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Summary

Architects: Guex and Kirchhoff, Geneva
Construction plan and contractor: Pingeon, Perreten and Jeheber, Geneva
Construction of the incineration installation: Von Roll AG. Zurich

Refuse incineration plant in Geneva, Les Cheneviers

(Pages 86–93)

Les Cheneviers, the household waste incineration plant of Geneva, with construction cost amounting to 38 million francs, represents but a part of the reorganization program extending from 1959 to 1967 and costing 200 million francs.
Coinciding with the entry into force of the law on anti-pollution and disposal of household waste is the creation by the Genevan authorities of a department responsible for the realization of the reorganization program in the Canton. The centralization of the public bodies in Geneva has induced the Canton of Geneva to build also all the installations having to do with collection of waste water on the shores of the Lake, of the Rhone, of the Arve, of the other rivers, pumping stations, activation stations and purification plants for waste water as well as installations for the treatment of household waste, of sludge and of other refuse. The project was financed by the city and the Canton and, to a lesser extent, by the communes.
The Cheneviers plant was built to handle a capacity of 80,000 tons of refuse and sludge. Although the growers of Geneva had called for a composting installation and although the engineers had stated that the farmland would profit by such a plant, it was necessary to give up the idea of this excessively costly project. For the time being, incineration constitutes the sole solution for Geneva. Nevertheless, the plan of the incineration plant envisages the addition of a composting plant, if at some time in the future the development of agriculture and the problems involved in the treatment of sludge should prove the utility and the necessity of such an installation.

Site

The possibility of transporting to the river the refuse and the sludge from drains as well as the construction of the waste water purification plant for Geneva at Aire (on the barge route) induced the planners to erect the incineration plant far outside the city and near the plant of the Verbois Power Station, the future user of the electric power generated by the new plant.

Technical procedure

The household waste material of Geneva and of the neighbouring communes is collected by trucks and then transported to the incineration plant in barges. The stretch on the river amounts to 10.8 km., that is, the distance from the loading point, "La Jonction" to the harbour of "Les Cheneviers".
The barges loaded at La Jonction have a capacity of 120 tons. A tug tows one or two loaded barges down river as far as Aire, where the waste water purification plant for Geneva is located. Here, there is added to the waste the sludge from sewers (15%). At the harbour of Les Cheneviers, the barges are taken toward a canal. These barges constitute the principal waste storage reservoir. Thus they replace the big waste pit which is a normal feature of most such installations.
Unloading is effected by means of grapples that are remotely controlled, which feed the furnaces. Solid objects are carried into a pit where they are crushed in a special machine.
Firing is accomplished by means of a loading funnel and a shaking apparatus. The furnace is equipped with 2 grids for the drying and the incineration of the waste matter. The cinders then drop from the furnace grid into a duct filled with water. A conveyor transports the cooled cinders into the cinder pit. Trucks carry them to Nant de Chatillon for storage.
The combustion gases are conveyed into a dust removal installation consisting of an electro-filter, etc. They then leave the plant through a stack 100 meters high.

Heat utilization

The steam produced by the cooling of the combustion gases feeds a steam turbine which serves to generate electric power. The generator produces 6200 kW and delivers its power to the neighbouring Verbois heating plant by direct cable.

Yield

It is possible to speak of the "yield" of a waste material incineration plant, as of any other of the industrial installations that serve man, due regard being had for the investments made.

Complete automation and mechanization permit the plant to function with a minimum of personnel. The combining of the incineration plant and the power station produces an appreciable supplementary yield: 20 million kWh are supplied annually to the power network.
The incineration plant is equipped with 2 furnaces, each having a capacity of 240 tons per day. Nevertheless, plans have already been made to instal 2 supplementary furnaces, so that there will be a total daily capacity of 960 tons.

Construction

The complex is divided into 3 parts: the building reserved for unloading, that containing the incineration installations and the turbines and, finally, the section housing the offices. This administrative building comprises 5 levels interconnected by stairways and lifts.
The 3 parts of the complex have different functions, and therefore they have been constructed in different ways, this being apparent both in their design and in their appearance. This result is obtained by the variety of the elevation elements. Moreover, it is not immediately apparent from the outside what functions these buildings serve.
The supporting structure consists of reinforced concrete H-supports and reinforced concrete girders. The H-shape of the supports has enabled the installation of water and ventilation ducts, which are clearly visible in the open pillars.

