POTASSIUM AND NITRATE POLLUTION OF SURFACE WATER IN THE CATCHMENT AREA OF THE "BLANKAERT" WATER PRODUCTION CENTRE IN FLANDERS (BELGIUM)

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SUMMARY

The Environment Inspection Section, West Flanders Local Service has jurisdiction over the "Blankaert" water production centre, which is completely fed by surface water from the Ijzer river, the Blankaert pond and the Koevaardeken.

The quantity of drinking-water hourly distributed in the water supply system ranges from 300 to 2.800 m^3. Increasing pollution and seasonal differences in quality and quantity render a reservoir (3.000.000 m^3 capacity) absolutely necessary.

The rising potassium and nitrate content of the reservoir water led the drinking-water collection company to request the Environment Inspection Section to conduct an exhaustive inquiry into the causes of this pollution.

The potassium pollution turned out to be completely caused by the waste water discharge of an important company. Stopping the potassium discharge turned out to be impossible on the short term but initiatives on the European level will eventually cause standards as to the potassium content of drinking-water to be adopted.

The causes of the nitrate pollution are diffuse and are fully due to agricultural activities, being the excessive manuring of lands and pastures, on the one hand and the manure discharges on the farms, on the other. Our Local Service intensively scanned the catchment area of the water production centre and consequently imposed various preventive measures. Offenses have been reported to the Public Prosecutor.

1 Introduction

The water production centre (WPC) the "Blankaert" of the Flemish Water Supply Company (VMW) is located in the extreme West of Flanders (Belgium) (see Figure 1) and distributes 300 tot 2800 cubic meters of drinking water an hour based on surface water coming from the Ijzer river, Blankaertpond and the Koevaardeken.

The hydrographic basin of the Ijzer river covers the municipalities listed below: Alveringem, Poperingen, Vleteren, Lo-Reninge, Heuvelland, Ieper (Ypres), Zonnebeke, Langemark, Staden and Houthulst; the overall number of inhabitants amounts to 110,000 (see Figure 2).

The area has a surface of about 300 square kilometers and is largely agrarian: intensive farming and intensive cattle breeding. Overall livestock consists of more or less 100,000 bovine animals, 630,000 pigs and 1.7 million of poultry. Only in the Ypres area do we find a limited industrial activity.

