CLEAN-UP PROCEDURES FOR WASTE WATERS WHICH FLOW FROM REFINERIES AND OTHER CHEMICAL COMPANIES

V. Calamaz, Water Quality Protection Office, Water and Environmental Department, Romanian Waters Authority, ROMANIA

ABSTRACT This work deals with a part of the treatment activity of the rivers from our district. This paper presents information about an installation for keeping petroleum products, placed on the discharging channels from two big refineries, out of two major rivers. Its efficiency and how it should be located will be shown. The impact of those installations on the Prahova and Teleajen rivers has been studied in systematic laboratory analyses; the results are shown in graphs. Also presented is the method for retaining suspensions derived from the Valea Calugareasca Chemical Works. The results obtained during a year are shown in graph.

KEYWORDS: surface water clean-up

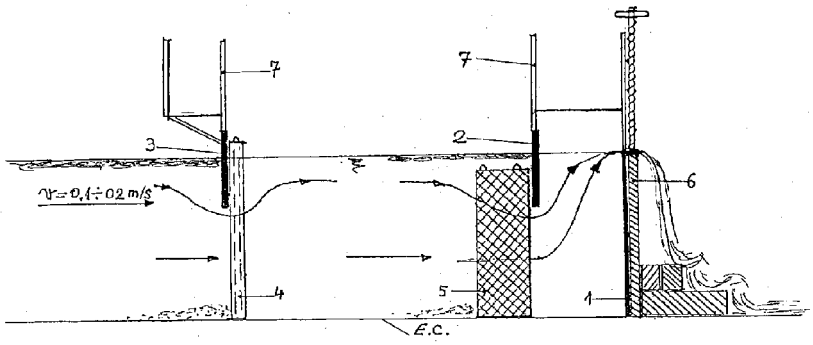
INTRODUCTION

The Prahova Valley is well-known in Romania and in the whole world as the "Carpathian Pearl." The main rivers—Prahova, Teleajen, and Doftana—cross the Bucegi mountain area, which is a part of the Carpathian mountain range. My district, besides having tourist importance, is known as an important petroleum zone, where hundreds of petroleum wells bring crude oil out of the heart of the Earth.

The abundance of petroleum led to the development of an important petroleum industry in Ploiesti, with five main petroleum refineries—Petrobrazi, Petrotel, Astra Romana, Vega, and Steaua Romana. Although modern industry in the city improves the quality of life, one can assume that these industries continually put the environment at risk of permanent damage. Important industries are a major source of many pollutants.

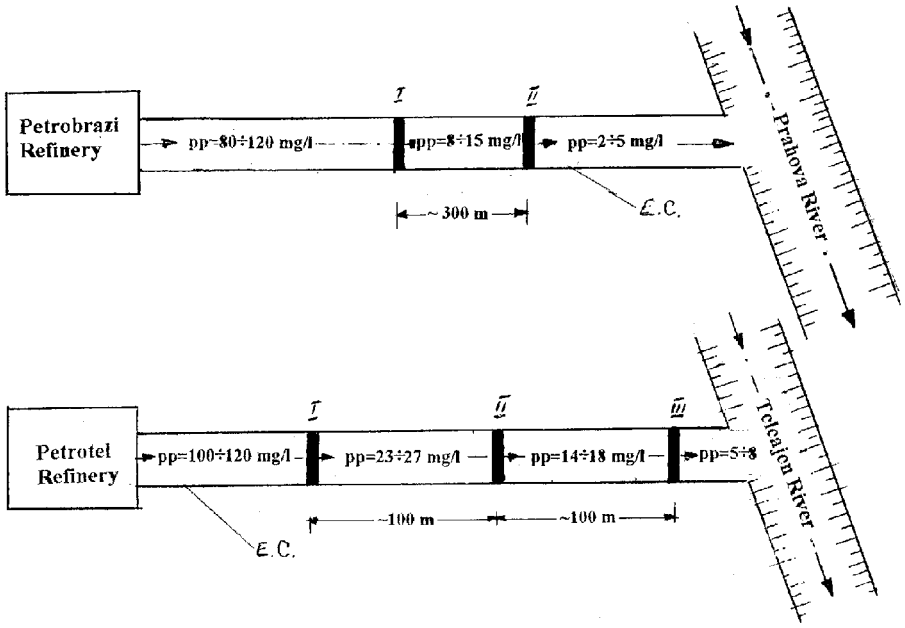
The petrochemical industry is causing specific problems for Prahova County, with negative effects upon the waters such as pollution problems. The main pollution source is the inadequacy of the purging stations in some petrochemical enterprises. Many technological installations, which become old, can produce accidental pollution. In these situations, the purging stations need to remove large amounts of petroleum products. This is the main reason for the polluted waters in rivers.