Frankfurt a/M

Architect: Rambald von Steinbüchel-Rheinwall, Frankfurt a/M
Engineers: Goepfert Offices, Hamburg, and Russ & Stroh, Wiesbaden–Frankfurt
Construction of the incineration installation: Von Roll AG. Zurich

Refuse incineration plant, Frankfurt a. M.

Construction beginning: 1963
(Pages 94–96)

All the waste matter collected in the city of Frankfurt and its outskirts will be burned up in this new incineration plant designed to handle household refuse. The plant has not yet been completed. The quantity of garbage amounts to 600 tons per day. This figure will be doubled during the coming decade. This is why the incineration plant is designed for a capacity of from 1200 to 1400 tons per day. Adjoining the plant is a heating plant which will produce all the electric power and the heat for the northwest sector of the city.

Technical procedure

Special trucks collect the garbage and transport it to the incineration plant. There the refuse is unloaded into sluiceways and carried toward the tanks, situated at a lower level, where grapples lift the material and empty it into the funnel feeding the burner. The cinders fall into a trough filled with water from where they are conveyed to the cinder mill. Here the cinders are pulverized and sifted. A magnet picks out the fragments of metal, which undergo special metallurgical treatment and are stored in scrap bins. The gases of combustion are extracted from the burner by means of suction blowers through electronic filters. The smokestack is 110 meters high.

Heat utilization

The steam produced by the refrigeration of the combustion gases is carried into the adjoining heating plant. It powers 3 turbines, which produce 15,000 kW each, or 26% of the electric power requirements of the city of Frankfurt. The lost heat energy in the household waste matter thus represents a considerable portion of the output of the incineration plant.
The plant is situated in a complex comprising the following: a heating plant with turbines, a transformer station, garages, a dust-bin store, a depot for garbage trucks with repair shop and offices. Between the incineration plant and the vehicle shed is the common entrance of the 2 buildings. The refuse bin, with its 8 sluiceways, is just as high as the incineration plant. On both sides of the burner building there are 2 sheds. The 4 cinder pits constitute a separate structure.

The sluiceways, the refuse bins and the cinder pits have been constructed of concrete poured in situ, except for the east partition (20 meters) of the refuse bin, composed of prefab concrete elements.
The facing of the 2 burner sheds consists of large fitted Hostalith panels. On the west elevation, they are transparent to allow for interior illumination. On the other hand, on the other sides, they are dark grey.
All parts of the construction resemble gigantic slabs. There is here an amalgam of many different proportions and of several different kinds of face materials, and this creates a disconcerting effect. Although we have here a recently constructed complex, we cannot help thinking that these buildings have been adjoined one to the other at various times.

Suter & Suter, architects, Basel
F. Maurer, H. R. A. Suter, W. Krabatsch, B. Kunze
Plan: Von Roll AG. Zurich, Gruner & Frères, Engineers, Basel, G. Gruner, R. Felber, A. Wackernagel, Z. Malbohan

Refuse incineration plant in Basel

Planning commenced in 1963
Work started, October 1966
Construction volume, 1st stage, 79,000 cubic meters
(Pages 99–103)

The household waste incineration plant of the City of Basel is a project which will be realized in several stages. The plan calls first for an extension to the present installations; the other phases of the project are based on a total replacement of these installations.
The present installation was put into service in 1943 already. At the time it burned 18,000 tons of refuse daily, for a population of 160,000. At the present time, the household waste amounts to 86,000 tons per year, and the population of Basel is approaching 220,000. This development has induced the authorities of the Canton of Basel-City to make a study of the problem with a view to a satisfactory solution.
During the first work on the extension of the old plant, the decision was taken to erect an entirely new plant, independent of the other, but situated on the same location and with a capacity $1^1/_2$ times that of the old plant. There will be no interruption in the operation of the latter.