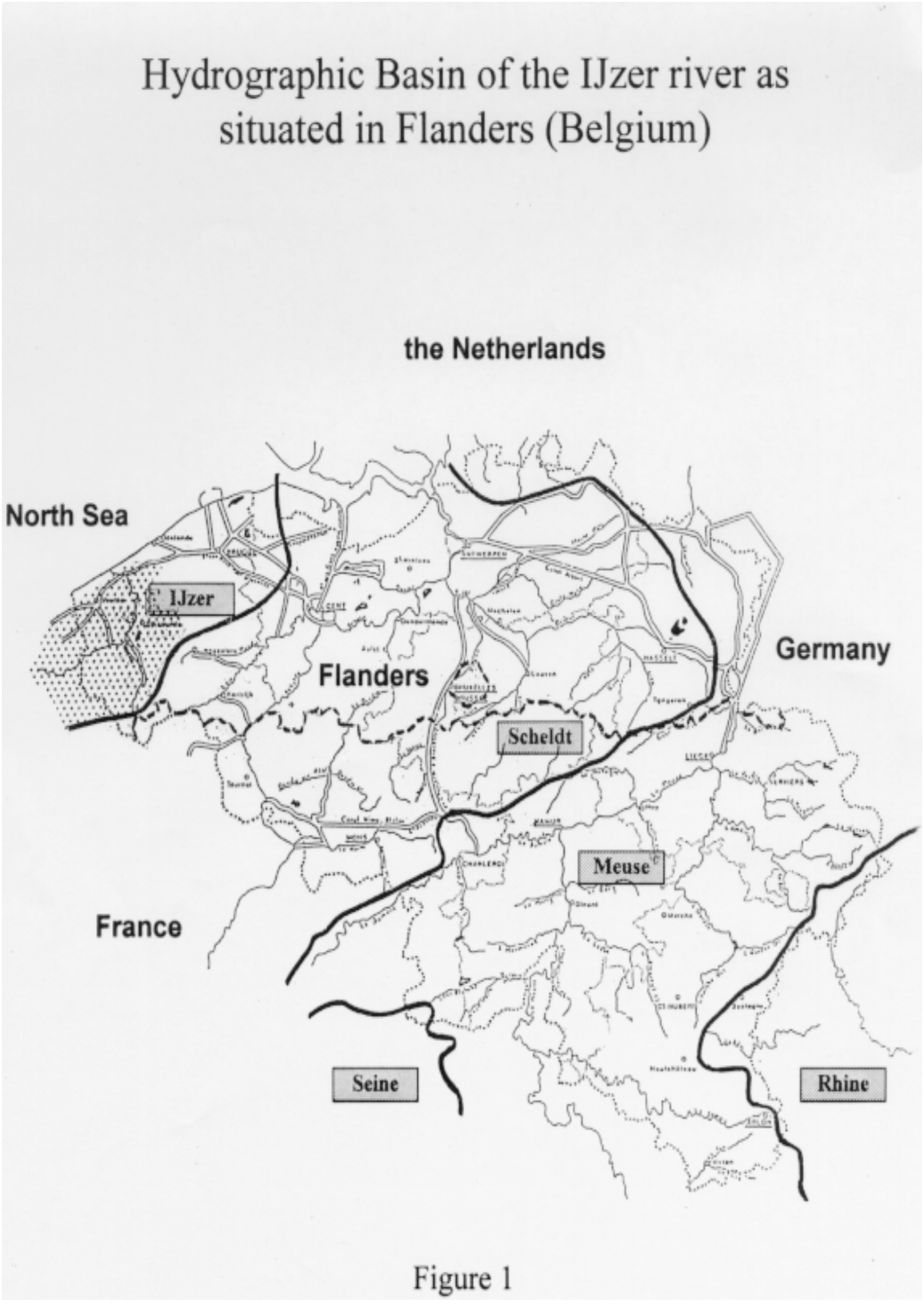
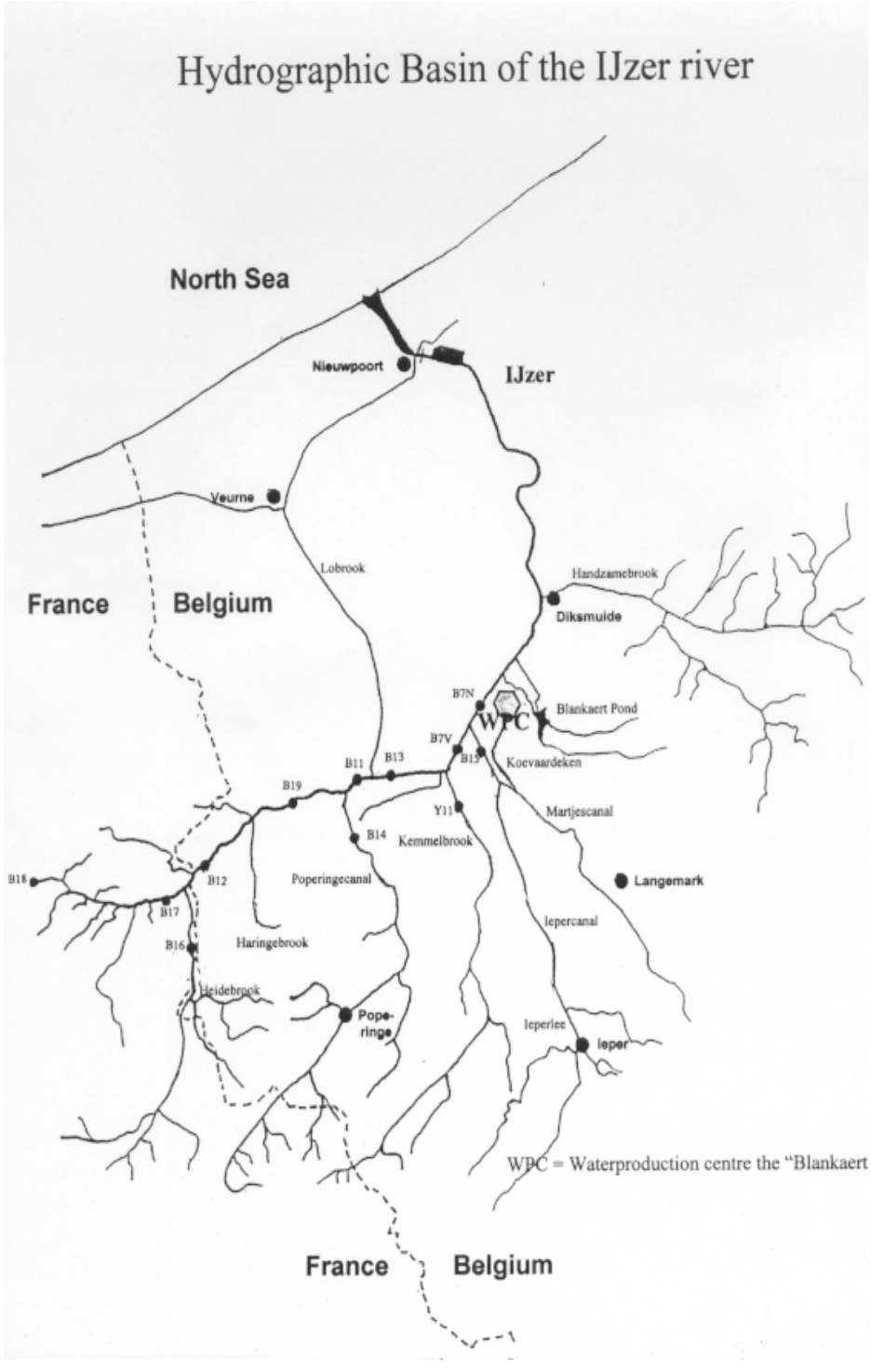