The great petrochemical factories around the city of Ploiesti shed tens of tons of petroleum products into the Prahova and Teleajen rivers daily. In 1992 the Water Quality Protection Office in Romanian Waters Authority was established. After trying a few models in my own laboratory, I designed the installation (Figure 1) for keeping petroleum products out of the waste waters coming from refineries.



Legend:

1 - panel
2, 3 - panels half-dipped
4 - filter model CV1
5 - filter model CV2
6 - dam
7 - staircase and passing way



I - the first keeping installation
II - the second keeping installation
III - the third keeping installation

pp - petroleum products
EC - evacuation channel

FIGURE 1. THE TECHNOLOGICAL SCHEME.

From the beginning, my results were marvelous. The installation was able to stop hundreds of tones of petroleum products that otherwise would enter the Prahova River. Now, there are several of these installations for keeping the petroleum products out of the waste water: three at Petrochemical Enterprises in Ploiesti and one at Darmanesti Refinery. In the future, this installation will be put at all Romanian refineries and could be supported by the Water Department.

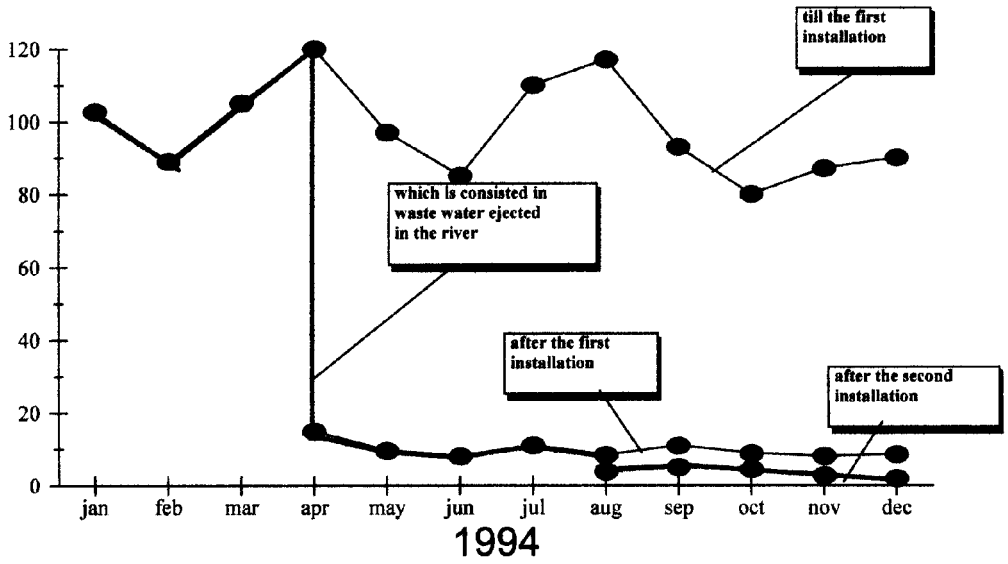


FIGURE 2. CONCENTRATION DIAGRAM OF PETROLEUM PRODUCTS ON THE EVACUATION CHANNEL OF THE PETROBRAZI REFINERY.

