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CONCEPTUAL DESIGN -

General Description for
Bulgarian National Hazardous Waste Centre

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under the

Phare

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and

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"Phased implementation of National Hazardous Waste Centre"

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Executive Summery

This report describe the conceptual design applied for the Bulgarian National Hazardous Waste Centre (NHWC)

When the NHWC is fully constructed the center will occupy an area of close to 20 ha. and include the following facilities:

- Administration building comprising offices, changing rooms, canteen and laboratory.
- Maintenance and repair shop
- Reception and unloading area
- Separate storage facilities areas for inorganic, organic and special waste
- Drum emptying and pre-treatment facilities for organic waste
- Tank farm for liquid organic waste
- Facility for handling of highly toxic waste
- 2 (two) Incineration facilities having a total capacity of 15,000 and 30,000 tonnes per year (rotary kilns type including flue gas cleaning equipment complying with EU requirements)
- Physical-Chemical treatment (PCT) facility
- Solidification facility
- Secure Landfill at the NHWC and regionally in the Sofia area
- Landfill for Asbestos waste
- Effluent handling system including monitoring station
- 2 (two) Transfer stations

This set-up of the NHWC will ensure that all types of waste (excluding infectious, radioactive and explosive waste) can be treated and disposed of in an environmental safe manner.

The design applied for the individual treatment processes shall use proven technology and follow practices and methods which has been applied world-wide for a number of years and includes up-to-date equipment to ensure the safety of the workers and the surrounding environment.

The NHWC shall be constructed in a phased approach. This means that the center shall gradually be developed to incorporate the requirements and demands from the waste generators in its services.

In the first phase all the facilities mentioned above will be constructed either partly or at reduced capacity. This will ensure that the capacity of the facilities is fully utilized. This especially applies for:

- the incinerator where a small 15,000 tonne per year will be constructed
- the tank farm where only a few of the tanks will be erected and
- the PCT facility where the reactor, sludge handling equipment and safety features will be installed
- Recycling facility where only the mercury evaporation device is included

- Civil and electrical works will only be included to an extend allow for the operation taking place in the first phase
- Also for utilities and other general facilities only the parts required for operation of the facilities installed in phase 1 will be constructed.

The facilities which are constructed during the 2nd and 3rd phase shall be based on the actual waste scenario and market conditions at the time of extension. However, it is foreseen that a 30,000 tonnes per year incinerator will be constructed in year 2015.

Additional landfill cells, both at the NHWC and at landfill located in the region of Sofia will be constructed on demand. Also completion of the PCT facility, the recycling facility and construction of a second transfer station (proposed to be located in Shumen) is planned for in the later phases.

The center will have a limited fleet of truck especially dedicated collection of flammable and corrosive waste. Additionally a number of trucks from outside transport companies will be engaged for collection and movement of the waste intended to be disposed of at the NHWC.

For operating phase 1 of the NHWC a workforce of around 100 persons will be employed by the NHWC. This number will gradually grow to around 140 persons when the facility is fully developed in phase 3.

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1. INTRODUCTION

This document provides the conceptual design and a general description for the Bulgarian National Hazardous Waste Centre (NHWC). The conceptual design foresee that the NHWC is established based on a phased implementation strategy.

The conceptual design is based on the findings of the reports "Conceptual Design – General Description for Bulgarian National Hazardous Waste Centre" from 2001 and "Review of Waste Amounts and Design Capacities" from 2003.

The conceptual design and NHWC will be designed in such a way that it shall be capable of receiving any type of hazardous wastes produced in Bulgaria excluding only explosives, radioactive and infectious wastes which are not to be accepted.

2. DESIGN BASIS

The basis for the phased implementation of the NHWC has been established in the report "Review of waste amounts and design capacities". The review is based on the previous waste survey which evaluated data from more than 4,000 information sheets for the years 1998 and 1999 submitted by the waste generators to the Environmental Executive Agency. Further the review included a general evaluation of new information sheets from the years 2000 and 2001 as well as new data from the European Environment Agency from 2002 presented in the report "Hazardous waste generation in EEA member countries; Comparability of classification systems and quantities"

The review shows as the waste survey that in the first year of operation small quantities will be received due to a low capture rate as the collection and disposal systems are new. However, the capture rate slowly increase and it is expected that 80% of the generated waste will be received at the facility between 8-10 years and that the maximum amount collected will be 90% of the generated amount.

In the graph below the amount of waste expected to be collected are shown for physical-chemical treatment (PCT), waste for incineration (INC), waste for solidification (SOLI) and waste for landfill (LF) additionally waste for recycling and asbestous waste shall be considered when preparing the design for the
NHWC.

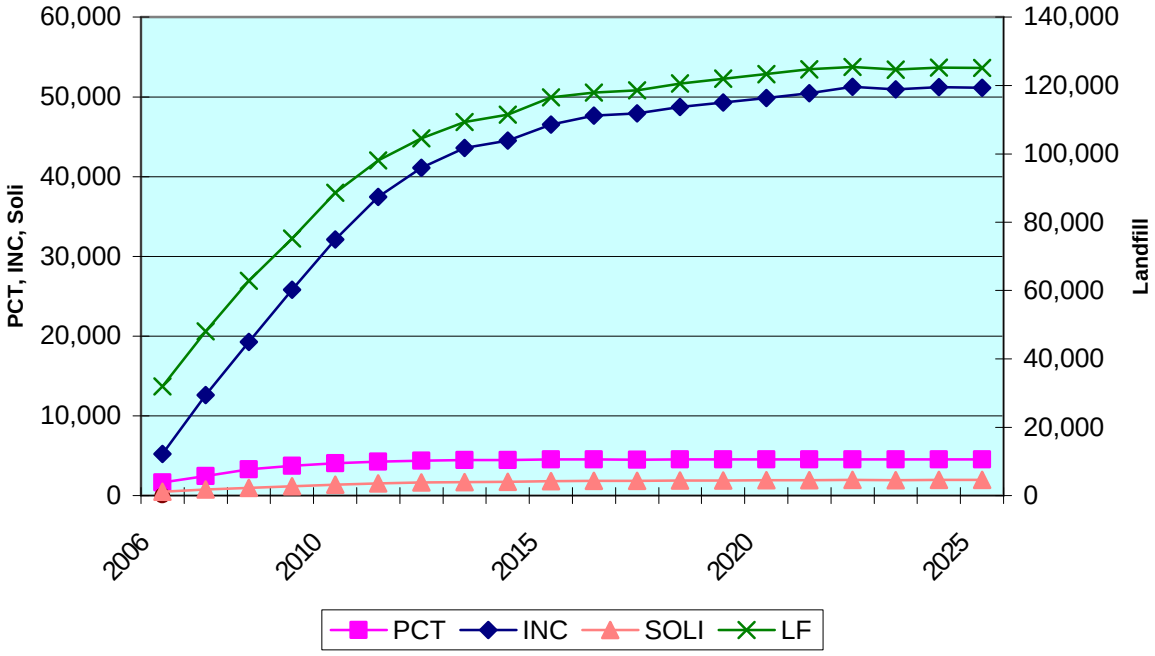


Figure 2-1 Expected amounts of waste collected

Based on the amounts of waste which is expected to be collected, the establishment of the treatment facilities has been divided into 3 phases.

By introducing the facilities in a phased approach the investments required for establishing the NHWC will not be as high as if the entire facility was constructed. Further the NHWC will not be as economic sensitive to lacking waste amounts which is a major concern due to new concept of the NHWC and the fact that payment has to be made for waste disposal.

2.1 Phased Implementation

2.1.1 Phase 1 (1-A and 1-B planned for implementation in year 2006/2008)

The process facilities constructed during the first phase (1-A) of the NHWC have been designed to handle and dispose the following quantities:

Disposal Method Phase 1A	Design Basis [tonnes/year]
Secure Landfill NHWC (total capacity)	150,000
Secure Landfill Sofia Region (total capacity)	200,000
Asbestos Landfill (NHWC and regional landfill) (total capacity)	5,000
Solidification	5,000
Incinerator No.1	15,000
Physical-Chemical Treatment	1,000
Recycling (mercury)	100

The secure landfill at the NHWC and the regional landfill shall be designed with the possibility of a future extension. The regional landfill shall be established in the region of Sofia as most of the waste for landfill is generated in this area

The cells shall be split into a number of sub-cells to minimize the amount of leachate. The capacity of the sub-cells shall be determined during the detailed design taking local topography into consideration.

The capacity of the incinerator may be supplemented by incineration of specially selected types of waste in cement kilns or similar equipment outside of the NHWC. However special conditions have to applies for the disposal outside the NHWC.

The capacity of the physical-chemical treatment plant can easily be increased by operating the facility in 2 or 3 shifts.

In phase 1-B the NHWC will be extended with the following facilities:

Disposal Method Phase 1B	Design Basis [tonnes]
Secure Landfill NHWC (total capacity)	150,000
Secure Landfill Sofia Region (total capacity)	300,000
Transfer station in Sofia (yearly throughput)	1,100

As for phase 1-A the landfills shall be divided into a number of cells and sub-cells and be constructed as an extension of the existing secure landfill

2.1.2 Phase 2 (Planned for year implementation in year 2015)

In phase 2 the remaining auxiliary equipment originally planned for will be constructed at the NHWC and further the NHWC will be extended with the following facilities:

Disposal Method Phase 2	Design Basis [tonnes/year]
Secure Landfill NHWC (total capacity)	250,000
Secure Landfill Sofia Region (total capacity)	500,000
Incinerator No. 2	30,000

The landfills shall be divided into a number of cells and sub-cells and be constructed as an extension of the existing secure landfill over a period of 5-6 year.

Taking the second incinerator into operation the total capacity for waste to be incinerated will be 45,000 tonnes per year.

2.1.3 Phase 3 (Planned for implementation in year 2020)

In the third and last phase the following main facilities are supposed to be supplied:

Disposal Method Phase 3	Design Basis [tonnes]
Secure Landfill NHWC Cell (total capacity)	150,000
Secure Landfill Sofia Region (total capacity)	300,000
Transfer station (Shumen)	1,100

The location of the 2nd transfer station is based on the results from a logistic analysis undertaken under the DEPA project. This report recommended the transfer station to be established in the Shumen area to service the north-east part of Bulgaria.

3. LAYOUT OF THE NHWC

Based on the expected amount of waste, and the selected disposal facilities two preliminary layouts have been prepared illustrating the constructed installations of the NHWC in phase 1 (drawing No. 47091-BG1-124-100) and the installations constructed in phase 2 as the final layout (drawing No. 47091-BG1-124-101).

When all phases are implemented the NHWC will occupy an area of close to 20 ha. and include the following facilities:

- Administration building comprising offices, changing rooms, canteen and laboratory.
  (completed in phase 1)
- Maintenance and repair shop
  (partly phase 1, completed in phase 2)
- Reception and unloading area
  (partly phase 1, completed in phase 2)
- Separate storage facilities areas for inorganic, organic and special waste
  (partly phase 1, completed in phase 2)
- Drum emptying and pre-treatment facilities for organic waste
  (partly phase 1, completed in phase 2)
- Tank farm for liquid organic waste
  (partly phase 1, completed in phase 2)
- Facility for handling of highly toxic waste
  (Mercury evaporation device included in phase 1; fully constructed in phase 2)
- 2 (two) Incineration facilities (rotary kilns including fluegas cleaning equipment)
  (15,000 tonnes/year in phase 1 and 30,000 tonnes/year in phase 2)
- Physical-Chemical treatment facility
  (Reactor and filtration equipment in phase 1, completed in phase 2)
- Solidification facility
  (completed in phase 1)
- Secure Landfill at the NHWC and regionally in the Sofia area

(partly phase 1 and 2, completed in phase 3)

- Landfill for Asbestos waste
  (partly phase 1 and 2, completed in phase 3)
- Effluent monitoring station
  (completed in phase 1)
- 2 (two) Transfer stations
  (Sofia Transfer Station constructed in phase 1, Shumen Transfer Station constructed in phase 3)

The completed NHWC will ensure that all types of waste (excluding infectious, radioactive and explosive waste) can be treated and disposed of in an environmental safe manner. The design used for the treatment processes will follow practices which has been applied world-wide for a number of years and make use of up-to-date equipment to ensure the safety of the workers and the surrounding environment.

4. GENERAL PROCEDURES

This section will describe the general procedures, which will take place at the NHWC please refer to the "Overall Flow Diagram" and the detailed flow diagrams for the different processes in appendix 2.

