Sewage Sludge Treatment in Warsaw
– Current Situation in Poland –

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1. Introduction

Polish EU Accession Treaty signed on 16 April 2003 imposed on Poland the obligation to provide city agglomerations with sewer systems and wastewater treatment plants in accordance with the requirements of EC Directive 91/271/EEC. In order to implement these commitments, in 2003, the National Program for Municipal Wastewater Treatment (Krajowy Program Oczyszczania Ścieków Komunalnych – KPOŚK) was elaborated. It stipulates that:

- in agglomerations, in which the Population Equivalent (P.E.) exceeds 100,000 – construction of 7 wastewater treatment plants and rehabilitation or extension of 90 wastewater treatment plants,
- in agglomerations in which the Population Equivalent (P.E.) is between 15,000 and 100,000 – construction of 32 wastewater treatment plants and the rehabilitation or extension of 272 such structures,
- in agglomerations in which the Population Equivalent (P.E.) is between 2,000 and 15,000 – construction of 220 wastewater treatment plant construction and the rehabilitation or extension of 542 such structures,

The National Program for Municipal Wastewater Treatment implicates also the necessity of extension and rehabilitation of wastewater networks, and, up to 2015, enabling the collection of wastewater from 98 % inhabitants of agglomerations with more than 100,000 inhabitants and between 80 % and 90 % inhabitants in case of smaller cities.

Increase in the amount of collected and treated wastewater means also increase in the load of wastewater sludge generated in the wastewater treatment process. After the construction or rehabilitation of wastewater treatment plants it is estimated that, in 2015 approximately 642 thousand tons of dry solids of stabilized wastewater sludge shall be generated, what makes an increase of 62 % comparing to the amount of sludge generated in 2001.

The construction and rehabilitation of wastewater treatment plants, as a part of the National Program for Municipal Wastewater Treatment, also includes construction of structures for preparation of wastes (among others wastewater sludge) for its further management or thermal disposal at the source of waste generation, in accordance with long-term objectives set out in the National Waste Management Plan (NWMP). In this plan, up to 2018 the following dhal be obtained:

- limiting the amount of stored wastewater sludge,
- increasing the amount of municipal wastewater sludge processed before introduction into the environment,

- increasing the amount of municipal wastewater sludge transformed by thermal methods,
- maximizing the utilization of nutrients contained in sediment while meeting all requirements of chemical and sanitary safety.

2. Legal aspects of municipal wastewater sludge management

Describing the state of municipal wastewater sludge management, special attention to the legal aspects associated with this type of activity shall be paid. In Poland, the basic law regulations defining the rules for waste management in an environmentally friendly manner are stipulated in Legal Act, dated 27th of April 2001 concerning waste management (Dz.U.2010.185.1243) and the executive regulations related to this Legal Act. Waste Law is the transposition of EU Directives on waste management.

The Legal Act defines municipal wastewater sludge as *sludge coming from the wastewater treatment plant, the sediment from septic tanks and other installations for municipal wastewater treatment and other waste with a composition similar to the composition of the waste water treatment sludge*. Two methods for such waste management are allowed:

- transfer of municipal wastewater sludge for further use in systems such as thermal treatment installations, composting plants
- recycling of municipal wastewater sludge outside installations involving the agricultural use, for land reclamation and cultivation of plants not intended for consumption.

Land area on which municipal sludge can be disposed, has been limited to the area of the district in which such sludge was generated, unless the distance from the place of waste generation and the place of its recovery or disposal is smaller than the distance to the place located within the same district (Article 9 pt. 4 of the Legal Act).

The management of wastewater sludge in plants is regulated by administrative decisions in form of waste management permit, in which the parameters of process and necessary protections reducing any adverse impact on environment are described in detail.

