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H₂O management and chemistry

It is well known that the Netherlands is built in and from the water. The country is situated in the estuaries of many great rivers: the Rhine, the Meuse, and in the north the Ems. And, of course, a sea forms a major part of its borders: the North Sea. Moreover, many parts of the country are situated below sea level. Water — H₂O — galore, therefore; a liquid that must be managed every day, with chemistry because of its chemical properties.

The Netherlands is divided into “waterschappen.” These districts water boards are functional government agencies commissioned to manage the water within their boundaries. They are responsible for water management, both qualitatively and quantitatively. They are also responsible for the sea dikes. Every day, these water boards ensure that Dutch citizens do not get their feet wet and that the water in the ditches and canals remains clean.

What, you may ask, does this day-to-day water management have to do with chemistry? Well, a lot!

Water quantity management

To begin with, the water in this case is not simply H₂O, i.e. pure distilled water; no, it contains many additions. It holds much organic material, for example, which will give trouble eventually. This organic material will enter the water, for example, because the Dutch soil in many places contains much peat. Suspended peat particles will quickly bind chemical substances. When heavy enough, it will sink to the bottom of the ditches and canals as sludge. This sludge must be removed at regular intervals, because it obstructs the supply and discharge of water. The water boards have a great sludge problem, both under water on the bottom of the watercourses, and on land. The Netherlands, therefore, has many sludge depots. Essentially, these may often be characterized as major chemical dumping grounds. Many of these depots are a great burden to the environment. For this reason, they must be insulated to prevent pollution of the groundwater. Sometimes they must be decontaminated. In short, they are a chemical point of attention.

Subsidence due to gas extraction

The presence of natural gas and oil under the Dutch soil has made a significant contribution to the birth and flowering of the Dutch chemical industry. But gas extraction has also had a different and remarkable effect in Groningen. It has caused the land – often already lying below sea level – to subside even more. How is this possible? The gas is contained under high pressure in porous rock layers deep underground. As soon as the gas is being extracted, the pressure in the emptying reservoir will gradually begin to decrease. When this happens, the pebbles of reservoir rock will become slightly compressed by the weight of the layers on top of the reservoir. The degree of subsidence



The large pumping station ‘Rozema’ near Termuntenzijl

depends, among other factors, on the drop in pressure, the composition and porosity of the rock, and the thickness of the reservoir. A measurement made in 1998 showed a maximum subsidence of 23 cm. According to the prognoses, this will increase to around 45 cm in the year 2050. In a flat country, several tens of centimeters of subsidence will have such an impact on the soil hydrology that, for example, several

pumping stations will have to be built to counter these effects. The large pumping station in the photograph above, situated near Termuntenzijl, is one of them. It pumps water from the polder into the Wadden Sea. Besides gas extraction, other causes of subsidence may be, for example, the settling of clay and peat layers, the lowering of the groundwater table, and oil and salt extraction.

Water quality management

As we have seen, it is not distilled water we are concerned about. The district water boards do not supply (drinking) water either. However, they are responsible for the purification of waste water. After the various municipalities have collected the waste water in their sewer systems, the district water board transports this polluted water through large

pipes to one of the many purification plants. The every-day use of water in private homes, in the street, and in factories pollutes it all over again with organic material and other chemicals. In the purification plants, all this water is purified with biological processes. Bacteria and much oxygen are used to purify the

See next page >>

No day off for mentors on Sunday

Saturday evening and Sunday were particularly hectic times for the mentors. The assignments for the practical exams they were given gave rise to an hours-long debate about the exact formulations of the assignments, the marking regulations, and the marking weights. When a persistent difference of opinion could not be overcome by talking about it, the representatives of the participating countries voted by holding up a red or green card; the decision was then taken by majority vote. Because the chair was strict but fair, these discussions could fortunately be concluded well within the appointed time frame, and the translation stage could begin. The mentors are expected to translate the (English) master document into the native



language or languages of the students in their teams. For this purpose, 60 computers had been deployed throughout the holiday park.

Intensive use was made of these machines until the small hours of the night and again from early in the morning into the day. For the mentors of several countries with English as native language, this translation stage was relatively easy. They were free to explore the countryside on foot, by canoe, bicycle, or sail boat.

>> Water management

waste water. Sometimes this process has to be supported with additives, for example to increase the water's acidity. After a long series of bacteriological treatment, aeration, and sedimentation steps, the water has for the most part been purified while the pollutive chemicals have settled in the sludge. The result is clean water and, once more, polluted sludge. In the past, this sludge was used as fertilizer in agriculture but it is now too polluted to be spread on the fields. The purification sludge is now processed with various alternative methods, for example drying, burning, storage in old mines, and using it as raw material for cement.