General safety procedures will be maintained to avoid accidents. This will include non-smoking areas, speed limits, safety equipment such as goggles, helmets and protective clothing, safety distance to operating machinery, etc. At least one person within each department and work shift shall be trained in first aid.

The NHWC shall work closely together with the local fire fighting and emergency response teams. A detailed emergency response plan and actions plans in case of fire shall be prepared including task by task instructions in alarming of the fire department, evacuation of site and use of fire fighting equipment. The routines shall be trained and practiced on regular intervals.

4.1 Reference samples

Before the waste can be accepted by the NHWC a sample has to be send for analysis at the facilities laboratory. The reference sample must be representative for the whole amount of waste intended for delivery.

In order to avoid mixing of different waste types it is important that each type of waste is collected and stored separately at the waste generators premises before being shipped to the HWC. The purpose of this analysis is to evaluate whether it will be possible to accept the waste for disposal and to inform the waste generator on the expected treatment fee. It is important to mention that the results from the analysis, only serves as an indication on disposal method and treatment fee. The actual disposal method and treatment fee will be determined based on the samples taken and analysed on the waste delivered to the facility.

The treatment fee is based on the disposal method. The more complicated the method of treatment, the higher the treatment fee.

4.2 Waste Collection

When the waste generator has agreed to the proposed disposal method and treatment fee, trucks will collect the waste at the waste generator premises.

The trucks will be equipped with safety equipment allowing the trained truck driver to handle minor accidents.

In case of uncertainty of the origin or the properties of the waste, lacking identification of the waste containers or wrongly filled in registration form the waste shall be left at the generator.

All received waste must be properly packed and accompanied by a registration form, signed by the waste generator otherwise it shall not be accepted. If several types of waste are sent for disposal by one waste generator one registration form for each type of waste must accompany the waste.

The registration form shall comply with Bulgarian regulation and must state the nature, physical and chemical properties, and amount of the waste. The way of packaging and number of drums shall also be stated. The registration forms will be computerised at the NHWC. The computer registration will enable the centre to register the location of the waste at any time, prepare statistics on waste generator, type of treatment, etc.

4.3 Reception, Sampling and Analysis

When the waste arrives at the facility the truck will be weighed on a weighbridge when entering the facility. Based on the result of the reference sample the truck will unload at the inorganic unloading area, the organic storage unloading area or at the landfill unloading area. Bulk liquid waste will be pumped to the tank farm. The waste shall be checked regarding compatibility before unloading into the storage tanks.

At the unloading areas the staff from the waste reception section will collect the registration form and sample the waste in accordance with the instructions given by the waste evaluator. The number of samples from each delivery will depend on the type of waste, the packaging and the waste generator. The sample and the registration form is taken to the laboratory where it is placed in the storage fume cupboard until a laboratory technician collects it and performs the appropriate analyses as ordered by the waste evaluator.

The Waste Evaluator is an essential person in the system as he will be responsible for safe and correct disposal of the waste. The waste evaluator can be the Laboratory Manager, the laboratory supervisor or chemists who has a good chemical knowledge and understanding of the different disposal options at the NHWC.

By searching the computer database for the specific sample the laboratory technician shall be able to look up which analyses the waste evaluator has prescribed to be performed for the relevant sample.

After the analysis has been completed the Waste Evaluator, based on the result of analysis, prescribes the disposal method for the waste. The disposal method at the same time indicates to which storage facility the waste shall be moved.

4.4 Storage

At the NHWC a number of different storage areas are available.

- Storage for organic Waste
- Storage for inorganic Waste
- Storage for Special Waste

The storages have racks for placing of the waste. The location of each waste delivery will be recorded and entered into a computer system so that the exact location of the waste will be known at all time.

The storages are roofed and designed in such a way that any spillage will be collected in sumps. For the organic waste storage and the special waste storage fire fighting sprinklers are installed.

From the storage areas the waste is transported to the relevant treatment facilities for disposal. All transfer of waste shall be recorded in order to document the treatment and disposal of all wastes received at the facility.

In phase 1 liquid waste for physical-chemical treatment will be stored in drums or containers suitable for this purpose. In phase 2 liquid waste will be pumped to physical-chemical storage tanks before treatment.

4.5 Organic Tank Farm

Bulk organic waste will be pumped into a reception tank. Here liquid waste from the pretreatment section also is pumped. The staff in the tank farm will, based on the composition in the reception tanks, mix a blend suitable to be used in the incineration system. The main criteria are calorific value and content of halogens.

The tank farm is covered with nitrogen in order to minimize the risk of fire accidents.

The construction of the tank farm will be split into two phases, in order to integrate the tank farm with the capacity of the incinerators.

4.6 Pretreatment

Waste in drums for incineration will in many cases have to be divided into smaller quantities in order to comply with the feed requirements for the incinerator (weight, energy or chemical composition).

This sub-dividing takes place in the pretreatment facility where staff will operate machinery capable of transferring liquid waste to the tank farm and divide the solid waste into smaller quantities. The machinery is placed in cabins having an exhaust system and the workers will be dressed in protective suits with fresh air supply.

After sub-dividing the drums containing the waste will be placed on a conveyer belt taking them to the incineration facility.

The facility also contains a special tank where liquid waste with too low pH will be pretreated by addition of NaOH. After neutralization the waste will be transferred to the tank farm.

4.7 Disposal

Secure landfill

Waste which is disposed of directly to the secure landfill must comply with the criteria's given by the EU directive for hazardous waste landfills also implemented in the Bulgarian legislation.

Typical types of waste for direct land filling is filter cakes, slag and fly ash. The waste will be disposed in drums or if delivered in bulk unloaded into the landfill. When the waste has reached a certain height a layer of soil or slags will be laid on top of the waste allowing for new waste to be placed on top of it.

Having reached the final height the waste will be covered with a plastic membrane and soil.

In the landfill the waste will be arranged so that certain types of waste (filtercakes, flyash and slags) are placed in certain areas of the landfill. The size of the landfill shall take into consideration internal generated waste from the incinerator it shall be based on 10% of the waste fed to the incinerator. Solidified waste will be poured over the top of the stacked drums exploiting the volume of the landfill to the maximum.

The construction of the landfill will be split into several phases. The capacity of the NHWC landfill is 300,000 tonnes in phase 1; 250,000 tonnes in phase 2 and 150,000 tonnes in phase 3.

The landfill at the Sofia region shall have a capacity of 500,000 tonnes in phase 1; 500,000 tonnes in phase 2 and 300,000 tonnes in phase 3.

Solidification

At the solidification plant waste which can not comply with the criteria for direct landfilling is mixed with cement to reduce the release of heavy metals from the waste.

First the waste will be feed into a concrete truck from a waste hopper, water will be added and finally the cement will be feed from a cement silo according to a prepared recipe. During the transport to the landfill the mixing will ensure a uniform product.

Incineration

The incineration units will allow for feeding of whole 200 litre drums, bulk waste, liquid waste and sludges. Contaminated water is disposed into the secondary combustion chamber.

The facilities will be operated in compliance with the EU regulation regarding incineration of hazardous waste. This means that a temperature of more than 1,100°C will be maintained for more than 2 seconds at an oxygen concentration of more than 6%. Furthermore the fluegas cleaning system will ensure compliance with the EU regulations regarding fluegas emissions please refer to section 5.10.

The system will be controlled by a fully automatic control system incorporating maximum safety measures.

Physical-Chemical Treatment

In the first phase only containerized waste will be collected for treatment at the PCT facility. The waste shall after testing be pumped directly to the reactor where the neutralization will take place. Safety features such as ventilation and cooling water will be provided already in phase 1.

In phase 2, when the facility is fully constructed, waste delivered in bulk will be pumped to the appropriate storage tank after testing has proven the composition of the waste. Also the drummed waste will be pumped to the storage tank by the PCT staff, this operation will take place at special suction stations having exhaust and a contained area to collect spillages.

After the waste has been taken to the storage tanks the detoxification is performed by a fully automatic control system, incorporating maximum safety measures.

Landfill for Asbestos Waste

Asbestos waste, which do not contain any other contaminants than asbestos shall be taken to the asbestos landfill. If the waste is generating dust the waste shall be delivered in plastic bags or other packaging to control the release of dust. The waste shall be unloaded into the landfill and immediately covered by soil to prevent the asbestos fibres migrating into the environment

Special Waste

At the special waste area batteries shall be sorted so that lead, Ni/Cd batteries can be send for recycling.

Mercury waste (mainly light tubes) shall be treated in a evaporation unit separating. The system will generate a glass, metal and mercury fraction.

Miscellaneous waste delivered in small packaging shall be sorted in this area.

Pesticides shall be transferred to small packaging for incineration or pumped to a feeding tank.

5. DESCRIPTION OF EACH FACILITY / UNIT

In this section more detailed information on the design are provided for the individual facilities of the NHWC

5.1 Administration Building

The administration building contains offices for the Managing Director and the 4 department managers, plus offices for transport planning, sales / PR, accountants, secretaries and other administrative staff. In addition the administration building contain waste reception office including rooms for the truck drivers (10 persons), laboratory including office, reception hall, meeting rooms, canteen with attached kitchen capable of servicing 100 persons, archive, technique room, changing and bathing facilities for 100 workers shall be available

The total area shall be around 1,800 m² but the basic design will provide more detailed information.

All traffic in and out of the area shall pass by the gatehouse where registration of all personnel, and vehicles is made. No waste delivery trucks should be allowed into the area without proper registration form(s) and no persons without proper identification cards should have access. The entrance shall be closed with an electric operated gate/barrier. As peak traffic can be expected during daytime, waiting areas with sufficient parking space shall be provided.

In front of the gatehouse a weighing facility shall be situated to determine the load of the waste carrying trucks. The actual weight shall correspond to the weight stated on the registration form. In case of mixed loads containing more consignments, i.e. from pickup at a number of facilities, separate weighing must take place.

The gatehouse shall be manned 24 hours a day all year either with staff from the reception department or with security personnel.

Major Equipment

- Administration equipment (desks, chairs, phones, fax, computers etc.)
- Weigh bridge
- Computer system for waste registration

5.1.1 Laboratory

The laboratory is a service facility for the NHWC and shall be designed and equipped with analytical instruments so that the laboratory is able to perform certified analyses in the following areas:

- hazardous waste,
- operational parameters required for running the plant
- monitoring the impact of the plant on the environment.

The laboratory shall not be capable of analyzing dioxin and furans which shall be analysed by an outside accredited laboratory.

Analyses of reference samples (samples of waste which is in the progress of being send to the NHWC) and waste deliveries shall generally include: radioactivity, flammability, pH, reactivity towards miscellaneous substances such as water, organic solvents, acids, alkalis, influence of heat, etc. Further parameters such as the content of organic/inorganic matter, organic bound halogen and sulphur, heavy metals, calorific value, ammonia, pH, cyanide, chromium(VI) may also be analysed.

Analyses concerning the operation of the plant includes: analyses of chlorine content, solid matter and calorific value of the organic waste to be fed into the kiln. The latter is performed in order to ensure that the calorific value is within a certain range so that a stable combustion is ensured. Other typical analyses are the determination of the concentration of metals, ammonia, cyanide and chromium(VI) in inorganic waste for PCT treatment. Also the preparation of formulas for the solidification plant and verification of the solidified product is part of the operational analyses.

Concerning the plant emissions to air, soil and water the analyses includes determination of:

- Composition of the flue gases, fly ash, and slag from incineration
- Composition of effluent water and leachate from the landfill.
- Ground water samples from nearby control wells.
- Water discharge

As it is quite expensive to conduct a comprehensive analytical program on all waste deliveries the following procedure shall be applied.

For the 3 first deliveries the waste is sampled and analysed based on a comprehensive testing programme. If the analyses shows the same results the number of analyses shall be reduced for the following deliveries only applying the comprehensive testing programme on a random basis.

The samples shall be stored for 2 months allowing for repeated analysis if any disputes regarding treatment fee occurs.

Operation

When the sample enter the laboratory it shall be registered. For waste samples the Waste Evaluator already shall have decided on the parameters to be analyse and have typed them into the computer system. Operational and environmental samples shall be analysed according to a standard test scheme.

After having completed the analyses, the results are entered into the computer system. This system shall allow the results to be reviewed by the Waste Evaluator, who then shall decide how to dispose the waste. Having entered the treatment code the waste is released for treatment in the plant operations computer system.

Major equipment

- AAS flame with hydride system and the possibility of adding graphite furnace
- Bomb calorimeter
- TOC analyser
- UV/VIS spectrophotometer
- Flash point tester
- Geiger counter
- Analytical Balances
- Water purification system
- Ventilation system
- Fume cupboards

Phased Implementation

The entire administration building shall be constructed during phase 1-A.