Site

The old plant is located on the northwest periphery of the city, near the frontier. The peculiar situation of Basel, in close proximity to France and Germany, required not only a local but also a regional conception. In fact, what is planned is the incineration of the household waste of 17 neighbouring Swiss communes and also of a number of French and German communes, along with the industrial waste from the Canton in Basel-Country.
In March 1965, the authorities extended a credit amounting to 47 million francs for the first stage of the construction. This was started in October 1966. It will be finished in 1969. The 2nd stage is planned for between 1975 and 1980. At the present time, the demolition of the old plant is under way. Finally, the 3nd and last construction stage will be undertaken in 1980 and completed in 1985. This program is based on the estimate that in 1980 there will be 220,000 tons of waste per year.

Technical procedure

The Basel incineration plant hardly differs from the other installations discussed in this issue, at least as regards the technical aspect. The refuse pit is unusually large, having a volume of 7000 cubic meters. In the final stage, there will be 16,500 cubic meters available, which corresponds to the maximum capacity of 5 furnaces over a period of 4 days and 4 nights.
The pit is divided into several compartments, which allows for separate reception of solid objects, household waste and industrial scraps. The large unfilterable objects are passed through a crusher, then they are conveyed to another part of the pit, from where they arrive at the furnaces, having been reduced to normal dimensions and quantities.
The industrial waste materials that are liquid or that melt at high temperatures are deposited in special reservoirs, where they are subjected to special treatment. In a decanter the various oils and oily sludges are separated into their constituents: water, sludge and oil. For purposes of burning up waste oil, each furnace is equipped with a special combustion chamber.
After the ordinary waste incineration procedure, the cinders fall into the cinder duct, where they are re-cooled, then conveyed farther on an endless chain rig. Each burner possesses its cinder duct with a conveyer. An electro-filter with multiple blowers at set intervals is planned for removing combustion gases from each incinerated load. The heat gained by the re-cooling of the gases, in the shape of steam and hot water, is transmitted to a heating network.
In keeping with the technical organization of the plant, the assembly in linear series of the parts serving a given function guarantees the absolute independence of each incineration unit.

Architects: Otto Peter Görl, Theo Kief
Plan: Von Roll AG. Zurich

Refuse incineration plant, Nuremberg

Start of construction: June 22, 1966
Start of assembly of electro-mechanical part: June 15, 1967
Planned start of installations: June 15, 1968
Planned completion of project: End of 1968
(Pages 104–106)

The city of Nuremberg is in the process of constructing a plant for the incineration of household waste as well as industrial refuse and used oil. The complex is sited on the edge of the Ludwig-Danube-Main Canal, near the municipal heating plant. The plant comprises, in its first construction stage, 3 burner-boiler units, each having a maximum incineration capacity of 360 tons of refuse per day. A fourth incineration unit will be added to the other three.

Technical procedure

The technical installations and the incineration process are, by and large, the same as those in the plants already described in this issue: collect-

ing truck, unloading sluiceway, refuse bin, loading funnel, incineration burner and boiler, cinder duct with cinder bin, electronic filter with suction blower. The smokestack is planned to be 100 meters high.

Heat utilization

The heat produced by the burner-boiler unit is carried to the central heating plant of the city of Nuremberg, which makes use of it for electric power production.

Construction idea

Some aspects of the Nuremberg plant are interesting enough to warrant, in our opinion, being published even before the plant is finished. First of all, attention can be drawn to the linear assembly of all the parts fulfilling a function in the complex. In this way, intersections and deviations are avoided. The trucks run up on a high ramp to unload their contents into the refuse bin.
From the outside, we can distinguish very clearly the functions of every part of the structure. Unfortunately, an excessively modern line interferes with the good design of the complex as a whole. Moreover, the office building does not come up to the quality of the main building.

Drafting of plan: Municipality of Lausanne, Department of Works and Highways

General Contractor: Highway Division

Architects: Jean-Pierre Dezarzens, Adriano Soppelsa

Engineers: H. B. de Cérenville (for the filtration basins and the sludge treatment facilities), J.-P. Alioth (for the buildings)

Purification plant in Lausanne – Vidy

Construction time for 1st stage: 1962–65

(Pages 111–116)

Starting in 1990, at which time it will be completely finished, the Lausanne-Vidy plant will be handling the purification of the waste water of the entire Lausanne region. The reader will no doubt be interested in some of the aspects of the plan, its realization and the procedures adopted, for the architect was confronted here by very special difficulties which had a great influence on his way of dealing with the assignment.