The management of municipal wastewater sludge by the use on lands is different, because it is not necessary to obtain a permit for such activity. Therefore, in order not to cause any danger for the environment by introducing wastewater sludge on lands, regulations for the process are defined in the Legal Act concerning Wastes and in executive regulation related to this legal act, i.e. Minister of Environment Decree dated 13th of July 2010concerning municipal wastewater sludge (Official Journal 2010.137.924). In 2010, several important changes were introduced to above mentioned regulations, including:

- the responsibility for the management of municipal wastewater sludge is borne by its producer,
- waste management by collection of municipal wastewater sludge was banned,
- the rules for determining the dose of sludge used on land were simplified by resigning from determining the dose levels of metals introduced into the ground with sludge.

3. Municipal wastewater sludge management in Poland

Municipal wastewater sludge, before any management is stabilized in course of biological treatment (an aerobic or anaerobic stabilization) or by chemical methods in wastewater

treatment plant. After stabilization, wastewater sludge is dewatered and passed to specialized companies for further management. In recent years, an extension of sludge treatment process with drying and incineration becomes more and more popular.

Wastewater sludge treatment in wastewater treatment plant has a decisive influence on the possible choice of methods for final sludge management and on associated costs. Between 2000 and 2002, the prevailing method of wastewater sludge management was storage, including storage on landfills located within wastewater treatment plant. An alternative waste management was the use of wastewater sludge on lands, in agriculture and for land reclamation, including lands for agricultural purposes. Every year the amount of wastewater sludge managed in this way grew, and in 2003, the amount of wastewater sludge used on lands exceeded the amount of wastes landfilled. In subsequent years, this trend remained. There was also a gradual decline of the amount of sludge accumulated in landfills located inside wastewater treatment plants. In 2000, 675 thousand tons of dry solids of sludge was collected on wastewater treatment plants. In 2009, this number dropped to 454 thousand. The disposal on landfills within waste treatment plants, and thus the change of the method of final waste management, has resulted in increase of the amount of sludge temporarily stored in the plant by several times. Between 2000 and 2009, only about 1 % of the sludge was incinerated in the only wastewater sludge incineration plant belonging to the Group Wastewater Treatment Plant *Dębogórze* near Gdynia. The picture No.1 shows methods of wastewater sludge management in Poland, in 2009, basing on the data from the Central Statistical Office.

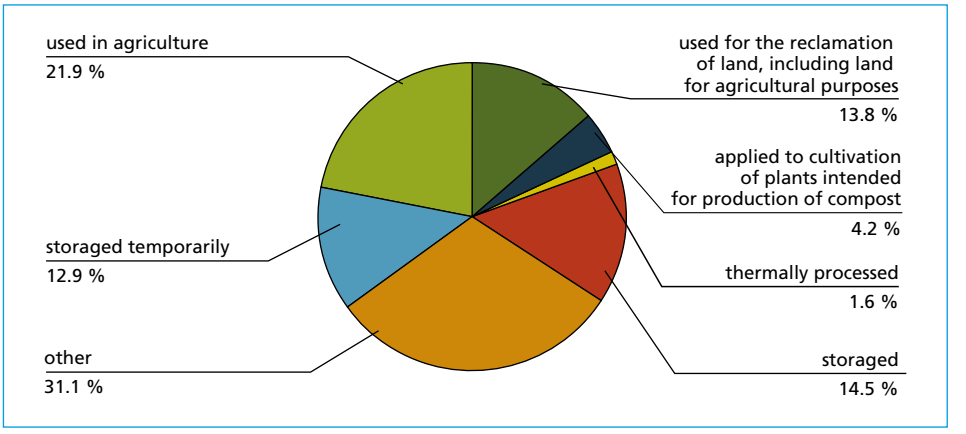

Figure 1: Participation of the different methods of sludge management in Poland in 2009

In 2009, in Poland 563 thousand tons of dry solids of wastewater sludge was generated, but as shown on the chart, approximately 40 % of this amount was used in agriculture. However, presented data does not represent the actual amount of wastewater sludge used on land. In fact, this quantity is much greater. It is due to deposits on lands for purposes other than those listed above such as the cultivation of plants for fuel production (the energy willow). On the chart, there is no information concerning the amount of composted wastewater sludge, which after the composting process is also introduced into the soil as compost. The methods of sludge management mentioned above, are classified as *other*. The same applies to wastewater sludge exported to landfills. A part of sludge is used for landfill rehabilitation in construction of the reclamation cover. This type of wastewater sludge use is also hidden in the category *other*.