5.2 Service & Maintenance Building

The service & maintenance building shall contain workshop for general maintenance of mechanical and electrical equipment. Also offices and storage for spare parts shall be included.

The maintenance building shall have a size of 500 m²

Major equipment

- Rack system for storage of spare parts
- Common workshop machinery for steel works
- Common workshop machinery for electrical works

Phased Implementation

The service & maintenance building shall be constructed partly during phase 1-A and be completed in phase 2

5.3 Quarantine Area / Unloading Area for Waste in Drums

All waste in drums or other small containers shall be temporarily stored at the quarantine area until a sample has been taken. If the waste origin from a company with a long record at the NHWC the waste shall be transferred to the normal storage location of the waste. If the waste is a new delivery the waste shall be stored at the quarantine area until the sample has been analysed and the Waste Evaluator has decided on the treatment and disposal method. Thereafter, the waste shall be directed to the relevant storage area.

Based on the result of the analysis waste can be moved to different storage facilities.

- Inorganic waste
- Organic waste
- Special waste (Pesticide and other waste which require special attention)

Major equipment

- Forklift

Phased Implementation

The entire quarantine area / unloading area shall be constructed during phase 1-A.

5.4 Inorganic Storage

5.4.1 Inorganic Liquid Waste

Inorganic liquid waste is assumed to arrive in drums or in bulk and shall be treated at the PCT facility.

The waste shall be transferred to dedicated storage tanks for the special type of waste. During the transfer a sample of the waste is taken for laboratory analyses. Liquid waste in drums shall be stored together with the solid inorganic waste in the storage building for inorganic waste before finally being pumped into the storage tanks.

The tank farm for storage of inorganic liquids shall be situated in a contained area within the PCT plant in order to prevent pollution in case of spillage.

Waste containing mercury shall be stored separately until a reasonable amount has been collected to justify recovery, or the waste shall be disposed of separately at the secure landfill.

Operation

Liquids arriving in tankers shall only be emptied to the storage tanks after an analysis has verified the composition of the waste. Liquids arriving in drums shall be analysed before being pumped to the reactor or storage tanks in batches. For larger amounts of drums arriving with the same transport spot testing may be used.

Design
The inorganic liquid storage area includes in phase 2 tanks for acidic and alkaline solutions, chromium waste, and other heavy metal containing solutions. The tanks shall be designed so that sludges can be removed from the tanks.

The storage tanks shall be situated in a contained area in order to collect accidental spillage.

Special waste that should not be mixed with the above categories should be stored separately in drums until treatment is viable.

Major Equipment

- Roofed area (400 m^2), storage racks, concrete floor, closed sump. Unloading area (100 m^3)
- Pumping system

In phase 2 following equipment shall further be provided

- Storage tank for chromium waste
- Storage tank for acidic waste
- Storage tank for alkaline waste
- Storage tanks for other wastes

Phased Implementation

In phase 1 liquid waste for PCT shall be stored in the drums or containers used for the transport or if the drums are of poor quality transferred to pallet tanks.

In phase two liquid waste collected by tanker trucks shall empty their load directly to the appropriate PCT storage tanks dedicated for that type of waste. Transfer shall only take place after a sample has proven the composition of the waste.

5.4.2 Storage building for Solid inorganic waste

Incoming inorganic solid waste unloaded at the reception area is after testing transferred to the storage area. The location of the waste is registered.

The storage area shall be paved with chemical resistant concrete and a roof shall avoid incoming rain. The floor shall contain a collection system for spillage.

The storage capacity shall be able to store waste collected for at least 3 weeks

Major Equipment

- Storage Area for Drums (roofed building).
- Storage racks
- Forklift

Phased Implementation

The storage building shall be constructed during phase 1

5.5 Organic Waste Storage

To allow for the most safe storage of the organic waste solid and liquid organic waste is stored in different types of storage. Liquid waste is stored either in the tank farm or in a storage building on racks. Solid waste are also stored under roof but not on racks and no system for collection spillage is considered

5.5.1 Tank farm for Liquid Waste

Organic liquid waste is assumed to arrive in drums or in bulk.

Tanker trucks shall after has having performed a compatibility test empty their load into the tank farm. During the transfer a sample of the waste is taken for through laboratory analyses.

The incineration facility will be operating 24 hours per day, and the storage area for liquid organic waste must therefore be large enough to contain drums prepared for feeding to the incinerator. The design of the storage capacity is calculated based on that sufficient waste must be stored for at least 2 weeks of operation. Furthermore, extra space is needed for shut down periods for major maintenance etc. This storage space should not be used during daily operation.

Major Equipment

- Tanks
- Containment
- Pumping system
- Nitrogen system (inert atmosphere)

Phased Implementation

The construction of the tank farm will be split into two phases, in order to integrate the tank farm with the capacity of the incinerators.

Phase 1 will include construction of concrete dike, pumps, filters, nitrogen system, gas-cleaning facilities and instrumentation and control functions. The tank farm will in the first phase consist of 2 tanks for reception and storage of liquid waste, 2 tanks for mixing and feeding to the incinerator and 1 (one) fuel storage tank.

Phase 2 will further extend the tank farm with 2 reception/storage tanks and one tank for high viscosity waste. This will ensure enough capacity to operate both incinerators for 3 weeks by liquid waste.

5.5.2 Storage Building for Liquid Organic Waste

Liquid waste in drums will be stored in a closed building having a pavement containing drainage channels and sumps which will collect any spillage. Sprinklers will be installed in the building.

Operation
Incoming waste unloaded at the reception area is after sampling transferred to the solid waste storage area. The location of the waste shall be recorded.

Major Equipment

- Roofed storage building for drums (roofed area)
- Racks
- Forklift

Phased Implementation

The construction of the storage shall be split into two phases, in order to integrate the storage with the capacity of the incinerators.

In phase 1 only half of the total area shall be constructed. The remaining shall be constructed in phase 2.

5.5.3 Storage Building for Solid Organic Waste

The storage for solid organic waste is a area under roof allowing for forklift access from both sides. The waste will be stacked on top of each other not using racks. As the waste is solid no provision for collection of spillage is foreseen except normal pavement of the area.

Operation
Incoming waste unloaded at the reception area is after sampling transferred to the solid waste storage area. The location of the waste shall be recorded.

Major Equipment

- Covered storage area for drums (roofed area)
- Forklift

Phased Implementation

The construction of the storage shall be split into two phases, in order to integrate the storage with the capacity of the incinerators.

In phase 1 only half of the total area shall be constructed. The remaining shall be constructed in phase 2.

5.6 Temporary Storage

If more waste is collected than can be accommodated in the storage areas the waste shall be stored outdoor on a temporary basis.

The temporary storage shall be divided into sections for inorganic and organic waste and have sections for both liquid and solids. Preferably only solid waste shall be stored in the temporary storage, all containers must be tight and of high quality.

Operation
Incoming waste unloaded at the reception area is after sampling transferred to the temporary storage area. The location of the waste shall be recorded.

Phased Implementation

An area for the temporary storage shall be included in phase 1 and additional area be included in phase 2 .

5.7 Solidification

For stabilizing inorganic waste which can not be disposed of to the landfill directly it is proposed to use a solidification technique whereby cement, fly ash from the incinerator and waste are mixed with water to form a virtually insoluble matrix. This technique has the advantages of using simple equipment, being cheap to operate and being very flexible.

The solidification plant is designed for a capacity of 5,000 tonnes per year operated in a single shift operation. If more waste needs to be treated additional shifts can be included.

As different wastes will require different amounts of cement to obtain the maximum stability, small-scale tests will be performed in the laboratory before applied on a larger scale.

The solidification plant is proposed to consist basically of a waste storage hopper, cement silo, fly ash silo, feeding and weighing system and a cement truck.

The chemistry of the solidification process is based on the silicate chemistry. The final product of the treatment is a mixture of amorph and crystalline silicate. With time all the remaining amorphous silicate will turn into crystalline silicates which will give an ongoing decrease of leachability.

The mixture of cement, flyash is an ideal buffer against the influence of acid rain. The mixture of cement and fly ash acts as cement but is much cheaper than using only cement.

Operation
The solidification unit shall be operated batch-wise. Cement, fly ash and water, is added to the waste and then mixed. The amount of the different reagents depends on the type of waste. Therefore it is necessary to develop recipes for each waste type on laboratory basis first.

The weight of the solidified material will be increased by approximately 100%. The volume will, however, not be increased accordingly, as the density of the mixture will be higher than in the original waste. The density of the mixture will be app. 1,500-2,000 kg/m³. With optimised recipes the waste volume usually increases by 20-30%.

Design
The solidification unit is relative simple, consisting basically of a silos for cement and flyash a conveyer with weight cell and a truck (cement truck) for transporting the solidified waste to the landfill.

Cement will be stored in silos and transported to the mixer unit by feed screws and a conveyor belt. Leachate water from the landfill or process water shall be preferred as water supply. Drummed waste and filter cakes from the PCT plant are introduced to the mixer unit by emptying of drums or storage containers into a waste hopper by use of a forklift. Drums will be crushed after emptying and sent for recycling if possible otherwise they will be landfilled.

Given the above assumptions for use of reagents, storage for about 200 t of cement shall be provided, equal to about one week of operation.

Major Equipment

- Storage silo for cement
- Storage silo for flyash
- Process water tank
- Waste hopper
- Weighing equipment
- Cement Truck

Phased Implementation

The solidification unit shall be constructed during phase 1.

5.8 Secure Landfill (NHWC / Regional Landfill)

Inorganic waste which passes the leaching test procedure and contain a low amount of organic material shall be deposited at the secure landfill at the NHWC or at the regional secure landfill which shall be constructed in the surrounding of Sofia to minimize transport costs. Both locations shall have a separate section dedicated for asbestos waste.

The landfill shall be constructed with a double bottom liner system and a drainage system to prevent contamination of ground water and secure collection of run-off water and leachate water.

When a cell is full, a top liner system to prevent rainwater from entering must be applied. An example of a top liner is a system consisting of a layer of a mineral material placed on top of the waste, followed by a high density polyethylene membrane, a drainage layer and finally a layer of top soil.

The actual design including sizing of the cells will be decided in the basic design.

Operation

The landfill will be established and operated in cells with only one cell active at the time. When a cell is about to be finalised the new cell will be taken into operation. Each cell will be operated in layers, and after each deposition of waste measures shall be taken to cover the waste in order to keep water from entering. When the layers reach the maximum height the top cover shall be started.

Most of the operation is concerned with tipping of waste, construction of temporary barriers and tipping roads and covering of the waste.

The waste will be deposited either as bulk or in drums. Also heavy-duty bags can be used. The depositing will be made with a front-end loader.

Only one section is operated at the time, if possible, whereby control of leachate and drainage water is made easier. Drainage water will usually be unpolluted and can be discharged without treatment, whereas leachate often contains heavy metals.

Leachate mostly arises from water penetrating the cover of the landfill or rain water penetrating unprotected deposited waste. Inclusion of daily cover is a way to minimize leachate.

Design

The design of the landfill will follow the Bulgarian and EU regulation. This includes a double liner system consisting of a polymer liner on top of a layer of compacted clay having a permeability of less than 10^{-10} m/s. Also included shall be a top liner and drainage system.

Bottom layer

Between the layer of clay and the plastic liner a layer of gravel including a drainage system shall be placed to act as leak-detection and support layer for the polymer liner. Choosing a clay layer and the protective gravel layer will enable the membrane to resist differential settling and displacements in the landfill base possibly provoked by earth tremors.

Finally on top of the gravel layer the HDPE liner is laid out.

Drainage system

Above the HDPE liner system 0.5 meter of gravel shall be placed to ensure drainage. The plastic liner shall be safely secured at the edges of the landfill. A drainage ditch shall surround the landfill for collection of drained rain water.

The drainage layer shall have a permeability of not less than 10^{-3} m/s to allow any leachate to penetrate down to the leachate collection pipes situated in the drainage layer. The pipes shall lead to collection sumps from where the leachate can be pumped away for treatment.

Monitoring wells

A number of groundwater monitoring wells/borings up- and downstream from the landfill area and the overall site will act as a form of leak-detection system, which will however only detect percolate leaks from the landfill area, measures to identify any cell leaking shall be considered.

Top cover

The top cover shall prevent water for entering the landfill when closed. The top cover shall consist of a layer of soil, a plastic liner (HDPE), a drainage layer which also act as root barrier and a final layer of soil for planting of vegetation only be grass or low bushes that will not penetrate into the plastic liner shall be used. The top cover shall exceed the edge of the landfill.