Description of the site and the functions of the plant

The plant is situated on the shore of Lake Geneva, to the north of the Parc du Bourget, in an area west of the Lausanne exit of the express highway. The site, trapezoidal in shape, is level. On the north, it is bounded by the express highway, on the south, by the Vidy road. In this angle are located the office building, the labs, the workshops and the staff premises. The functional elements are sited parallel to the express highway and are determined in their design by the technical procedures adopted and by the topography of the site: a building housing the desander and the grid, located at the end of the main collector, then a group of 3 rectangular pre-decantation basins and a group of 2 post-decantation basins, between them, a rectangular activation basin and the compressor building. From that point, the purified water is conducted into the lake, via a conduit situated in part below the water level. The treatment of the residue is effected in the southeast zone of the pre-decantation basin and the office building. A cubic structure, containing the sludge drainage and incineration installation, is located at right angles to the grid and parallel to the long partition of the pre-decantation basin. The sludge concentration installation is located, in relation to the incineration facilities, on the periphery of the southeast zone, between the grid and the incineration plant.
The requirements of possible future expansion were determining factors in the disposition of the installations. That is why 2 development directions have been selected, situated perpendicularly to each other. In the future, there is envisaged the installation of a supplementary decantation basin, several post-decantation and activation basins, a drainage and incineration plant as well as another sludge concentration installation.

The complex is made up of 3 different buildings having specific functions:

1. the office building,
2. the building housing the desander and the grid as well as the sludge drainage and incineration installations,
3. the building housing the sludge concentration installation.

The first 2 structures are rectangular in shape, the other one is circular owing to its special functions and because the filter compressor is likewise circular.

The surface structure of the buildings was determined by the following considerations:

1. The buildings are envelopes serving to protect complicated technical processes.
2. They are designed to provide ideal working conditions for the staff.
3. The plant will be entirely finished in 1990.

Technical details

The plan for the waste water purification plant of the City of Lausanne was realized by the Highway Department on the basis of thorough studies extending over several decades.
These studies have permitted the determination of the characteristics of the various installations, account being taken of the special features connected with the problem of waste water in the Lausanne region. Then, the City of Lausanne built an adequate pilot plant having a maximum capacity of 10 liters per second. A sludge drainage and incineration installation was also established on a reduced scale. The experiences thus assembled were crucial in the construction of the final plant.
The electro-mechanical equipment was made the subject of a competition among the different specialized concerns. The deadlines were extremely brief, because the City of Lausanne insisted on having a part of the plant in operation in time for the Swiss National Exhibition of 1964.
The first stage, now finished, is designed to handle the waste water of a population of 220,000. In its final stage, the Vidy installation will effect purification of the waste water of an estimated population of 440,000.
The installations were put into operation on the following dates: July 1963, the main collector, the desander, the grid, the overflow conduit, the re-entry conduit beneath water level. In May 1964, the pre-decantation basin. In January 1965, the aeration basin, the pre-decantation basin and the compressor station. In December 1965, the drainage installation and the sludge incineration and concentration facilities.

Treatment of the water

The treatment of the water is effected in 4 successive stages: preliminary filtration, mechanical filtering, biological treatment and chemical treatment. The preliminary purification permits the removal of sand and pebbles as well as all materials carried by the water. The 4 pre-decantation basins are designed for mechanical filtration eliminating all floating organic material. The duration of the operation varies between 14 and 43 minutes, depending on the degree of pollution. A mobile bridge ensures the elimination of sludge and floating material that has accumulated at the bottom of the basin.
The biological purification is effected in the aeration basin and in the post-decantation basin. Aeration lasts a maximum of 45 minutes, while post-decantation varies between 1 hour and 10 minutes and 1 hour and 45 minutes. After the second purification, the water is conveyed into the lake by means of a conduit located 10 meters below the surface. The chemical purification process is intended to eliminate any chemical products that have been dissolved in water that is biologically pure. This process is effected mainly with the use of phosphates, nitrates and nitrites.