In subsequent years, one should expect a significant increase in the amount of incinerated sludge. This is mainly due to three factors:

- the completion of erection of nine sludge incineration plants,
- the increase of amount of dried wastewater sludge used as fuel in cement production,
- the prohibition of wastewater sludge storage since 01st of January, 2013r.

4. Municipal wastewater sludge management in Warsaw

Municipal Water Supply and Wastewater Company of Warsaw municipality runs four wastewater treatment plants:

- The Wastewater Treatment Plant *Czajka*, located in the northern part of Warsaw on the right-bank of Vistula River,
- The Wastewater Treatment Plant *Południe*, located in the southern part of Warsaw on the left-bank of Vistula River,
- The Wastewater Treatment Plant in Pruszków located within the area of Warsaw agglomeration,
- The Wastewater Treatment Plant in Orzechowo receiving wastewater from the area of Zegrzyński Lake. Due to the location and the supported area, the data from this wastewater treatment plant was not included in further part of this report.

In 2009, in three of wastewater treatment plants mentioned above 25 thousand tons of dry solids of municipal wastewater sludge was produced approximately 70 % of which was used on lands, about 15 % used for composting, and 4.2 % was sent to landfill as a biologically active layer.

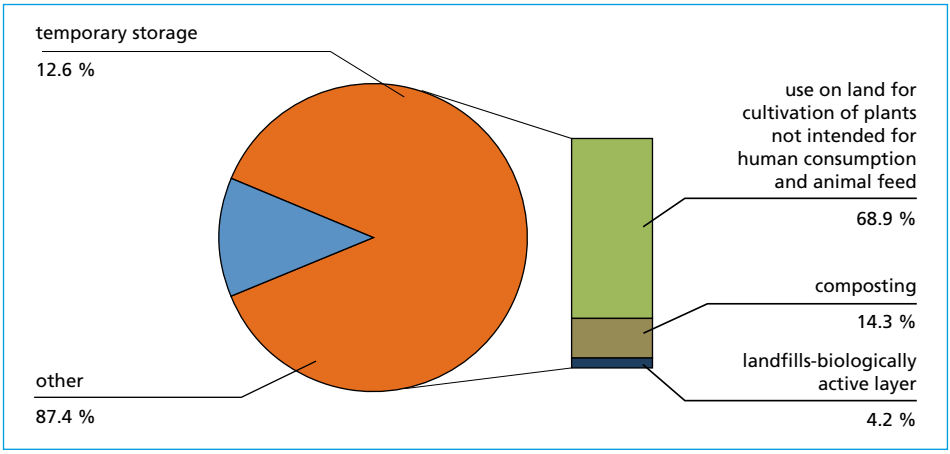

Figure 2: Participation of individual methods of the management of sewage sludge produced in Warsaw in 2009

In Wastewater Treatment Plants *Czajka* and Pruszków, sludge was stabilized in course of mesophilic fermentation and then dewatered in decantation centrifuges. In cases the presence of alive parasite eggs in sludge was found, such sludge was additionally treated with partly slaked lime with calcium oxide contents exceeding 60 %. The main method of

management of wastewater sludge from these two wastewater treatment plants was the use on lands for cultivation of plants for compost production and for the cultivation of energy willow used in power plants. In the Wastewater Treatment Plant *Południe*, sludge was additionally dried to about 85 % of dry solids. Most of the sludge produced in this plant was exported to the composting plant.