The topsides of the secure landfills shall have a maximum slope of 1 vertical to 3 horizontal for stability

Gas venting system

As no organic material is disposed no gas will be formed and the design shall therefore not include a gas venting system.

Leachate control system

The drainage pipes installed in the bottom part landfill shall transport the possible leachate water and rain water to a collection well. The collected water shall be pumped to a collection basin and analysed before being discharged to the process water tank or the contaminated water tank.

Drainage from a non-operational part of cells will not be contaminated and will be discharged or transferred to the process water tank.

Major Equipment

- Gravel and Clay
- plastic liner (HDPE)
- Front End Loader (with special wheels)
- Drainage system and pumps for pumping of drainage and leachate water

Phased Implementation

In the first phase 1-A the capacity of the NHWC landfill shall be 150,000 tonnes whereas the capacity of the regional landfill shall be 200,000 tonnes.

In phase 1-B additional cells shall be constructed both at the NHWC landfill (150,000 tonnes) and at the regional landfill (300,000 tonnes)

In phase 2 further cells shall be constructed both at the NHWC landfill (250,000 tonnes) and at the regional landfill (500,000 tonnes)

Finally in phase 3 a capacity of 150,000 tonnes shall be constructed at the NHWC and 300,000 tonnes at the regional landfill.

Figure 5.8-1 below illustrates the free capacity of the regional secure landfills. It must be emphasized that the capacities shall be adjusted to the actual demand when operation is initiated.

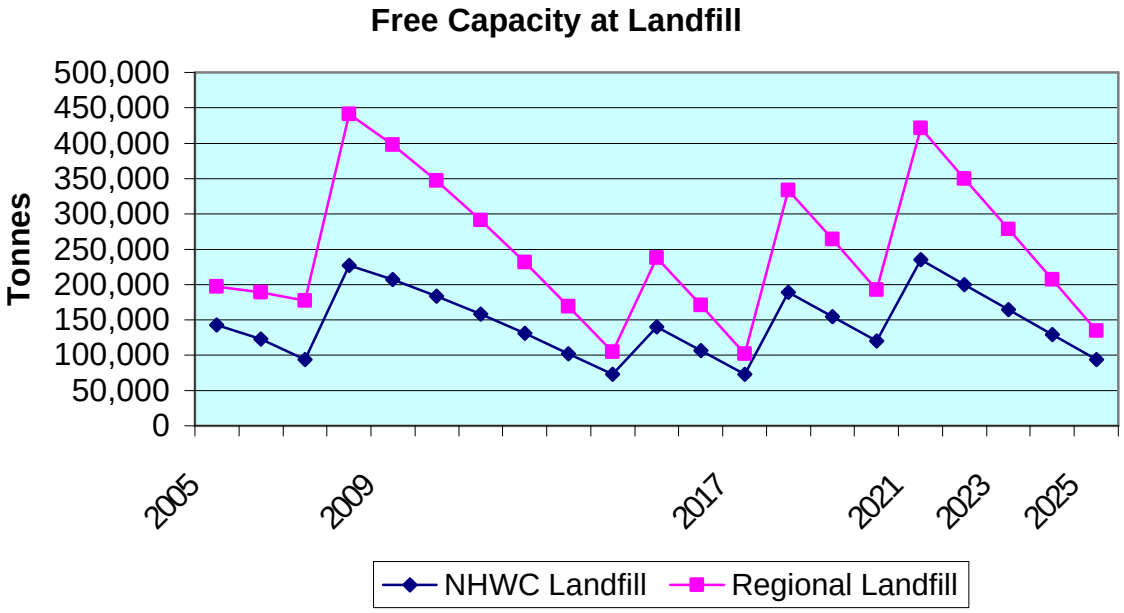


Figure 5.8 – 1 Free landfill capacity

5.9 Physical-Chemical Treatment Facility (PCT)

The physical/chemical treatment facility shall be designed for treatment of 1,000 tonnes/year of various inorganic wastes, including:

- Cyanide waste
- Chromium waste
- Acidic waste
- Alkaline waste
- Other waste containing heavy metals

Operation

The physical/chemical treatment plant shall be operated in a batch wise approach in one shift operation making use of the following treatment methods for rendering the wastes harmless:

- Oxidation of cyanide
- Reduction of chromium
- Precipitation of heavy metals
- Neutralisation of acids and alkalis

Treatment of Cyanide Waste

Cyanide (CN^-) containing waste is oxidised by means of sodium hypochlorite (NaOCl) to the biodegradable cyanate (OCN^-) following the reaction scheme

1) $$CN^- + OCl^- + H_2O = CNCl + 2\ OH^-$$

2) $$CNCl + 2\ OH^- = OCN^- + Cl^- + H_2O$$

With excess hypochlorite, the cyanate compounds can be further oxidised to nitrogen and carbon dioxide gases

3) $$2\ OCN^- + 3\ OCl^- + 2\ H^+ = N_2 + 2\ CO_2 + 3\ Cl^- + H_2O$$

Step 1), 2), and 3) are completed under alkaline conditions by addition of sodium hydroxide to reach a pH-level of at least 12. This is to avoid production of the poisonous hydrocyanic acid gas.

After approximately 1 hour pH is adjusted to around 8.5 and the chlorine surplus is removed by adding ferrous sulphate or ferrous ions containing waste.

Reduction of Chromium Waste

Chromate (Cr^{6+}) is very toxic to most higher life forms. The treatment method is reduction by means of ferrous ions (Fe^{2+}), sodium bisulphite ($NaHSO_3$), or a similar reducing agent, followed by precipitation of chromite (Cr^{3+}) in alkaline solution. The reduction using ferrous sulphate is:

$$CrO_4^{2-} + 3\ Fe^{2+} + 8\ H^+ = Cr^{3+} + 3\ Fe^{3+} + 4\ H_2O$$

In case ferrous containing waste is available it can substitute the ferrous sulphate. Sulphuric acid is added to reach an approximate pH-level of 2.5.

In order to speed up the process ferrous ions are added in excess. To precipitate the reduced chromium and iron, pH is adjusted to around 11 where hydroxides are formed

$$Cr_2(SO_4)_3 + 3\ Fe_2(SO_4)_3 + 12\ Ca(OH)_2 = 2\ Cr(OH)_3 + 12\ CaSO_4 \cdot 2\ H_2O + 6\ Fe(OH)_3$$

Neutralisation and Precipitation of Metals

Acidic, alkaline, and pre-treated chromium containing waste are precipitated in a multiple purpose reactor by adjustment of pH to around 10 where most heavy metals form relatively insoluble hydroxides. Cyanide containing waste will be able to form soluble cyanide complexes and a few heavy metal containing ions, such as chromate, will also be able to stay in solution. Hence the pre-treatment of such fractions.

Acidic and alkaline waste can be pumped directly to the multi purpose reactor where the pH adjustment takes place. For economic reasons the two waste streams are often mixed in the reactor. As the mixing and pH adjustment is an exothermic process, the temperature must be carefully monitored.

The high operating pH will ensure that metals such as cadmium, copper, nickel, zinc, chromium, manganese, iron and silver are precipitated.

It is expected that around 1,500 tonnes of filtercake will be generated from the PCT plant

Problematic Waste

Not all types of inorganic waste can be treated using the methods described above. As mentioned, cyanide is able to form complexes with for example iron and copper, but also amines are capable of forming complexes, which are soluble at high pH. Additionally, heavy metals such as lead, mercury, arsenic, selenium, and others are not precipitated by means of hydroxides. Furthermore, a high content of organic material can also complicate the treatment.

These wastes will be stored for later treatment when a sufficient amount for a batch is collected. Cyanide and amines storage can be oxidized, and lead, mercury, arsenic, and selenium can be precipitated with sulphite. Sulphite treatment will also split and precipitate most of the formed complexes.

Design

Storage tanks

Storage tanks shall be included for storage of waste before being transferred to the reactor. A pH monitoring shall be installed in the pipe used for transferring the waste to the storage tanks to avoid mixture of different waste types.

Reactor

The reactor shall be able to receive waste from the storage tanks for treatment according to the type of waste. Fittings to chemical containing tanks shall ensure the easy addition of acid, alkaline, ferrous containing solution, and other needed chemicals. Furthermore, the reactor shall allow for easily extracted of samples for testing.

An agitator shall will ensure homogeneity and keep the precipitate in suspension. This will speed up the precipitation.

In case the temperature raises rapidly in the reactor provisions shall be made for automatic release of cold water into the reactor.

A ventilation system shall ensure that the gas emissions from the reactor passes through a scrubber before being released to the atmosphere.

For controlling the reaction relevant instruments measuring temperature, redox potential, pH and pressure shall be installed.

Sedimentation Tank

After treatment in the multi purpose reactor, the mix of waste water and suspended solids is transferred to a sedimentation tank. The sedimentation tank should have sufficient capacity to ensure continuous operation of the de-watering equipment, and at the same time act as an equalizer for the different waste streams. Also, the tank acts as storage tank when the de-watering equipment is out of operation.

Flocculent are usually added in the sedimentation tank for quicker settlements of the suspended solids. Sludge scrapers situated at the bottom provide mixing and uniform transfer to the de-watering equipment.

The sedimentation tank also act as overflow tank from the reactor

Sludge De-watering

The sludge de-watering equipment shall consist of a filter press. The sludge enters the filter press from the sedimentation tank and is pumped under high pressure for effective de-watering. The filtrate is pumped to the process water tank. If the content of heavy metal in the filtrate is higher then what can be accepted in the process water the filtrate is collected for additional treatment in the PCT facility.

When the pressure builds up to a certain set point before the filter press reaches, the filterpress shall be emptied automatically into a container. The filter cake is transferred to the landfill if it passes the leaching test, otherwise it is send to the solidification unit before being final deposited in the landfill.

Reagent tanks

These tanks shall be equipped with stirrers, various fittings and safety valves. They will be placed together with the inorganic liquid storage tanks in a bonded area.

Phased Implementation

For phase 1 the following main equipment shall be installed to allow operation of the PCT at reduced capacity

- Reactor
- Sedimentation tank

- Filter press
- Pumping system
- Cooling system
- Ventilation system including scrubber

The remaining major equipment to be installed in phase 2 comprises

- Waste storage tanks
- Lime slacking unit
- Storage tanks for chemicals

5.10 Special Waste

In the special waste area a number of operations will take place.

Evaporation of Mercury

A small facility for evaporation of mercury will be included, mainly for handling of spent mercury containing light tubes. The tubes will be handled in a closed system where they first a shredded and continuous feed to an indirect heated evaporator operating at around 500°C. The vapors will be cooled and the mercury condensed before being extracted from the device.

The system will be in a closed container, which operates at a slightly negative pressure, ensuring that no mercury gasses are released to the working environment.

The gasses will be cleaned by passing the gasses through a sulphur impregnated activated carbon filter.

Sorting of Batteries

The batteries will manually be separated into the following fractions

- Lead batteries
- Ni/Cd batteries
- Mercury batteries
- Lithium batteries
- Other batteries

The lead batteries will be processed for reuse in Bulgaria.

Lithium and Ni/Cd batteries will be exported for recycling at specialized facilities which comply with European regulations

Mercury batteries will be treated in the evaporation device installed at the NHWC

Other batteries will be mixed into the solidified product and be placed in the landfill.

Phased Implementation

In phase 1 only the unit for mercury evaporation and a part of the storage and sorting facilities to handle batteries shall be constructed. The facility shall be completed in Phase 2.

5.11 Highly toxic waste facility

Liquid pesticides and other highly toxic liquid waste shall be handled in a special area designed for this purpose. The pumpable highly toxic waste will be emptied to a specially designed collection and feeding tank. From this tank the waste are feed to the incinerator in small quantities, in order to avoid high loads of the incinerator.

Transfer of the waste from the tank to the incinerator is achieved by pressurizing the tank. The feeding line will be made of double piping in order to collect any spillage in case the inner pipe leaks.

The personnel working in the area will wear special protective clothing and fresh air supply.

Phased Implementation

The facility shall be constructed in phase 2.

5.12 Incinerators and Flue gas Cleaning System

For treatment of organic chemicals and other substances high temperature rotary kiln type incinerators are included for the NHWC. This type is chosen as it is highly flexible towards waste types and feeding arrangements. Another important aspect is that it has a long and proven track record from a number of facilities world-wide.