THE EFFICIENCY OF THE INSTALLATION FOR KEEPING THE PETROLEUM PRODUCTS

The petroleum products are kept and returned to the refineries as a raw material. In fact, the refineries in Ploiesti use this installation because it is very efficient. The results are spectacular if there are two installations, one after another. The interest by companies and firms is because of several things:

- the simplicity of the installation;
- very easy siting of the installation;
- simple working of the installation;
- high rate of efficiency if used daily;
- high rate of efficiency when accidental pollution occurs because of damages at the refineries.

To better show the efficiency of the system, I'll give a short example and statistical data arising from the analysis made in 1994 from the samples collected on the discharging channel for waste waters belonging to the Petrobrazi Refinery (Figure 2). From the refinery, the petroleum products concentration is from 80-120 mg/l. After the passing of waste waters through the first installation, the petroleum products concentration reaches values confined to 8-15 mg/l. Three hundred meters from the first installation is the second one, for extra removal. The waste water coming from the second installation has a concentration of petroleum products of about two to five mg/l. A quantity of ten to twenty tones of petroleum product is kept daily for the Petrobrazi Refinery.

During 1995 we also watched the evolution of the petroleum products concentration on the discharging channel of the Petrotel Refinery (Figure 3). There are three installations for keeping the petroleum products to this refinery, placed at about one hundred meters distance from one another. The waste water discharged from the purging station of the refinery has a

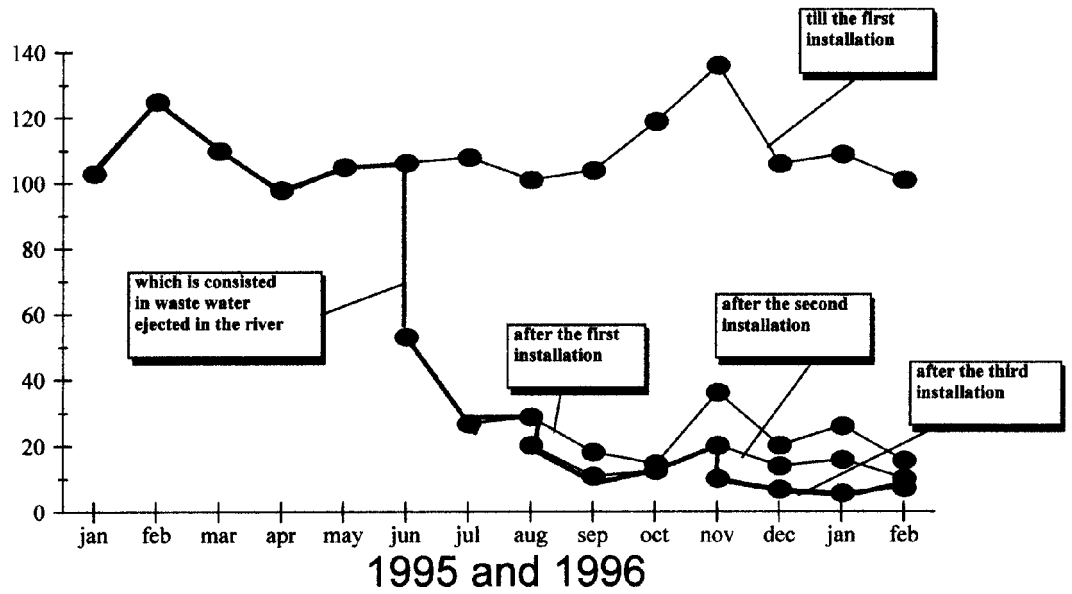


FIGURE 3. CONCENTRATION DIAGRAM OF PETROLEUM PRODUCTS ON THE EVACUATION CHANNEL OF THE PETROTEL REFINERY.

petroleum products concentration of about 100-120 mg/l. After the first installation, the petroleum products concentration in waste water is about 25 mg/l. After the second installation, the petroleum products concentration in waste water is from 14 to 18 mg/l. After the third installation, the petroleum products concentration in waste water becomes 5-8 mg/l.