Hydrographic Basin of the IJzer river as situated in Flanders (Belgium)
the Netherlands
North Sea
IJzer
Flanders
Germany
Scheldt
Meuse
France
Seine
Rhine

Figure 1


Hydrographic Basin of the IJzer river
North Sea
Nieuwpoort
IJzer
Veurne
Lobrook
France
Belgium
Handzamebrook
Diksmuide
B7N
WPC
Blankaert Pond
B7V
B15
Koevaardeken
B11
B13
B19
Y11
Martjescanal
B14
Kemmelbrook
Langemark
B18
B12
Poperingecanal
B17
Iepercanal
B16
Haringebrook
Heidebrook
Pope-
ringe
Ieperlee
Ieper
WPC = Waterproduction centre the "Blankaert
France
Belgium

As quality and quantity of surface water in waterways largely dependent on the seasons, intermediate storing in a reservoir is absolutely necessary (contents: 3 million cubic meters). The storage of surface water takes place as a function of the quality and mainly in wet periods. Figure 3 shows the water production center (WPC), the "Blankaert" and the surrounding catchment area (see Figure 3).

Initial sedimentation and a biological self-purification take place in the reservoir. After the reservoir, the water is purified in two biological oxidation towers with lava rock. Next, the remaining organic material is decanted with ferrichloride. Finally, after breaking-point chlorination and activated carbon filtration, sodium hypochlorite disinfection is carried out. This water is subsequently pumped to the consumer as tap water.

Nevertheless, reservoir water quality is negatively affected by the following parameters: pesticides, potassium, boron, nitrate and sewage. As far as sewage is concerned, an extended program is currently in progress and includes constructing waste water collectors and waste water treatment plants in the above-mentioned municipalities.

2 The potassium problem

On July 31, 1992, the Government of Flanders granted a deviation for the potassium parameter up to 30 mg/l for the VMW the "Blankaert" water production centre, whereas then drinking water standard for potassium amounts to 12 mg/l.

Conducting research into the cause of this high potassium concentration was made as a condition for granting that temporary deviation.

An initial study was carried out by the Flemish Water Company. As treatment at the water production centre itself did not influence the potassium levels, the latter completely depends on the quality of the surface water taken in.

That's why the hydrographic basin of the Ijzer river was examined. It revealed that the potassium levels already come close to the 12 mg/l standard value at the source in France and that it keeps on growing downstream up to the place where the water is collected for the reservoir. On the one hand, this rise is caused by draining farmland through topdressing and on the other hand by industrial discharges through the Ieperlee, by far making the largest contribution.

This way, one notices that the potassium levels in the Ijzer river rises from 19 to 43 mg/l due to the water supply from the Ieperlee (51 mg/l), in turn fed by the Ieperlee (192 mg/l).