Sludge treatment

The residue and the sludge stemming from the different purification stages have to undergo special treatment. The sand and the pebbles removed by the desander are discharged into the rubbish pit. The refuse caught in the grid is dried out and burned in the incineration plant of the City of Lausanne. The sludge coming from the pre-decantation and the biological purification process is first concentrated, then dried until its water content amounts to 4%. The dried sludge is burned in a special furnace, at a temperature of 900 °C. In the final stage, the installation will burn up 55 tons of dried sludge per day. The mineral matter (around 50%) is not destroyed by the burning and ought to be visible in the cinders. The latter are, finally, discharged into the rubbish pit.

Drafting of plan: Canton of Geneva, Department of Public Works

Contractor: H. Weisz

Architect: G. Brera, Associate: P. Boeklin

Electrical engineer: G. Hauser

Treatment of waste water: Société Générale d'épuration et d'assainissement, Paris

Treatment of sludge: Activated Sludge, Ltd., London, represented by Techfina, Geneva

Electro-mechanical pumping installation: Sulzer, Winterthur

Water purification plant, Aire – Geneva

Construction time: 1964–67

Cost: around 50 million Francs (purification plant), around 10 million Francs (pumping station)

Capacity: 400,000 inhabitants (1st stage), 800,000 inhabitants (finished installation)

(Pages 117–122)

Site

The installation is designed for the purification of the waste water of Greater Geneva. Located on the banks of the Rhone, this plant is integrated within the hydrographic pattern of the Canton. A network of collectors brings the waste water from the City of Geneva and the lakeside communes to the purification plant. The topographical conditions required the addition of a pumping station near St-Jean.
The site of the complex and the forecasts of its social, political and economic development determined the choice of the purification procedure, the capacity of the plant as well as the volume and the number of the buildings making up the complex. The first stage will allow for the purification of the waste water from 400,000 inhabitants, industries included. The complete installation will meet the same needs, but for 800,000 inhabitants. The plant is situated on rough ground in a loop of the Rhone. This site is divided into 3 parts, this arrangement being occasioned by the structure of the terrain and the requirements of the enterprise. On the northeast, we have the office buildings, the parking areas, the garages, the main building and the staff premises. At the southeast corner of the site we have the exit of the main collector. The waste water arriving at that point is then carried through the different purification stages: mechanical filtration and biological purification. The purified water, after treatment, is introduced into the Rhone via 2 canals. The treatment of the solid residue, its concentration, digesting and drying are effected in the southwest corner of the plant. The dried residue is then transported on barges to the incineration plant. The technical equipment of the purification plant was the subject of 2 international competitions in which 11 leading concerns took part.

Description of the installations

The office building, comprising in particular office premises, board rooms, labs and other rooms, is situated to the northwest of the plant. The building is constructed on a slope in such a way that the entrance gives access to the 3 upper levels and to the basement level.

Treatment of the waste water

The last shed element of the service building covers the automatic grid of the main collector, which empties out at that point. The grid, with its desander and deoiler, represents the first mechanical stage of the purification of the waste water. In connection with this we have 8 pre-decanting basins, each with a capacity of 3200 cubic meters. Water intake and discharge are effected via a conduit running contiguous to the narrow partition of each basin. Parallel to the pre-decanting basins, there are 8 rectangular aeration basins, each with a capacity of 1500 cubic meters, then, also parallel, 8 post-decantation basins, with capacity of 4000 cubic meters. From these basins, the purified water runs into the Rhone via 2 canals.

Treatment of the sludge

A small amount of the sludge remains in the system for reasons of activation, while most of it is carried west of the basins for later stages of treatment. The sludge is treated in a digestion installation made up of 2 inflators and basins that are circular in section and, then, in 2 heated digesters.
In the digestion installation, the liquid sludge is transformed into organic silt, which is highly pure and rich in solid material. The organic silt is then treated in a post-digestion apparatus, located on the edge of the water. It is progressively concentrated and finally is subjected to heat treatment. As a final stage, the residue, which has a water content of 45%, is loaded onto barges via a ramp construction. These barges carry the dried sludge to the incineration plant.