5. The EU Project Water supply and waste water treatment in Warsaw

Municipal Water and Wastewater Company of Warsaw Municipality is implementing the Project *Water supply and waste water treatment in Warsaw*, one of strategic goals of which is to treat 100 % of the wastewater before discharging it to Vistula River. For such purpose, a number of investments including: construction of wastewater collectors connecting the network on the left bank of Vistula River to Wastewater Treatment Plant *Czajka*, the rehabilitation and extension of the Wastewater Treatment Plant *Czajka* and the construction of Wastewater Sludge Incineration Plant.

The Project shall significantly increase the capacity of Wastewater Treatment Plant *Czajka*, thus increasing the amount of generated sludge. Rehabilitated and extended *Czajka* Plant shall generate about 500 tons of dewatered sludge per day (about 190 thousand tons per year), with an average dry solids contents of about 25 %. The amount of remaining process waste from wastewater treatment, i.e. screenings, grit from grit trap and grease from grease trap, is about 10 thousand tons per year in total.

In order to reduce the volume and quantity of process waste generated from wastewater sludge treatment, and to reduce noxiousness for local inhabitants related, for instance to truck traffic, odors emission and due to legal regulations in scope of municipal wastewater sludge management, the Company decided to erect the Sludge Incineration Plant within the Wastewater Treatment Plant *Czajka*.

6. The construction of wastewater collectors connecting the network on the left bank of Vistula River to Wastewater Treatment Plant Czajka

In order to transfer wastewater the network on the left bank of Vistula River to Wastewater Treatment Plant *Czajka* the collectors running through highly urbanized areas are being erected. In order to minimize inconvenience for the city inhabitants, related to civil works, the micro-tunneling technology is used, consisting of boring a tunnel by using a special boring/forming head avoiding excavations for the collectors. The erection is carried out in stages. For the moment, the part of collectors between the Wastewater Treatment Plant *Czajka* and the crossing under the bed of Vistula River has been concluded. Currently, the tunnel for the collectors under the bed of Vistula River is being drilled. It is shown in Figure 3.

The main goals of extension and rehabilitation of the Wastewater Treatment Plant *Czajka* are: increasing its capacity from 240 thousand m^3 of wastewater per day to 435 thousand m^3 per day and change of wastewater treatment process to enable the compliance with legal requirements concerning the quality of treated wastewater discharged to the river. The contractor is a consortium of companies: Warbud S.A. (the leader), WTE Wassertechnik GmbH, Krüger A/S, Veolia Water Systems Sp. z o.o. and OTV S.A. The scope of works in practice includes erection of an entirely new wastewater plant (most of old buildings shall be demolished, only a small number of them is rehabilitated or shall be rehabilitated.)

Figure 3: The Passage under the bed of Vistula River – visualization by MPWiK S.A. Extension and rehabilitation of the Wastewater Treatment Plant *Czajka*

The scope of extension of the wastewater also includes erection of the Sludge Incineration Plant, in which process waste generated in the Wastewater Treatment Plant *Czajka*(i.e. screenings, grit from grit chambers , grease and dewatered sludge) shall be incinerated, together with dried wastewater sludge imported from the Wastewater Treatment Plant *Południe*. The design and erection of Sludge Incineration Plant is carried by the consortium of companies: Veolia Water Systems sp. z o.o. (the leader), OTV FRANCE L'Aquarena, Kruger A / S, Haarslev Industries GmbH, WARBUD S.A..