Table 1 summarizes the potassium levels (in mg/l) in the surface waters of the collection area. The code refers to the sample location indicated in Figure 2.

Furthermore, it was revealed that the high potassium levels of the Ieperlee came from discharges of one of the industrial zones of Ypres town. The discharges of that particular industrial zone contained as much as 900 mg/l and this way the main potassium source was already found, more or less.

The Environment Inspection Section took waste water samples of all important companies located in the industrial zone concerned. The analysis results revealed that the potassium concentration in the waste water of a soya-processing company amounted to an average of 1.000 mg/l or a bulk of more or less 2.500 kilograms of potassium a day. The highest potassium concentration observed in the other examined companies amounted to 72 mg/l.

The discharge permit of the soya-processing firm did not include any potassium standard, but the Environment Inspection Section ordered the firm to submit an action proposal aiming at a dramatic decrease of the potassium level in the waste water.

Soon, however, one of the raw materials used (soya flakes) turned out to contain much potassium. Consequently, the potassium level in the waste water could not be lowered by changing the production process. Furthermore, it turned out that a period of at least two years would be

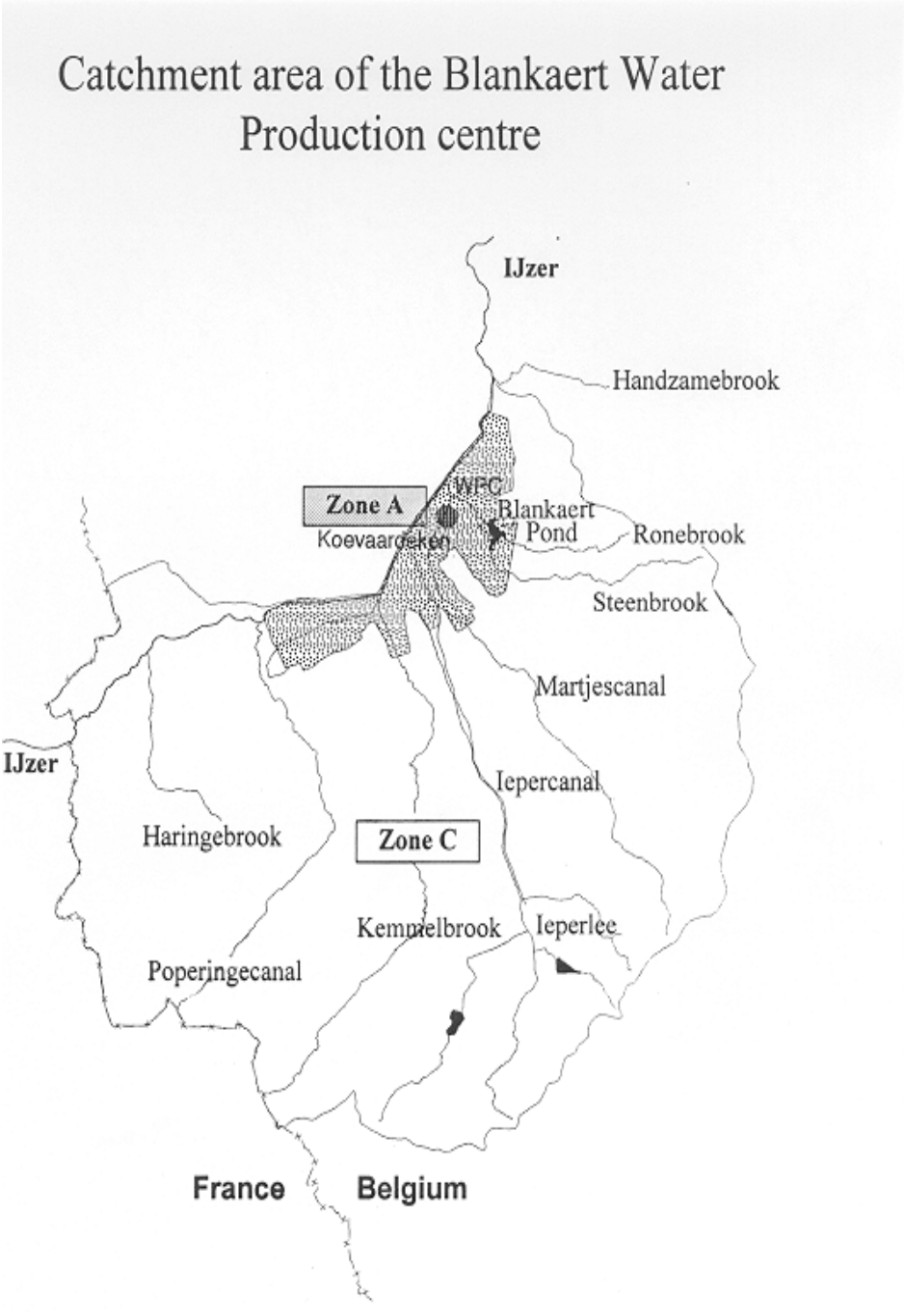

Catchment area of the Blankaert Water Production centre
IJzer
Handzamebrook
WPC
Zone A
Blankaert
Pond
Koevaardeken
Ronebrook
Steenbrook
Martjescanal
IJzer
Iepercanal
Haringebrook
Zone C
Kemmelbrook
Ieperlee
Poperingecanal
France
Belgium

Figure 3

required for a water purification extension with a facility based on the reverse osmosis principle to become operational. Moreover, this action would require the company to make a very considerable investment.