In order to avoid building a to large incinerator it is planned to construct 2 incinerators. The first incinerator constructed at the NHWC in phase 1-A shall have a capacity of 15,000 tonnes per year. The second incinerator planned to be constructed in phase 2 shall have a capacity of 30,000 tonnes per year.

These capacities will cover the amount of waste generated for disposal by incineration.

The incinerators at the NHWC may be supported by other external incinerators, e.g. cement kilns which may accept certain specific types of waste. One other alternative is to make use of other hazardous waste incinerators outside Bulgaria.

The same design philosophy shall be applied for both incinerators at the NHWC. The only difference is that they having different capacities.

The incinerator train will consists of a rotary kiln equipped with a scrubber and filter system for purification of the flue gas. The scrubber system shall comply with EU standards for flue gas cleaning for hazardous waste incinerators. A steam boiler and a turbine are included for generation of electricity.

5.12.1 Feeding System

The feeding system used at both incinerators shall be designed with great flexibility in mind to ensure that all kinds of organic, solid and liquid wastes can be treated continuously. Therefore the feeding system includes the possibility of feeding 200 litre drums, bulk waste via a skip hoist/crane and lances for different types of liquid waste.

In principle, all kinds of organic wastes can be incinerated in the rotary kiln, including

- waste oil/emulsions/sludges
- organic solvents
- paint sludges and lacquers
- plastic and synthetic material
- halogenated wastes
- pesticides

It is not foreseen that hospital waste shall be handled in the system.

The feeding of solid waste in drums takes place through a double sluice ensuring that no emission is released to the atmosphere. Furthermore it also act a safety measure in case of sudden rapid combustion of the waste. Bulk waste is also fed through a double sluice. The control system will ensure that bulk feeding does not take place at the same time as drummed waste is introduced to the kiln.

Liquid wastes are introduced into the kiln through specially designed lances. The waste is transferred from the tank farm in a ring main ensuring continuous feeding of the waste. In the special feeding lance, the liquid waste is atomized by compressed air, ensuring instant ignition of the waste at the introduction into the kiln.

5.12.2 Rotary Kiln

The rotary kilns has been designed to incinerate 2.14 tonnes of waste per hour (normal operation) for the 15,000 tonnes and 4.28 tonnes of waste per hour for the 30,000 tonnes incinerator. Considering an average heating value of 13.78 MJ/kg results in a thermal capacity of respectively 8.2 MW and 16.4 MW. The design ensures a residence time sufficient for a complete burn-out of the waste.

The slag handling system consists of a water filled bath and a conveyor system, which elevates and drains the residue before it is discharged into a transport container.

The flow of the combustion air is controlled by an oxygen measurement to maintain the desired amount of excess air. The kiln outlet temperature is controlled as well to ensure a stable and uninterrupted operation.

5.12.3 Secondary Combustion Chamber (SCC)

The secondary combustion chamber allows obtaining a residence time of minimum 2 seconds at 1,100 °C – 1,200 °C, which will ensure a complete destruction of the potential polluting compounds in the flue gas. In the secondary combustion chamber support burners are mounted as well as lances for introduction of contaminated water either from the landfill or from the paved area.

5.12.4 Quench

The secondary combustion chamber is succeeded by a quench where it is possible to cool the flue gas with water. During normal operation this quench will not be used as the energy is removed by a heat recovery boiler.

5.12.5 Heat Recovery Boiler

The flue gas from the quench is routed to a heat recovery boiler which takes out the energy of the fluegas. The boiler generates saturated steam, which will be used for generation of electricity in a condensing turbine.

5.12.6 Flue Gas Cleaning System

The gasses generated during the incineration process shall be cleaned before being released to the environment.

The emission from the facility shall after cleaning comply with the EU directive for hazardous waste incinerators. The maximum allowed concentrations (daily average) in the flue gas is:

HCl	10	mg/Nm^3
HF	1	mg/Nm^3
SO_2	50	mg/Nm^3
CO	50	mg/Nm^3
NO_x	200	mg/Nm^3
Dust	10	mg/Nm^3
TOC	10	mg/Nm^3
PCDD/F	0.1	mg/Nm^3

The same set-up of flue gas cleaning system shall be applied for both incinerators and consists of the following units:

- Spray Absorber
- Bag house filter
- Wet Scrubber
- Induced draught fan
- Stack

The spray absorber technology is chosen as it allows to dispose off water, which otherwise had to be discharged. The quality of the water is closely monitored by an automatic system. In case the water is contaminated it shall be introduced into the secondary combustion chamber where the organic components will be destroyed.

Spray Absorber
The spray absorber will introduce a suspension of very fine particles of slacked lime into the fluegas, mainly to remove the HCl in the flue gas, but also some SO_2 will be removed.

Bag House Filter Unit
The filtering area of the bag house filter unit is adequate for coping with the expected volumes of flue gas and the predicted amount of ash. The applied quality of the bags shall guarantee fulfillment of the EU requirements with respect to the amount of dust in flue gases.

Wet Scrubber Unit
The wet scrubber is a vertical column unit with packing, mainly to remove the SO_2 in the flue gas. NaOH is used as reagent. The scrubber blow down is evaporated in the spray absorber

Induced Draught Fan
The induced draught fan is supplied with variable speed to control the negative pressure at the start of the rotary kiln inlet.

Stack
The stack is expected to be 35 m high.

5.12.7 Automatic Control System for Incineration and Fluegas System

The entire incineration and fluegas cleaning system is automatically controlled by a control system. This system automatically shuts down the plant in case of malfunctions.

5.13 Effluent Control

The main philosophy in managing water in the facility is that no water shall be discharged but be utilized in the processes.

Water is collected from a number of processes and locations. In order to control the quality of the water it is intended to divide the water into 3 categories

- Rainwater
- Process water
- Contaminated water

Rainwater shall be collected from the roof of the buildings in a separate drainage system. Also precipitation collected in the unused landfill cell may be transferred to the rain water basin. The rainwater shall be used in the scrubber of the fluegas cleaning and for others purposes such as truck wash.

Precipitation falling on the paved area will be collected by a drainage system and depending on the quality it will be pumped to the rain water basin, the process water basin or the contaminated water tank. The quality of the water will be monitored of a water monitoring station, which constantly will be analyzing the composition of the water.

Parameters, which will be checked, will among others include pH, temperature, TOC and conductivity. When the parameters exceed certain concentrations the system will automatically switch between the water basins and the contaminated water tank.

In order to minimize the amount of water which is contaminated the areas of the facility where spillage are most likely to occur will be roofed. Furthermore, the area will be paved with concrete minimizing the risk of contaminating the soil. The drainage from these areas will be collected in a sump which shall be emptied to the contaminated water tank.

Percolate from the landfill will be analyzed before being pumped to the process water basin or the contaminated water tanks.

A water mass balance has been prepared showing that it is possible to utilize the water in the processes. The assumptions will, however, have to be reviewed when the site has been selected.

In the unlikely event water will have to be discharged to the public sewer system the quality of the discharged water shall follow Bulgarian regulation and standards. For evaporation of any excess water an area covered with straw or other suitable vegetation shall be included.

Sanitary waste water shall be collected in a septic tank and the overflow be treated in a root zone installation

5.14 Fire fighting

The NHWC shall have its own fire fighting system servicing the following areas:

- Tank farm
- Organic storage building
- waste pretreatment area
- Bunker and feeding arrangement at incinerator
- Highly toxic waste area

The system shall include water basin, pumps (electric and diesel) and sprinkler/hydrant system. For the tank farm a unit for preparation of foam shall be included.

Phased implementation

The entire fire fighting system shall be constructed in phase 1-A

5.15 Vehicles

The NHWC shall have its own fleet of vehicles for collection and transport of hazardous waste. The trucks shall comply with ADR regulation and the drivers shall be trained so they are capable of acting as the first respondent in case of an accident.

For waste which represent a low environmental risk and which can be easy handled in case of an accident (mainly waste for landfill) external transport companies shall be used.

Phased Implementation

In phase 1-A the NHWC shall operate nine trucks which in phase 1-B shall be extended to 13 trucks. Besides these trucks 6 external trucks shall be hired during phase 1-A expanding to 10 in phase 1-B for transport of Landfill waste.

In phase 2 the NHWC shall purchase additionally 2 trucks which also will cover the requirements for phase 3.

5.16 Auxiliary equipment/facilities

For operation of the plant, some auxiliary equipment/facilities must be included. These include:

- Internal roads/access road
- Water supply (potable water)
- Process water basin
- Contaminated water tank
- Storm water sewer
- Domestic sewer system
- Communication system
- Compressed air supply
- Power supply and Emergency Power Generator
- Drum crushing facility
- Truck wash
- Drainage systems
- Fire fighting equipment/fire water tank
- Fencing
- Lighting
- Front end loader
- Fork lift

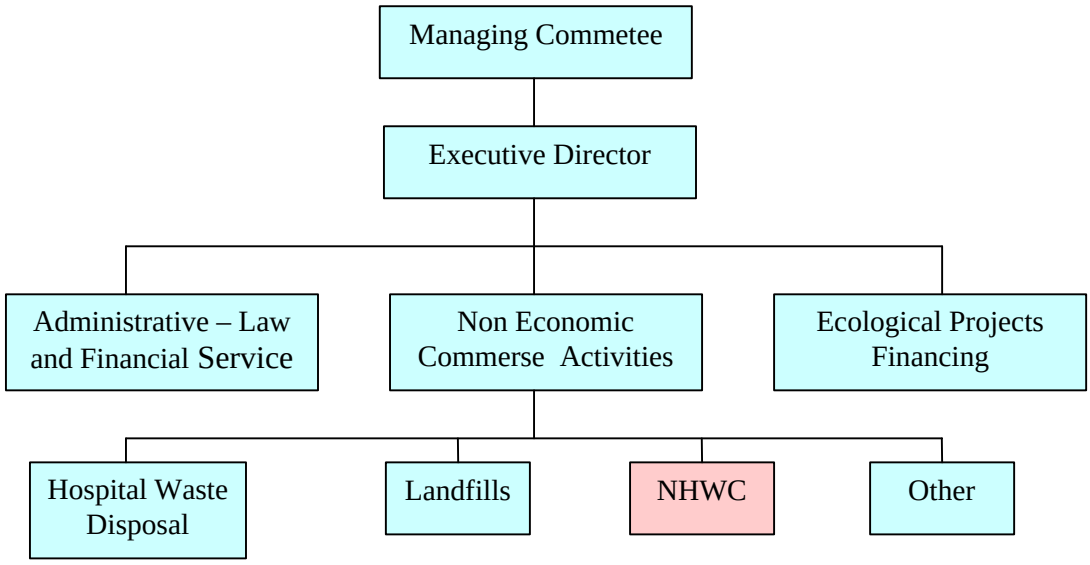
- Electrical tie-in and power distribution

For each pahse only the equipment and installations required for operation of the facilities will be installed.

6. ORGANISATIONAL STRUCTURE

The NHWC is foreseen to be operated under the management of the state owned "Enterprise for management of environmental protection activities" established under the environmental protection act and described in Decree 319 (2002).

The structure of the enterprise is shown below



6.1 Organisational Diagram

Although the NHWC will be under the management of the "Enterprise" it is foreseen that the NHWC shall have its own organizational structure comprising of 4 main departments:

- Common Staff/Administration
- Logistic
- Plant operation
- Maintenance

Each of these department will have one manager and make use of the common staff functions such as general administration, safety and health, financial and EDP.