7. Wastewater treatment process

Wastewater from the part of Warsaw located on the left-bank of Vistula River shall flow gravitationally to the inlet pumping station, where it shall be pre-treated on coarse screens with 50 mm clearance and then pumped into collective inlet chamber to be mixed with wastewater currently connected to the plant. Wastewater shall flow from this chamber onto dense screens, where coarse contamination shall be removed onto 9 units of belt and hook type screens with 6 mm clearance. Screenings shall be transported with two separate lines to rinsing and dewatering units. Rinsed and dewatered screenings shall be stored in enclosed containers equipped with disinfection means. After passing through dense screens, wastewater shall be directed to 4 units of double-chamber aerated grit and grease traps, where mineral (grit) and floating (grease) contamination shall be removed. The grit from the bottom of the tank shall be discharged into grit classifier and rinsing unit. Grease, scraped from the surface of wastewater shall be discharged from the grease trap to a storage chamber. After passing the grit and grease trap, wastewater shall be discharged into division chamber, from which it shall be directed to primary settling tanks, or immediately to biological treatment to provide the proper constitution of wastewater. Six radial primary settling tanks are designed, each of the diameter of 50 m and a depth of 3.3 m. Wastewater shall inlet into each tank, through so-called center column, while mechanically treated wastewater shall flow out through toothed overflow edge on the perimeter of the tank.

In order to eliminate odors emission, all mechanical treatment facilities described above shall be encapsulated and connected to air purification system.

Mechanically treated wastewater, after passing through primary settling tanks, shall be discharged through an intermediate pumping station and the division chamber to biological treatment section of the wastewater plant. Currently, 6 out of 10 treatment lines were erected, consisting of several-chamber biological reactors and groups of secondary settling tanks. Biological wastewater treatment is carried out in the active sediment method with Biodenipho technology, from Danish company Krüger A/S. Used reactors combine the features of plug flow systems and batch systems, and consist of: Bio-P and pre-denitrification

chambers supporting processes of biological phosphorus removal and denitrification and aeration chambers with alternating functions assuring effective removal of carbon, nitrogen and phosphorus compounds from wastewater. Each of ten bioreactors has a size similar to football yard and volume of 37,000 m^3. Wastewater treatment is controlled with advanced control system, STAR, which in relation to current composition of the mixture of wastewater and active sludge, by means of online metrics, selects the optimum conditions for the system operation. If necessary, biological treatment can be supported with chemical treatment - each bioreactor is equipped with a pipeline system for chemical reagents dosing. After passing through bioreactors, the mixture of treated wastewater and active sludge flows to 20 units of secondary settling tanks, of the diameter of 48 m and depth of 4.6 m. Sludge separated in settling tanks is discharged through 5 units of sludge pumping stations and returned to the beginning of biological treatment, the surplus biomass grown in course of biological processes is directed to further treatment and final disposal. Wastewater treated in each of process lines flows to the collective channel to the river. If necessary at high water level in Vistula River the outlet pumping station is started to discharge the treated water to the river. Part of treate 3d wastewater, so-called process water, after filtration and disinfection is used for current needs of the wastewater treatment plant, for example rinsing the tanks and watering the greenery.

8. Sludge treatment before incineration

In the rehabilitated and extended wastewater treatment plant two types of sludge shall be generated:

- primary sludge from primary settling tanks,
- surplus sludge from biological treatment,

Sludge accumulated on the bottom of primary settling tanks shall be pumped to 4 rehabilitated and 2 new gravitational thickeners. Each of them shall ensure the required degree of sludge thickening and generation of volatile fatty acids. For this purpose, gravitational thickeners shall be equipped with sludge circulation to replace of the entire volume of the thickener within 16 hours. Thickened sludge with dry solids contents of approximately 5.5 % shall be directed to mixed sludge reservoir, effluents from thickeners with a high contents of volatile fatty acids shall be discharged into a separate effluent pump, discharging the effluent to division chamber upstream primary settling tanks, or to division chamber upstream biological treatment.

Surplus sludge from biological wastewater treatment process shall be thickened in 6 centrifuges (4 in operation + 2 in stand by). After thickening, sludge with dry solids contents of about 6 %, shall be directed to mixed sludge reservoir, from where, together with thickened primary sludge and grease they shall be discharged to separate digestion chambers (WKF).

Digestion process shall be carried in six existing and four new separate digestion chambers. The new digestion chambers, similarly to the existing ones, incorporate single-stage mesophilic digestion in temperature between 33 and 38 °C. Digested sludge shall be dewatered in decantation centrifuges (3 in operation + 2 in stand-by). Biogas generated in digestion process shall be used for heat and power production.