A literature study further revealed that laying down a potassium standard for drinking water quality is obsolete. The 1992 revision of the World Health Organization guidelines for drinking water quality (report of the final task group meeting; Geneva; Switzerland, September 21 to 25, 1992) eliminated the potassium parameter. In its document entitled "Updated comments on the Revision of the Drinking Water Quality Directive 80/778,1993", the EUREAU organization stated the following regarding potassium: "*...can be omitted without any effect on the water quality or protection of the consumer.*" and also: " *...the parameter has no relevance to water quality to the consumer and can be removed from the directive.*" In fact, the potassium parameter will soon be omitted from the European directive.

Table 1. Hydrographic basin of the IJzer river: potassium-concentration (mg/l)

SAMPLING POINT	CODE	MEAN	MINIMUM	MAXIMUM
Ijzer at Esquelbecq	B 18	11,3	6,8	20,6
Ijzer at Bambecq	B 17	12,8	7,2	24,5
Ijzer at Eybecque	B 16	18,9	9,4	42,5
Ijzer at Roesbrugge	B 12	16,5	4,6	31,7
Ijzer at Stavele	B 19	20,8	8,5	46,4
Poperingecanal	B 14	23,5	11,6	49,4
Ijzer at Elsendamme	B 11	20,7	8,5	49,2
Ijzer at Flintels	B 13	16,9	8,0	38,2
Kemmelbrook	Y 11	25,2	10,5	76,5
Ijzer before confluence with Ieperkanal	B 7V	34,2	9,0	179,8
Ijzer after confluence with Ieperkanal	B 7N	42,6	3,1	181,8
WPC the Blankaert		22,4	15,5	35,4

For these reasons, it was decided to not impose any measure for the company involved lowering the potassium levels in the drained waste water.

3 The nitrate problem

High nitrate concentrations in surface water cause problems for reaching the drinking water standards laid down. The March 15, 1989 Government of Flanders Decree lays down the standard to be no more than 50 mg/l. Table 2 offers a summary of the nitrate grades (in mg/l) in the surface waters of the catchment area. The code refers to the sample location indicated in Figure 2.

No doubt, direct liquid manure drainage combined with topdressing of farmland are the main nitrate pollution sources.

Table 2. Hydrographic basin of the Ijzer river: nitrate-concentration (mg/l)

SAMPLING POINT	CODE	MEAN	MINIMUM	MAXIMUM
Ijzer at Esquelbecq	B 18	60	41	87
Ijzer at Bambecq	B 17	60	39	85
Ijzer at Eybecque	B 16	55	1	86
Ijzer at Roesbrugge	B 12	44	0	85
Ijzer at Stavele	B 19	48	2	84
Poperingecanal	B 14	52	0	115
Ijzer at Elsendamme	B 11	48	3	97
Ijzer at Fintele	B 13	48	0	98
Kemmelbrook	Y 11	58	0	133
Iepercanal	B 15	50	0	119
Ijzer after confluence with Iepercanal	B 7N	42	1	108
WPC the Blankaert		32	5	50