatment plants upwards of 100,000 PE, which in such cases requires the adoption of secondary precipitation and filtration. Furthermore, after 1991, all new plants must in practice accomplish far-reaching denitrification.

As mentioned, since 1980 criminal law covers also environmental offences. Today even relatively minor offences can be punished, not only as an administrative, but also as a criminal offence. The increase of environmental offences (Fig. 2) that has been observed in the past few years is not, however, attributable to more punishable acts being committed nowadays than before, but solely to the standards by which these offences are judged today being set much higher than in the past. Furthermore, the intensity

and quality of official controls have improved considerably, and the will to punish environmental offences has become much stronger.

Pollutants	Unit of Pollution		Threshold Value	
	since 1.1.1981	since 1.1.1989	Concentration	Load
COD	50 kg O ₂	50 kg O ₂	20 mg/l	250 kg/a
P	—	3 kg	0,1 mg/l	15 kg/a
N	—	25 kg	5 mg/l	125 kg/a
AOX	2 kg	2 kg	100 µg/l	10 kg/a
Heavy Metals				
Hg	20 g	20 g	1 µg/l	100 g/a
Cd	100 g	100 g	5 µg/l	500 g/a
Cr	500 g	500 g	50 µg/l	2,5 kg/a
Ni	500 g	500 g	50 µg/l	2,5 kg/a
Pb	500 g	500 g	50 µg/l	2,5 kg/a
Cu	1000 g	1000 g	100 µg/l	5 kg/a
Fish-Toxity	3000 m ³ :G _F	3000 m ³ :G _F	G _F = 2	G _F = 2

G_F : Dilution factor, for which the diluted wastewater shows no toxic effect

Tab. 2. Definitions of units of pollution regarding the Sewage Charge act

A major new element is the so-called Sewage Charges Act, in force since 1981, whereby the polluter has to pay for the sewage load he discharges (polluter-pays principle). The sewage load is defined by so-called units of pollution. The definition of the unit of pollution has been constantly broadened (Table 2) and the costs to be paid for the unit of pollution steadily increased (Fig. 3).

costs of unit of pollution (DM/UP)

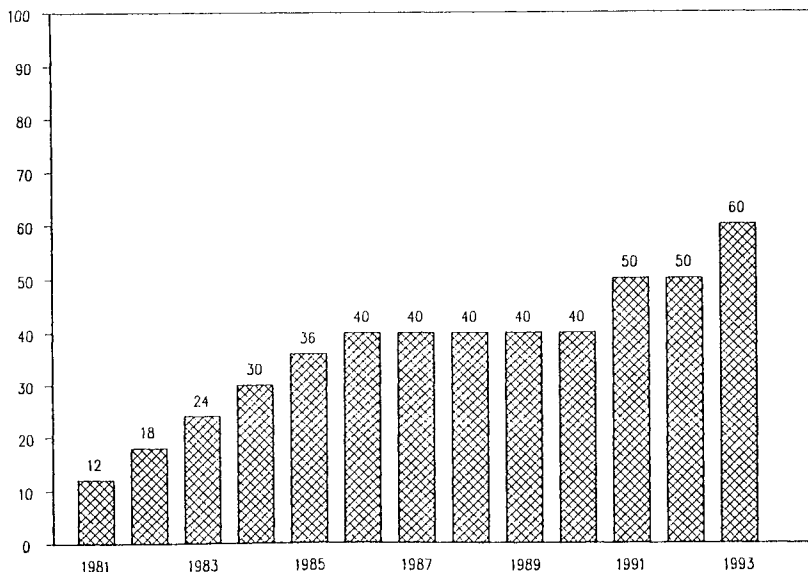


Fig. 3. Cost of units of pollution regarding the Sewage Charge Act

On the other hand, however, the Sewage Charges Act also offers the possibility of offsetting against such charges, under certain circumstances, capital expended for the improvement of sewage treatment. Moreover, the discharger who keeps well within the requirements is rewarded by a part of the charges being waived. The same applies to be charges for storm sewage from areas with combined sewerage systems.

All told, this Act, together with the so-called minimum requirements which - as said - reflect the generally recognized rules of engineering, has created a major economic incentive to use new technologies and to upgrade the treatment of sewage to a comparably high level.

CONCLUSIONS

More than 10 years of experience have meanwhile been gained with the Sewage Charges Act and with the minimum requirements of the Water Resources Act in the FRG. Even if both Acts were regarded at first with great scepticism, especially on the part of the sewage treatment plant operators, the advantages are today generally recognized. The Federal Government has thus broadened the range of administrative instruments with a very effective free-market-oriented instrument. It has created financial incentives for a continuous improvement of the technologies in use. Both instruments are very flexible and can - a fact of which many operators complain - be adapted very quickly to the changed ecological conditions. With the protection of the environment occupying a very prominent place in the consciousness of the population of the Federal Republic, this will also lead to a further tightening of the discharge conditions in future, to judge by the experience acquired to date. This will force planners, plant and equipment suppliers, and operators of sewage treatment plants, also in future, to think intensively about possible improvements, as well as to act.

Following the positive experience gained with the Sewage Charges Act it is to be expected that, increasingly, free-market-oriented instruments will be created and used in future also to resolve other ecological problems. In this respect a consensus seems to exist between the major political parties in the Federal Republic.

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