The district water boards do more than taking care of the quality of the (communal) waste water. They also monitor the quality of the surface water on a daily basis. Surface water is polluted by all kinds of natural processes, but often even more so by human activities. These activities — often industrial in nature — release many substances that pollute the water, either directly or diffusely. Through a permit scheme and a monitor system, the water board keeps an eye on the direct chemical pollution of the water. Various European and national regulations will help to push back the more diffuse chemical pollution also. We have come a long way in this respect in the Netherlands, but is still not the case that we can drink from any ditch without running serious health risks. Nature also suffers from this sub-standard water quality, since the water is still



Helophyte filter.

too polluted with phosphates, nitrogen, zinc, copper, and crop protection chemicals. The main sources of this pollution are intensive agriculture, the building industry, and the water mains network. Together with industry, agricultural organizations, and the population at large, we expect to push back chemical pollution, so that in the near future — even more so than today — we may truly speak of H₂O management in this low-lying, damp little country of ours.



Tomorrows program

Tuesday 09 July 2002

MENTORS / SCIENTIFIC OBSERVERS

08.00-17.00 Translation Theoretical Examination
19.00-23.00 Frisian evening

STUDENTS

07:00 Early breakfast at hotel
08.00-17.00 Excursion 'Water Management and Chemistry'
19:00 Dinner at hotel

GUESTS

08:00 Breakfast at hotel
10.00-19.00 Excursion in Friesland
19.15-23.00 Frisian evening

Trip to Bourtange



Team purple-blue discussing tactics

Yesterday afternoon, all IChO students played a kind of living Stratego in this authentic fortified town. The starting signal, a canon blast, was given by a member of the "a little bit Dutch team", South Korea. In four teams (split up into two subteams), they then had to answer the question "What is the Fifth Direction of the Wind?"

Puzzles

They could extract tips from a soldier, a lieutenant, a minstrel, a mill boy, and a monk who all happened to be in town. They also had to solve puzzles and carry out assignments in small groups. However, any team member was always in danger of being "taken out" by a member of another team with a higher rank. This could earn the teams points. In short, it all came down to the right combination of cooperation, communication, and competition. The final assignment involved the joint building of an amphitheater with wooden poles and ropes. In the amphitheater, it finally became clear what the "Fifth Direction" was. Each team was asked to answer the question and present arguments for their answer. One team had the correct answer: the Fifth Direction is within you. The argument: a group can achieve a lot if all members move as one in the same direction, as the afternoon's game had shown.



Questioning the lieutenant



Building the amphitheater

Girls (and boys) from Thailand, Norway, and Kuwait

A quick count of the names published in Catalyzer 4 shows that only 20 % of the students is female. The more striking, then, that there are three teams with three girls and one boy. The teams from Norway, Thailand, and Kuwait therefore had to have a group photograph taken of them

all together. These teams, and particularly the boys, themselves also felt that they were a bit special. The teams really did not know what to expect, but so far they have enjoyed the Olympiad tremendously. Especially the Dominoes game of the day before



yesterday was much appreciated. One girl on the Thailand team had also participated in last year's Olympiad in India. So far, the Netherlands compare well with India, she told us, but sadly it is very cold here!

Did you know that...

- The Byelorussian host expects his team to win five silver medals.
- The Mexicans are rapidly making friends with delicious tequila candy (highly recommended).
- Sam Salman (Australia) can be reached after the Olympiad at saamsal@hotmail.com.
- The Catalyzer Press can be found in rooms 124 and 130 in Zuidbroek.
- A flip-chart will probably be available as of tonight so that you can react to questions or propositions we want to put to you.

Safety instructions

To ensure maximum safety during the Olympiad, all students have been instructed on Sunday 7 July on how to work safely in the laboratories. They have also been instructed on what to do if a calamity should occur. This was done in two rounds with four groups of students each. Students are to abide by the following regulations:

- Wearing safety glasses or goggles and a lab coat is obligatory.
- Sandals and open shoes are prohibited; only closed shoes are allowed.
- Students are to wear a long skirt or full-length trousers.
- Long hair must be done up.

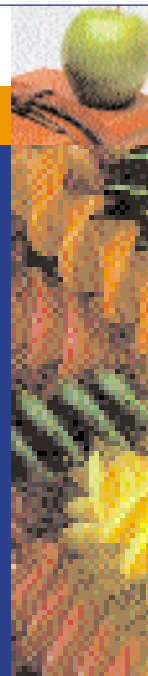
In the case of a first violation of the safety regulations, the student concerned will receive a warning. A second violation will result in exclusion of the student.

What's on today's menu?

Monday 08 July 2002

Dinner Zuidbroek

- Fish: fillet of hake or cod parings
- Meat: chicken drumsticks
- Vegetable: cauliflower
- Pasta with sauce (also vegetarian)
- Pilaf rice
- Cream potatoes
- Russian salad
- Salads with a variety of dressings



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