Such treated sludge shall be discharged to Sludge Incineration Plant.

9. Sludge Incineration Plant

The erection of Sludge Incineration Plant utilizing fluidized bed sludge incineration process was started on 1st of June 2009. This plant shall be a modern structure, incorporating state of art techniques and technologies of waste disposal, implemented successfully in many European countries.

The maximum capacity of incineration plant is about 1,000 tons per day, being 150 % of estimated maximum daily production of process waste. Table no.1 shows the assumed amount of waste to be incinerated in the Sludge Incineration Plant.

Table 1: Amount of waste to be incinerated in the Sludge Incineration Plant – design assumptions

Type of waste	Average amount	Range	Unit
Dewatered Sludge	21.32	< 24.9	t/h, wet basis
Dried Sludge (from WWTP Poludnie)	0.64	< 0.83	t/h, wet basis
Screenings	0.5	< 1.3	t/h, wet basis
Grit from grit trap	0	< 0.84	t/h, wet basis
Grease from grease trap	0	< 0.08	t/h, wet basis

Incineration in fluidized bed enables to reduce the amount and volume of waste generated in the wastewater treatment process by 10 times. In accordance with law regulations, waste from incineration process can be recovered (i.e. in installations such as cement plants) or disposed.

The main steps of Sludge Incineration Plant process are:

- incineration in two fluidized bed furnaces of wastewater sludge dried in disk dryers together with other wastewater treatment process wastes (screenings, grit and grease),
- production of steam in recovery boilers for heat and power production,
- cleaning the flue gas from incineration process.

Figure 4 shows the diagram of the process in Sludge Incineration Plant.

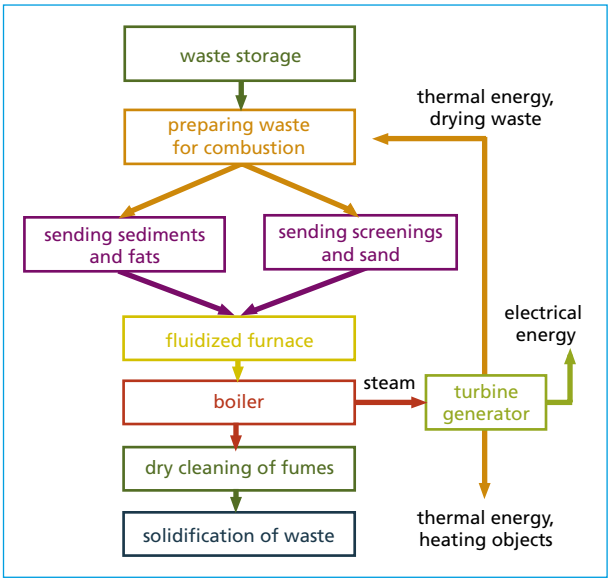

Figure 4:

Diagram of the process in Sludge Incineration Plant

10. Sludge and process wastes transport to the furnace:

10.1. Dewatered sludge from wastewater treatment plant Czajka

Wastewater sludge dewatered in centrifuges with dry solids contents of approximately 25 % shall be pumped with piston pumps of the capacity of approximately 20 m^3 per hour into two disk dryers in Sludge Incineration Plant, Then, after drying the sludge with dry solids contents of about 33 % (normal operation of the plant) shall fall into the hopper, where it is mixed with dried wastewater sludge from WWTP *Południe* and grease. Then such mixture is pumped with other piston pumps into fluidized bed furnaces.

In case of dryers failure dewatered sludge is sent directly into the hopper of piston pumps.

10.2. Dried wastewater sludge from Południe

Dried wastewater sludge shall be delivered to the Sludge Incineration Plant with silo trucks, from which it shall be pneumatically fed to two storage silos, each of the capacity of 50 m^3. From the storage silos, by means of two lines of screw conveyors, sludge shall be transported directly to piston pumps hopper, where it shall be mixed with dehydrated sludge and with grease. Then such mixture is pumped with piston pumps into fluidized bed furnaces.