As each department cover several functions a number of sections are foreseen. For the daily operations a number of supervisors will be responsible reporting to the deparment mamager. The supervisors will again be in charge of a number of skilled workers and general workers

Please refer to the organization scheme below

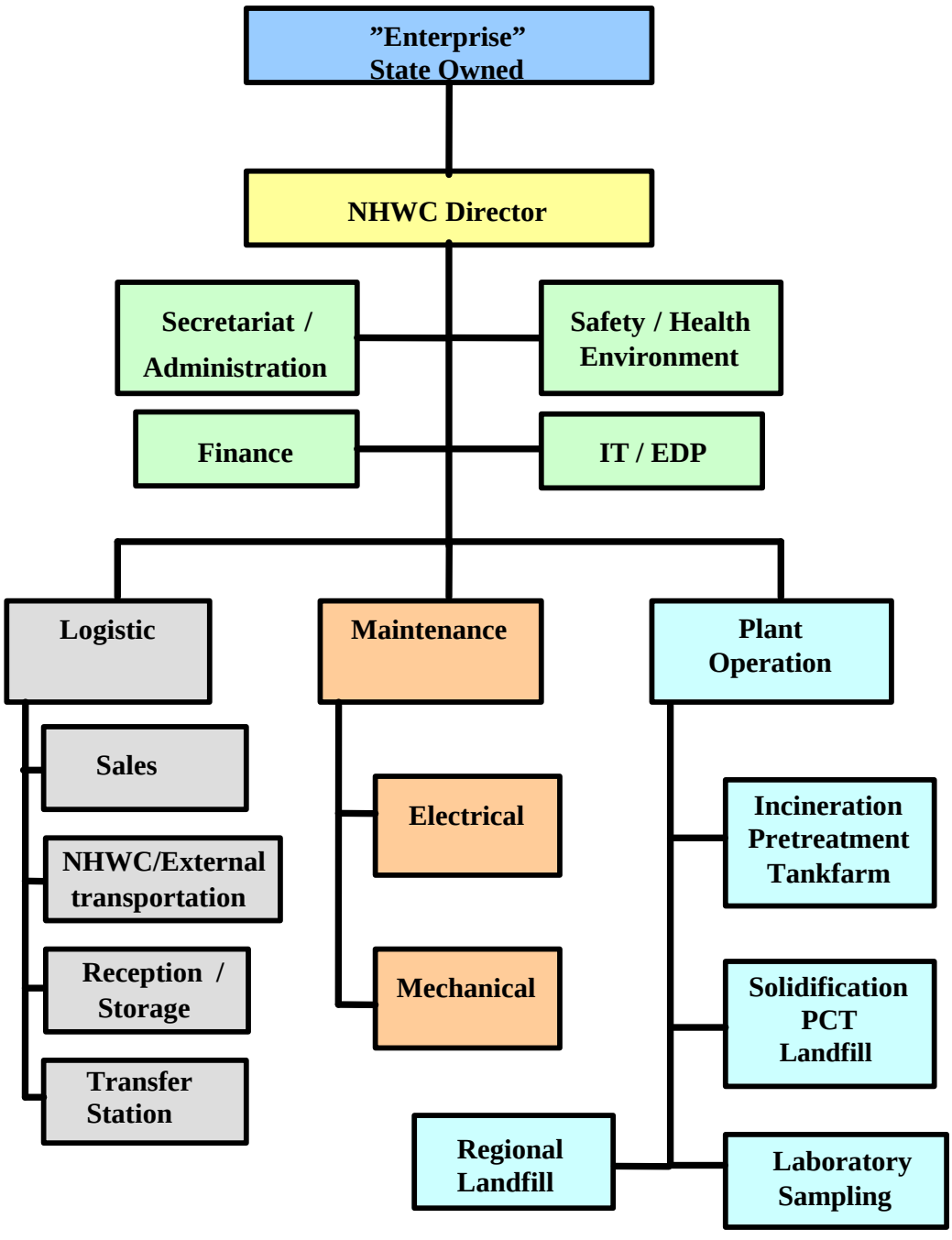


Figure 6.1-1 Organizational diagram NHWC

6.2 Number of Staff

In the following the proposed staffing of the facility is described more in details.

"State Enterprise"
The overall policies for the centre will be stipulated by the managing committee of the enterprise.

NHWC Managing Director
The NHWC Managing Director will be responsible for the daily management of the NHWC. It is proposed that one of the managers from logistic, maintenance or plant operation department be made Deputy Managing Director.

Common Staff/Administration

Secretariat / Administration
The secretariat / administration shall besides secretarial and administrational functions be responsible for human resources and security guards.

Safety / Health & Environment
To ensure that the work places are safe for the workers and to monitor and register the emissions to the surrounding environment a separate section is formed.

IT / EDP
This section shall be responsible for installation and support for the hardware and software for the IT/EDP systems installed.

Finance
The finance section shall be responsible for accounting, payment of salaries etc.

Logistic Department

Sales / PR
The sales section shall promote the NHWC and deliveries the N. The tasks of the section also includes public relations in order to have good relations to the surrounding communities and the media.

Transport
Acknowledgement and planning of transports both own and external will be the responsibility of the transport section.

Waste Reception / Storage
The waste reception & storage section handle unloading and the storage of waste.

Transfer Stations
Transfer stations will collect, store and transport the waste collected from small and medium industries and private house holds. The transfer stations will make use of the common service facilities at the NHWC.

Plant Operation Department

Incineration
The incineration section will be responsible for operating the incinerator and the related pretreatment facilities and the tankfarm. Operation of the highly toxic waste facility also is the responsibility of the Incineration section.

Landfill / PCT / Solidification

The landfill manager will undertake the operation and planning of the landfill, PCT and solidification.

Laboratory
The laboratory shall analyse the waste delivered to the NHWC but also process related samples and samples from environmental monitoring. It is recommended that 2 of the skilled workers on the department functions as waste evaluator, responsible for which treatment method shall be applied to dispose of the waste.
The department will also include technicians responsible for performing the sampling of the waste when delivered to the NHWC

Maintenance Department

Mechanical
For maintenance of mechanical equipment and installation of new equipment the staff from the mechanical section shall be responsible.

Electrical
For maintenance of electrical equipment and installation of new equipment the staff from the electrical section shall be responsible

Table 6.2-1, 6.2-2 and 6.2-3 provide the number of staff expected for each department for each phase.

Phase 1A and 1B

Department	Management	Supervisor	Skilled worker	General worker	Total
Director	1				**1**
Common Staf	1				
Administration		1	2	2	**5**
EDP		1	1		**2**
Health and environment		1	1		**2**
Finance		1	2		**3**
Security		1		10	**11**
Logistic	1				**1**
Sales and marketing		1	1		**2**
Transportation		1		15	**16**
Reception/Storage		1		5	**6**
Transfer station		1		2	**3**
Plant operation	1				**1**
Incineration		1	4	18	**23**
LF / PCT / SOLI		1		7	**8**
Regional landfill		1		2	**3**
Laboratory		1	5	3	**9**
Maintenance	1		4		**5**
Total	**5**	**13**	**20**	**64**	**101**

Table 6.2-1 Staffing plan phase 1A and 1B

In the second phase the second incinerator will be constructed together with the remaing outstanding installations. The number of staff therefore expands compared to phase 1.

Department	Management	Supervisor	Skilled worker	General worker	Total
Director	1				**1**
Common Staf	1				
Administration		1	3	3	**7**
EDP		1	2		**3**
Health and environment		1	2		**3**
Public Relations		1			**1**
Finance		1	2	1	**4**
Security		1		10	**11**
Logistic	1				**1**
Sales and marketing		1	2		**3**
Transportation		1		20	**21**
Reception/Storage		1		8	**9**
Transfer station		1		2	**3**
Plant operation	1				**1**
Incineration		1	5	22	**28**
LF / PCT / SOLI		1	1	9	**11**
Regional landfill		1		2	**3**
Laboratory		1	6	5	**12**
Maintenance	1	2	6		**9**
Total	**5**	**16**	**29**	**82**	**131**

Table 6.2-2 Staffing plan phase 2

Phase 3

During phase 3 only one new transfer station is constructed the other components are expansion of the landfills. The number of staff is therefore almost identical with phase 2.

Department	Management	Supervisor	Skilled worker	General worker	Total
Director	1				**1**
Common Staff	1				
Administration		1	4	3	**8**
EDP		1	2		**3**
Health and environment		1	2		**3**
Public Relations		1			**1**
Finance		1	2	1	**4**
Security		1		15	**16**
Logistic	1				**1**
Sales and marketing		1	2		**3**
Transportation		1		20	**21**
Reception/Storage		1		8	**9**
Transfer station		2		4	**6**
Plant operation	1				**1**
Incineration		1	5	22	**28**
LF / PCT / SOLI		1	1	9	**11**
Regional landfill		1		2	**3**
Laboratory		1	7	5	**13**
Maintenance	1	2	6		**9**
Total	**5**	**17**	**31**	**89**	**141**

Table 6.2-3 Staffing plan phase 3

Appendix 1

Time line for phased implementation

Phased Implementation of NHWC

Chemcontrol a/s

Year	2006	2008	2015	2020	2035
	Phase 1-A	**Phase 1-B**	**Phase 2**	**Phase 3**	

Facilities

Phase 1-A

- *Site preparation*
- *General infrastructure outside NHWC*
- *General infrastructure inside NHWC*
- *Land acquisition*
- *Auxiliary system*
  - *Electrical, Water etc. - partly*
- *Administration incl. Laboratory*
- *Service facilities & Trucks - partly*
- *Physical Chem. Treatment and Storage*
  - *Reactor and pumps*
- *Solidification unit and storage*
- *Solid organic waste storage*
  - *and pre-treatment - partly*
- *Tank farm for bulk organic waste (partly)*
- *Incinerator - 15,000 t/y*
  - *Boiler and steam system*
  - *Flue gas cleaning*
- *Secure landfill NHWC - 150,000 t*
- *Regional Secure Landfill (Sofia region) 200,000 t*
- *Mercury evaporation device*
- *Instrumentation and control*
- *Civil works - partly*
- *Contingencies*
- *Technical assistance*
- *Training / management assistance*
- *Supplies/spare parts - partly*

Phase 1-B

- *Secure landfill NHWC - 150,000 t*
- *Regional Secure Landfill (Sofia region)*
  - *300,000 t*
- *Transfer Station (Sofia region)*
- *Trucks*
- *Civil works - partly*
- *Contingencies*
- *Technical assistance*

Phase 2

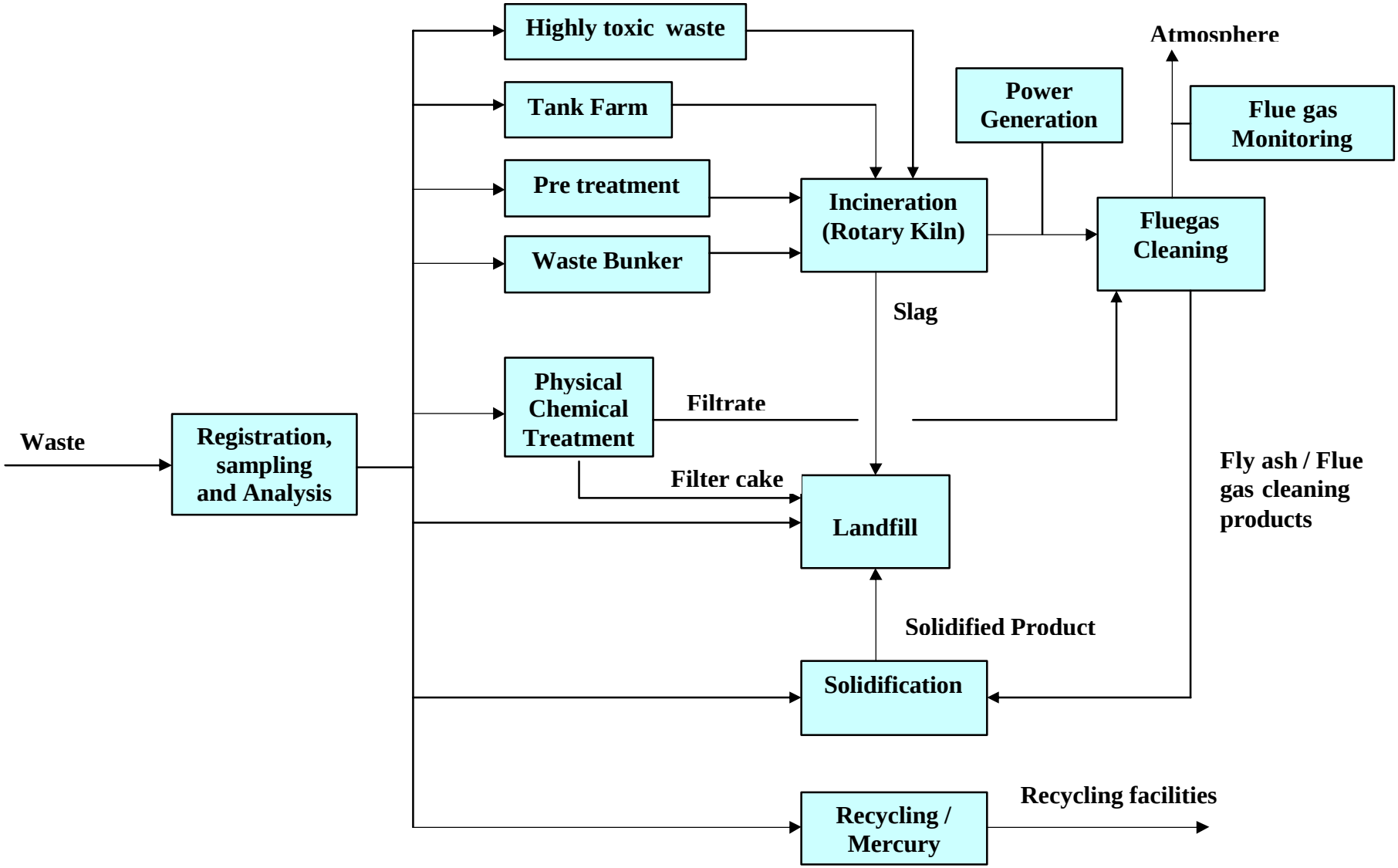
- *Remaining of Auxiliary system*
  - *Electrical, Water etc.*
- *Trucks*
- *Remaining of Physical Chem. Treatment*
  - *and storage*
- *Remaining of solid organic waste storage*
  - *and pre-treatment*
- *Remaining of Tank farm for bulk organic waste*
- *Incinerator - 30,000 t/y*
- *Boiler and steam system*
- *Flue gas cleaning*
- *Regional Secure Landfill (Sofia)*
  - *500,000 t - NEW*
- *Secure landfill NHWC - 250,000 t*
- *Highly toxic waste facility*
- *Instrumentation and control*
- *Civil works*
- *Contingencies*
- *Technical assistance*
- *Training / management assistance*
- *Supplies/spare parts*