In the future we will put in another installation, the fourth, for further reduction of the petroleum products concentration. Because of the age of the purging station, much biological sludge is discharged, putting heavier usage on the functioning of the installation for keeping the petroleum products. I have already shown the technological scheme of the keeping installation and also its parts. I have also shown the diagrams of the petroleum products concentration (the petroleum products discharged in channel by the two refineries).

THE IMPACT OF THE INSTALLATION FOR KEEPING PETROLEUM PRODUCTS FROM THE PRAHOVA AND TELEAJEN RIVERS

The impact can be assessed by comparing data from the analyses made in the last years. Watching the graph of the qualitative evolution of the water of the two rivers, we notice a considerable increase in the water quality in the river.

The Prahova and Teleajen rivers were considered as without life until the installations for keeping petroleum products out of the rivers were put in place. The petroleum products concentrations, the dissolved oxygen, and the chemical oxygen demand were very high, much greater than the admitted concentrations (Figures 4 and 5). Life began to appear in the Prahova and Teleajen rivers thanks to the improvement of the water quality parameters. In the future,

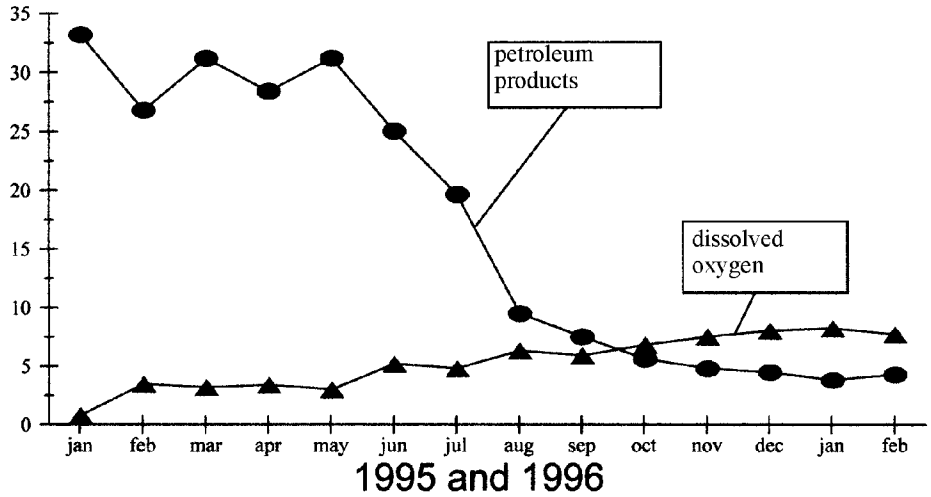


FIGURE 4. CONCENTRATION DIAGRAM OF PETROLEUM PRODUCTS AND DISSOLVED OXYGEN ON THE PRAHOVA RIVER.