10.3. Grease

Grease shall be delivered to Sludge Incineration Plant in containers from which it is unloaded to a small buffer tank with electric tracing. Grease after heating shall be pumped with two pumps to the piston pump hopper, and then together with sludge shall be sent to the fluidized bed furnaces.

10.4. Screenings and grit

Screenings and grit shall be delivered to Sludge Incineration Plant in containers. Each type of waste shall be collected in a separate hopper of the capacity of 20 m^3, and with screw conveyors shall be transported to a common metal separator. Then, wastes shall be crumbled and transported to the furnaces with two lines of screw conveyors.

10.5. Sludge dryers

Dewatered sludge from wastewater treatment plant shall be dried in two horizontal disk driers heated with steam. The process enables reduction of moisture content of in sludge to the level allowing autothermic incineration without additional fuel (natural gas, biogas).

In case of dryers failure dewatered sludge is sent directly for incineration, However, in such situation supporting fuel (natural gas or biogas) is required for incineration in order to maintain the parameters the process.

11. Incineration of sludge

11.1. Fluidized bed furnaces

Waste shall be incinerated in two fluidized bed furnaces. Piston pumps shall inject the mixture of dried sludge (normal operation) or dewatered sludge (driers failure) along with

dried sludge from WWTP Poludnie and grease to a sand bed at eight points located on the perimeter of each of the furnaces. Additionally, the mixture of screenings and grit shall be fed over the sand bed with screw conveyors. The composition of fuel mixture shall assure autothermic incineration.

In order to heat the furnace to the temperature of 850 °C, required by law regulations, and to maintain the temperature of waste incineration, furnaces are equipped with two supporting fuel systems, one for natural gas and one for biogas. For the furnace strat-up, only natural gas shall be used. In case of an increased furnace temperature, exceeding 900 °C, a system for cold water sprinkling shall be used to lower the temperature inside the combustion chamber.

Fluidization air shall be sucked from outside of the building, heated in recuperator and discharged into a wind box under fluidized sand bed. Part of fluidization air shall come from odor air suction system, removing odors from the process units (hoppers of screenings and sand, belt conveyor, grease hopper, and the common hopper of piston pumps).

11.2. Heat recovery system

Heat recovery system shall consist of two lines of exchangers, including recuperator and recovery boiler with a steam-drum. The recuperator heats the fluidization air to appropriate temperature before discharging it into the wind box under fluidization bed, using the heat from flue gas.

The recovery boiler with steam-drum recovers the energy generated during incineration of waste by producing steam for the turbine, driers and for heating purposes. During steam production in the boilers, combustion gases are cooled to protects flue gas cleaning equipment from damage.

Sludge Incineration Plant shall be the only installation in Poland. In which wastewater sludge is incinerated together with production of heat (3.5 MW) and power (1.6 MW) in two-stage steam turbine.

12. Steam circuit with turbine / generator unit

In the turbine the superheated steam generated in the recovery boiler shall expand transforming the heat into mechanical energy, which in turn shall be transformed into power in the generator. Some steam shall be extracted from turbine bleeding at a pressure of 5.9 bar and used for drying the sludge. The rest of the steam leaving the turbine shall be condensed in heat exchanger together with heating the water circuit 75 °C/95 °C and generated condensate shall be returned through the degassing tank into recovery boilers. In case the turbine is shut off, suitable by-pass circuit shall reduce steam pressure up to the level, normally present downstream the turbine.

13. Cooling System

Equipment requiring cooling is connected to one of two cooling circuits: 75 °C/95 °C and

35 °C/40 °C. Some of recovered heat shall be used to heat the process structures. Remaining (excess) heat shall be discharged with fan coolers.