Phase 3

- *Transfer Station (Shumen region)*
- *Secure landfill NHWC - 150,000 t*
- *Secure regional landfill(Sofia region) - 300,000 t*
- *Civil works*
- *Contingencies*
- *Technical assistance*

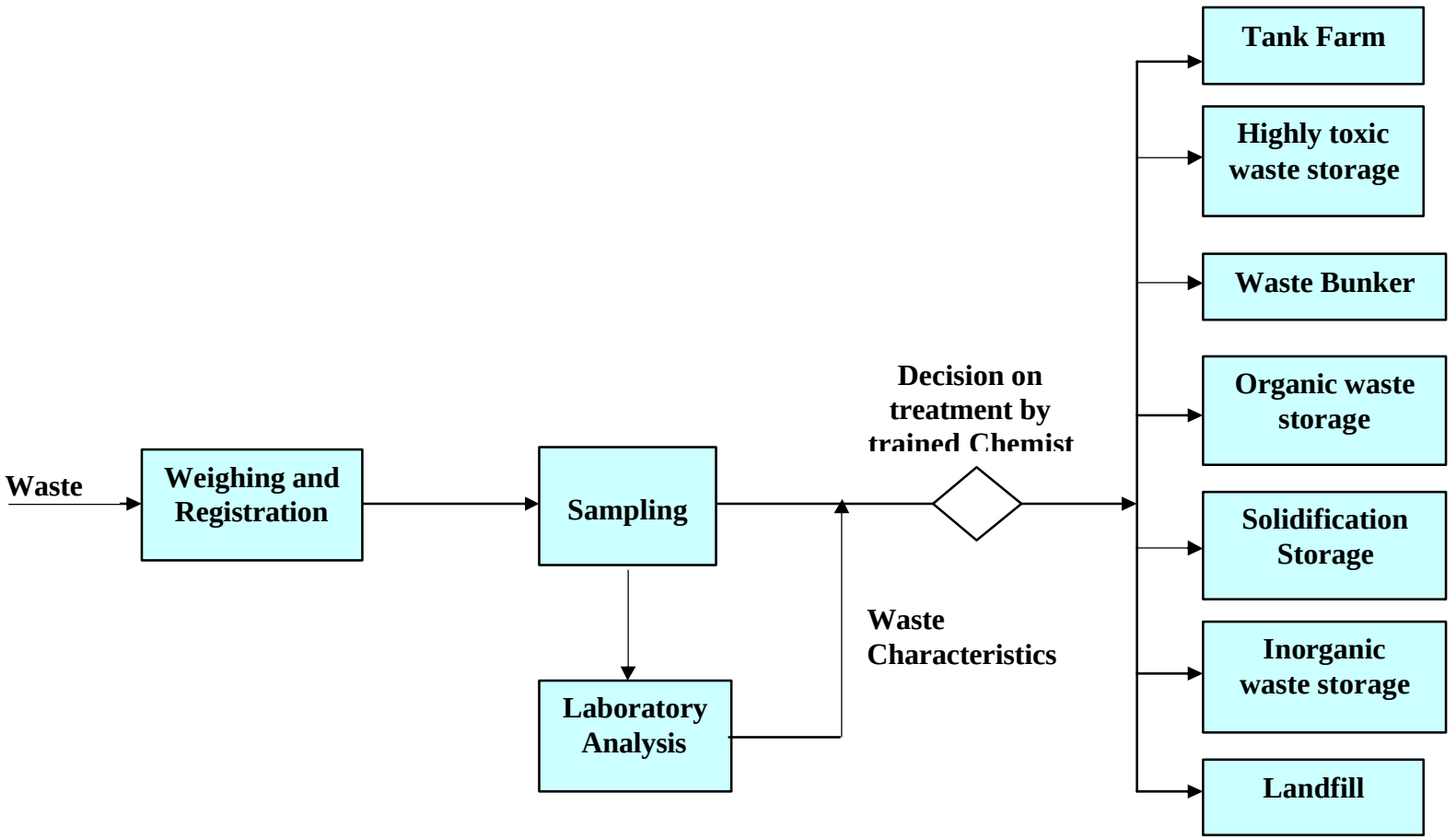
Appendix 2

Block Flow Diagrams



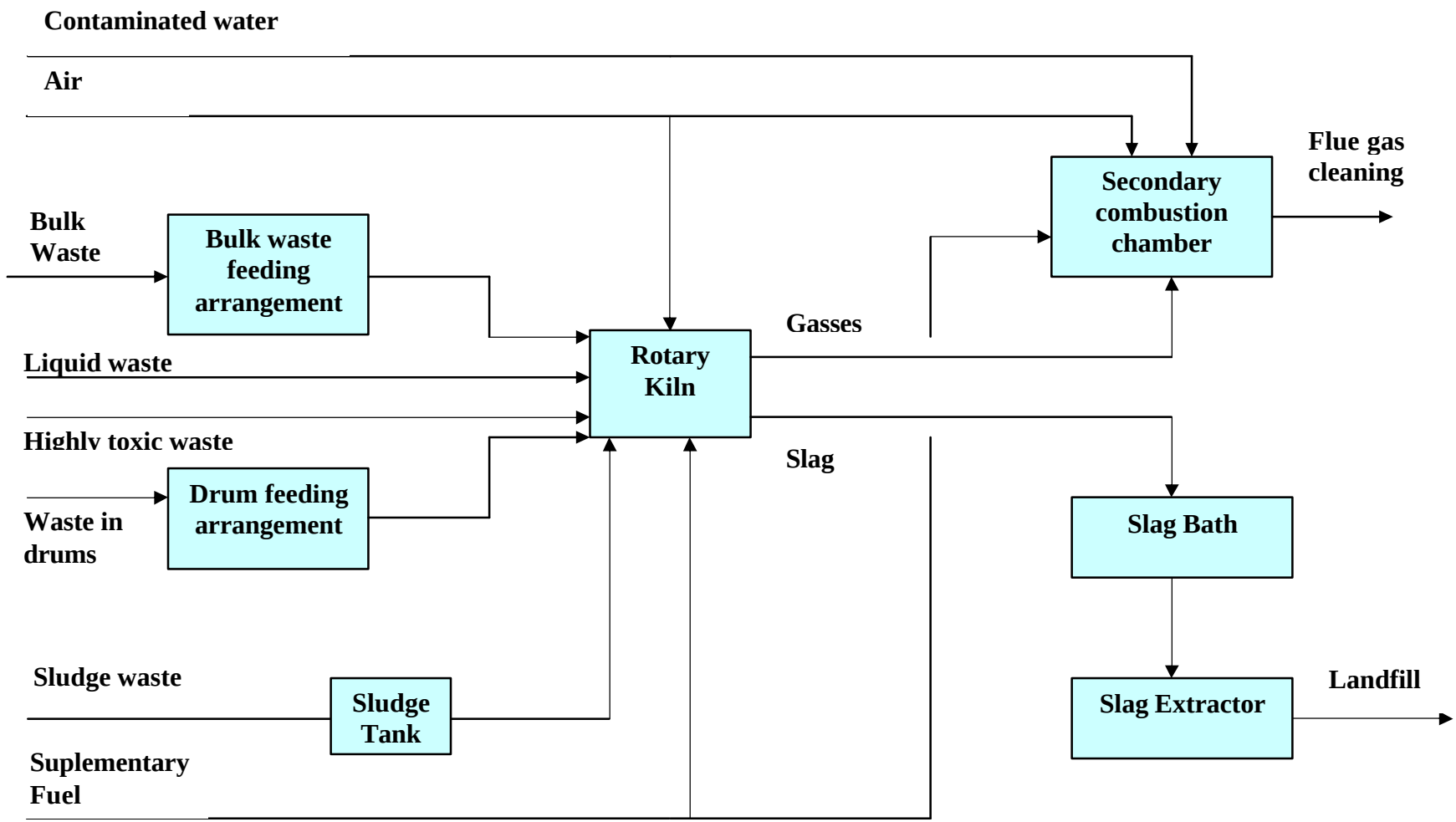
Chemcontrol a/s

Bulgarian National Hazardous Waste Centre
Block flow diagram
Over all flow
Drawing No. 47081-AB4-124-003
Rev 1. 11122003/mdh



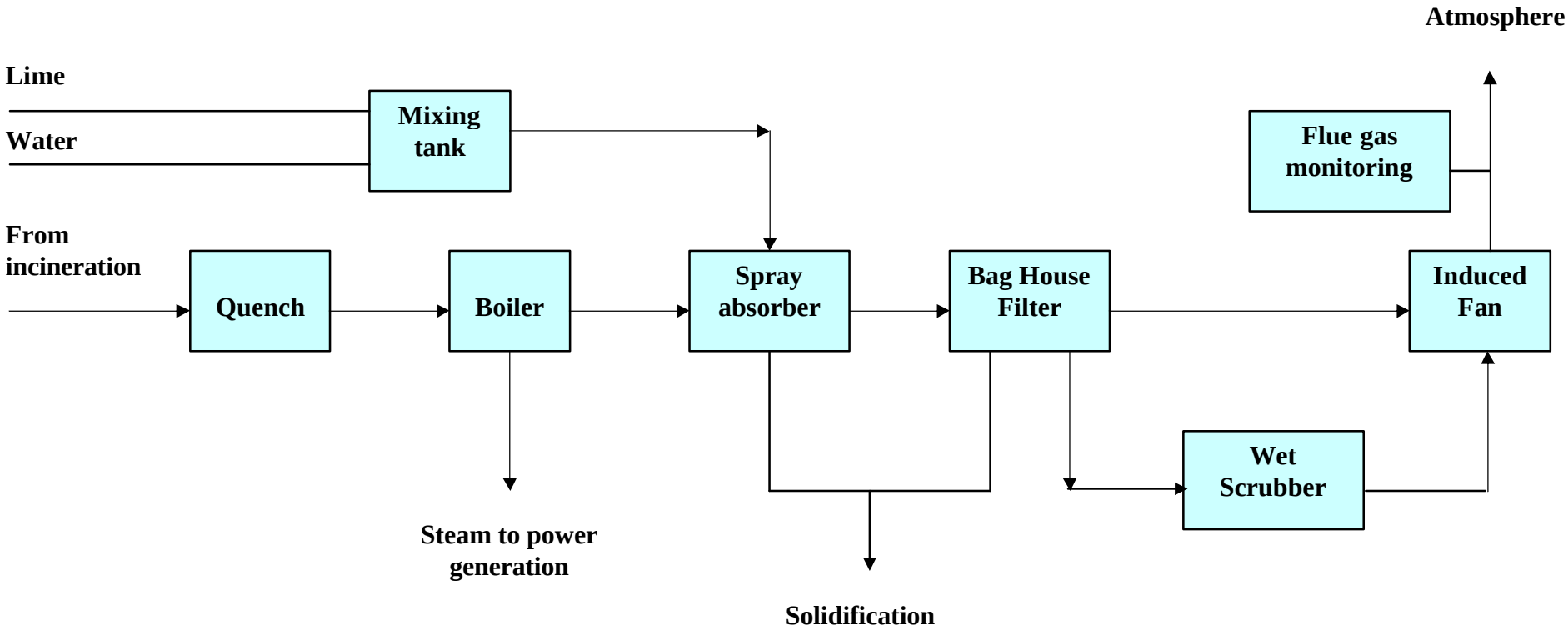
Chemcontrol a/s

Bulgarian National Hazardous Waste Centre
Block flow diagram
Reception sampling and analysis
Drawing No. 47081-AB4-124-003
Rev 1. 11122003/mdh



