

REHABILITATION OF A WASTE DUMP SITE

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1 The Problem

The 1.000.000 square meters Volgermeerpolder tipping site was used for disposal of municipal and industrial solid waste from Amsterdam from the 1920's onwards. In later years, barrels of chemical waste were also dumped there, the most damaging being the organic chlorine compounds (chlorobenzenes, chlorophenols, hexachlorocyclohexane, 2,4,5 T). Also small quantities of 2,3,7,8 (dioxin) and TCDF were analyzed. Dissolved pollutants were found to be spreading with the flow of groundwater and surface water.

Geologically the Volgermeerpolder consists of partially excavated peat in which area the waste has been tipped on top of a sandy layer from -15 to -40 m. In this sandy layer groundwater is transported. Hydrologically the Volgermeerpolder has a relatively high freatic water level, resulting in a flow of leachate towards the groundwater.

Grontmij was requested to assess the quantity and the quality of the polluted area and to develop a rehabilitation plan, involving geological and hydrological aspects, countermeasures to minimize effects in surrounding polders, water treatment, removal of excavated waste and rehabilitation of the area.

2 Proposed solution

Technical and financial considerations lead to a land rehabilitation method whereby lowering of the groundwater level in the Volgermeerpolder by approximately 3 m will counteract the spread of the pollution. The waste will be covered by an impermeable foil.

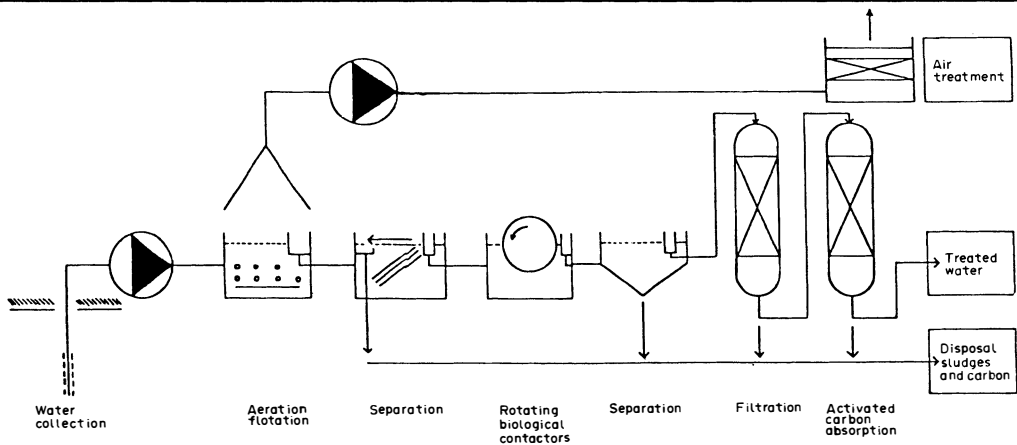
The treatment of the leachate was subject of a pilot plant study in which two systems were evaluated:

A Biological treatment - rotating biological contactors

Description of the process and calculated yields based on 5 month period pilot plant run on site. Throughput of pilot plant was approximately 1000 liters per hour.

Water quality parameters

		Raw effluent	After Rotating biological contactors	Treated effluent	Criteria for discharge to surface water
COD	mg/l	245	130-180	20-75	75
TKN	mg/l	80	40	30	15
EOCl	microg/l	540	6- 10	5	5
Chlorobenzene	microg/l	625	10- 50	5	1

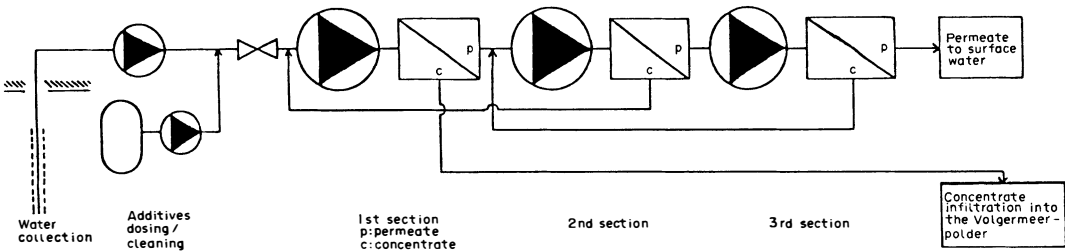


B Physical treatment - Reverse osmosis

Description of the process and calculated yields based on pilot plant experiments. Pilot plant experiments were conducted batchwise and in continuous mode on a 100 liters per hour scale. The unit was in operation on-site continuously during 17 days.

Water quality parameters

		Raw effluent	After 2nd section	Permeate	Criteria for discharge to surface water
COD	mg/l	245	0,2	0,1	75
TKN	mg/l	80	1,1	0,3	15
Pb	microg/l	490	0,1	0,03	50
Zn	microg/l	2150	0,4	0,2	200
EOCl	microg/l	540	6	1,5	5
Chlorobenzene	microg/l	625	0,2	0,1	1
Chlorophenol	microg/l	131	1	0,2	1



	Physical Treatment (Reverse Osmosis)	Biological Treatment
Approximate costs per m ³ treated water to meet criteria for disposal in surface water	Hfl. 4.50	Hfl. 4.00
Advantages	<ul style="list-style-type: none"> . always possible to meet criteria . positive barrier for heavy chemicals like dioxins . changes in throughput easily made (flexible system) 	<ul style="list-style-type: none"> . biological break down of chemicals (not all chemicals and systems may be effected by toxic chemicals)
Disadvantages	<ul style="list-style-type: none"> . concentrate flow has to be injected into waste . more expensive method . energy intensive, more maintenance required . water has to be kept anaerobic to prevent heavy fouling, mainly because of metal oxides and foam 	<ul style="list-style-type: none"> . uncertain if criteria will be met . not all chemicals biological degradable (e.g. dioxins) . production of sludge and waste carbon, that has to be dumped . plant design has to cope with heavy fouling mainly metal oxides and foam . activated carbon will mostly be used for removal of COD (mainly humic acids)