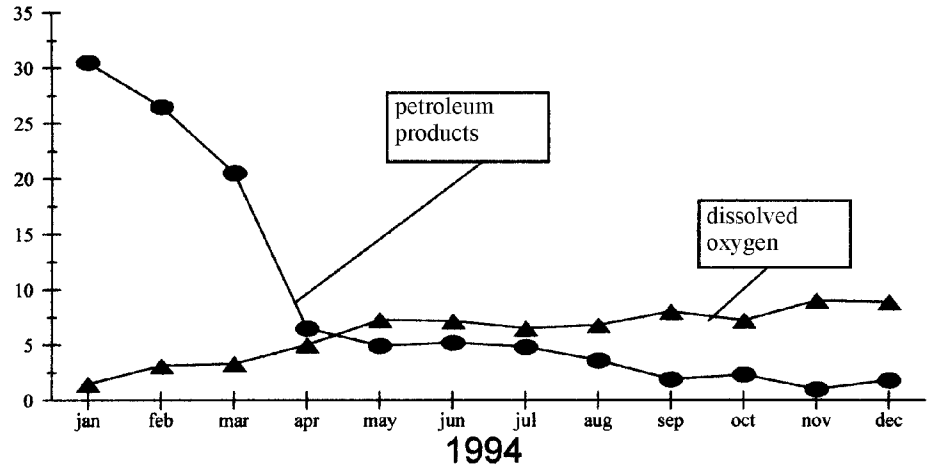


FIGURE 5. CONCENTRATION DIAGRAM OF PETROLEUM PRODUCTS AND DISSOLVED OXYGEN ON THE TELEAJEN RIVER.

aeration thresholds will be established as the dissolved oxygen quantity increases.

TREATMENT OF WASTE WATER DISCHARGED FROM THE CHEMICAL WORKS OF VALEA CALUGAREASCA

About 25 km from Ploiesti, there is a Chemical Works that manufactures phosphorus fertilizers, phosphorus salts, sulphuric acid and derivatives, and fluorine compounds. This factory constitutes a powerful source of water, soil, and air pollution. I investigated the activity of water treatment. Large quantities of iron ash are discharged in the Teleajen River because of the unsatisfactory functioning of the decantation basins. On the waste water discharging channel I put 6 cells, which fulfill a double role: retaining suspensions and aerating the water. More than five tones

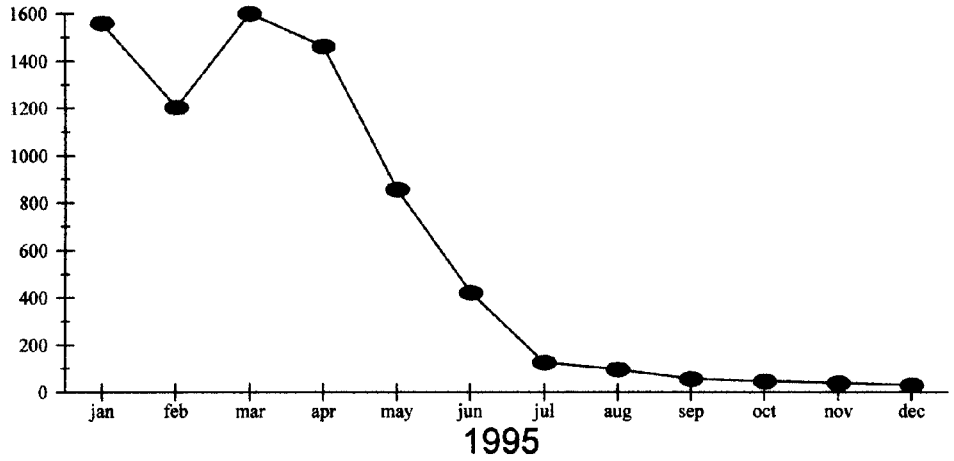


FIGURE 6. CONCENTRATION DIAGRAM OF SUSPENSIONS ON THE EVACUATION CHANNEL OF THE CHEMICAL WORKS.

of suspensions are kept in the cell daily. The suspension concentration in the waste water discharged in the river was reduced from 1,200-1,600 mg/l to 30-60 mg/l, reaching thereby the admitted norm (Figure 6).

FINAL CONSIDERATIONS

In this paper, I wanted to show just a part of the work and concerns of Romanian specialists in the water quality protection field. Water pollution has taken place over a long period of time, starting when people believed that powerful industry development was all that mattered. Almost the whole environment protection field and the impact of pollution on human beings has been ignored. People have become more aware, understanding the fact that we can only survive in a healthy environment. The water is an invaluable wealth on the Earth, the most delicate, the most pure wealth—the soul of the Earth.