14. Flue gas cleaning system

Designed flue gas cleaning system is based on the dry method, enabling the reduction of to the extent required by the stipulations of the Functional Program. Each furnace is equipped with a separate three-stage cleaning system. In case of failure it is possible to clean flue gas from one furnace with the flue gas cleaning system of the other furnace.

Each system consists of:

- multicyclone, removing about 95 % of solid waste (ashes)
- reactor, where activated carbon and sodium bicarbonate are injected into flue gas to reduce acid compounds and unbounded heavy metals.
- bag filter, removing the small fraction of pollutants and products of chemical reactions in the reactor (residue).
- SCR, the system based on selective catalytic reduction for nitrogen oxides (NO_x) removal including ammonia water injection system and a system for heating exhaust gases to a temperature of about 255 °C before entering the catalyst, to maintain optimum temperature for the process.
- SNCR – the treatment system based on the technology of selective non-catalytic reduction for the removal of NO_x when the SCR system will be out of service.

After cleaning, the flue gas shall be discharged into atmosphere through the stack. In conduits supplying flue gas to the stack, detectors and analyzers are installed for monitoring the composition of flue gas.

In the design, more stringent emission standards than required by Polish and European law regulations are assumed. Table 2 shows the comparison between selected emission standards specified in Polish and European law regulations and standards set out in the Functional Program.

Table 2: Acceptable emission standards for Sludge Incineration Plant

Emission mg/Nm³	Acceptable amount specified in Polish and European law regulations	Acceptable amount in Functional Program
Dust	10	8
CWO	10	8
CO	50	50
NOx	200	70
SO_x (as SO_2)	50	50
HCl	10	7

Emissions of ammonia (NH_3) shall be limited to a concentration of up to 10 mg/m^{3}U for half-hour values of average concentration.

15. The solidification process

In wastes incineration process three types of process waste shall be generated:

- slag (coarse material) from screening the sand from fluidized bed – non hazardous waste,

- ashes caught in multicyclones – non hazardous waste,
- bag filters residues – hazardous waste.

All this waste shall be fed separately into solidification plant, utilizing GEODUR Company process.

The solidification plant shall be located in separate building and include:

- two silos for binding materials storage,
- two silos for ashes and residues storage,
- mixer,
- reagents dosing and storage system
- pelletizer.

The installation shall solidify hazardous waste and non hazardous wastes. In order to separate the two types of wastes, each week the installation shall be operated with different type of waste for:

- 6 days, during which non-hazardous waste (ashes) shall be solidified
- 1 day, during which hazardous waste shall be solidified.

The pellets produced in the installation shall be transported into the hall with boxes, for 10 days will maturation process . Then, the waste shall be further managed by recovery or disposal.

16. Air purification system

Potential sources of odor in the Sludge Incineration Plant are hoppers for screenings and sand, the container with grease and sludge driers.

All sources of odors shall be kept under a slight vacuum to prevent uncontrolled emission of odors into ambient air. Polluted air shall be extracted with fans and incinerated in furnaces. In case of furnaces shut down air shall be purified in active carbon filter.

17. Summary

Completion of the extension and rehabilitation of the Wastewater Treatment Plant *Czajka* and the Sludge Incineration Plant is scheduled for April 30, 2012. After this date all the sludge generated in the Wastewater Treatment Plant *Czajka* and the Wastewater Treatment Plant *Południe* shall be disposed of in the Sludge Incineration Plant, reducing the amount of process waste and nuisance to local inhabitants, related to the emission of odors from large amounts of wastewater sludge stored temporarily in the area of the Wastewater Treatment Plant *Czajka*.

An additional benefit is the heat and power production. Generated power is the energy derived from renewable sources, so-called the green energy.

18. References

[1] Functional Utility – Programme for Project 1 – Extension and rehabilitation of the Wastewater Treatment Plant *Czajka*

[2] Functional Utility – Programme for Project 2 – Construction of Sludge Incineration Plant

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[4] Construction Project for Project 1 – Construction of Sludge Incineration Plant

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