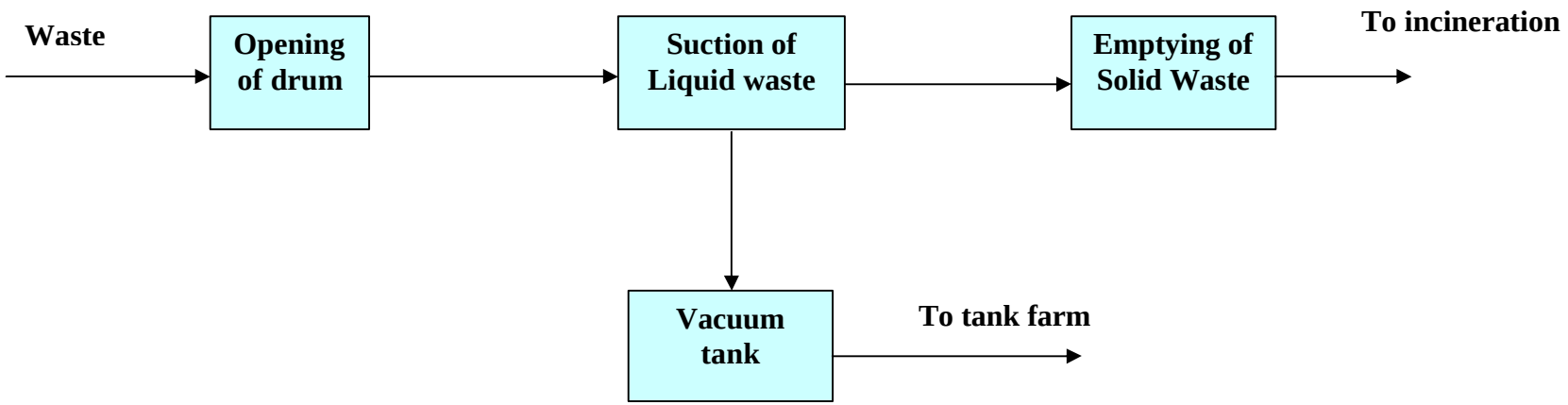
Chemcontrol a/s

Bulgarian National Hazardous Waste Centre
Block flow diagram
Incineration
Drawing No. 47081-AB4-294-008
Rev 1. 11122003/mdh

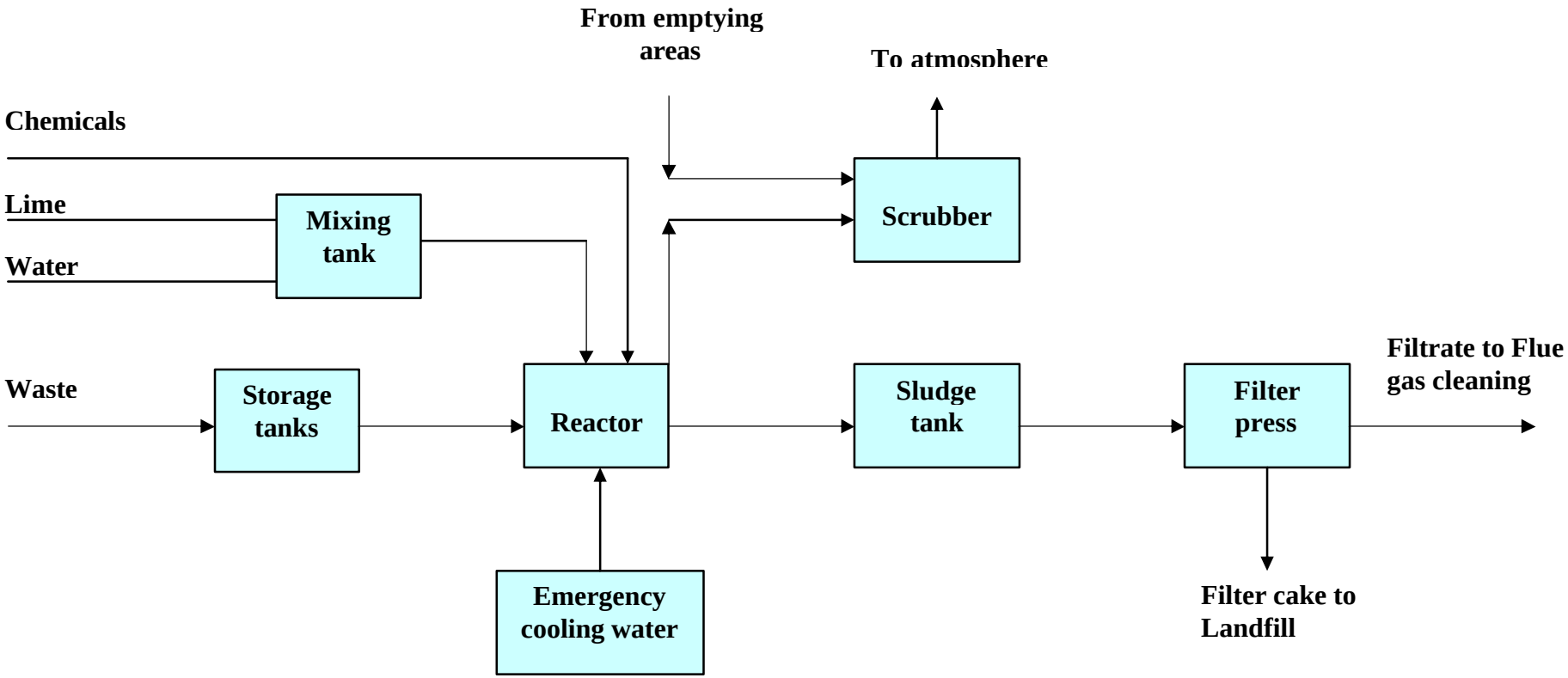


Chemcontrol a/s

Bulgarian National Hazardous Waste Centre
Block flow diagram
Flue gas cleaning
Drawing No. 47081-AB4-314-007
Rev 1. 11122003/mdh



Bulgarian National Hazardous Waste Centre
Block flow diagram
Waste pre-treatment
Drawing No. 47081-AB4-234-004
Rev 1. 11122003/mdh



Chemcontrol a/s

Bulgarian National Hazardous Waste Centre
Block flow diagram
Physical Chemical Treatment
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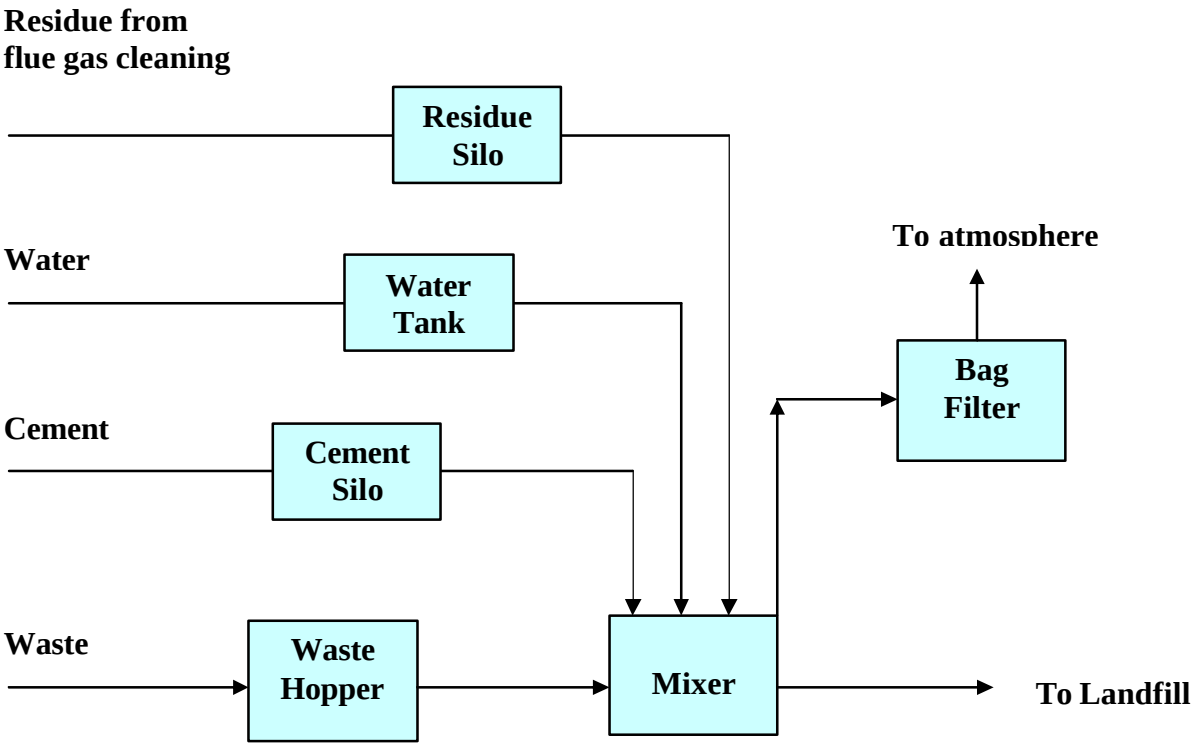
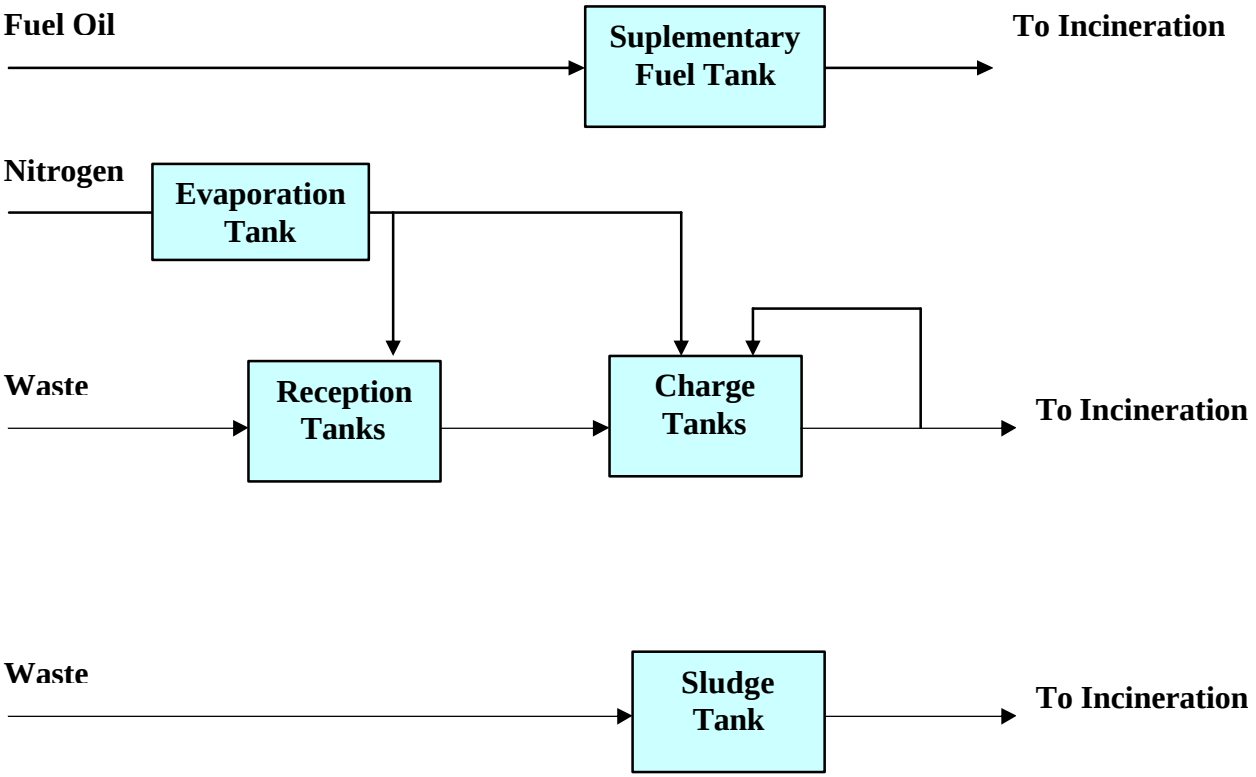
Rev 1. 11122003/mdh



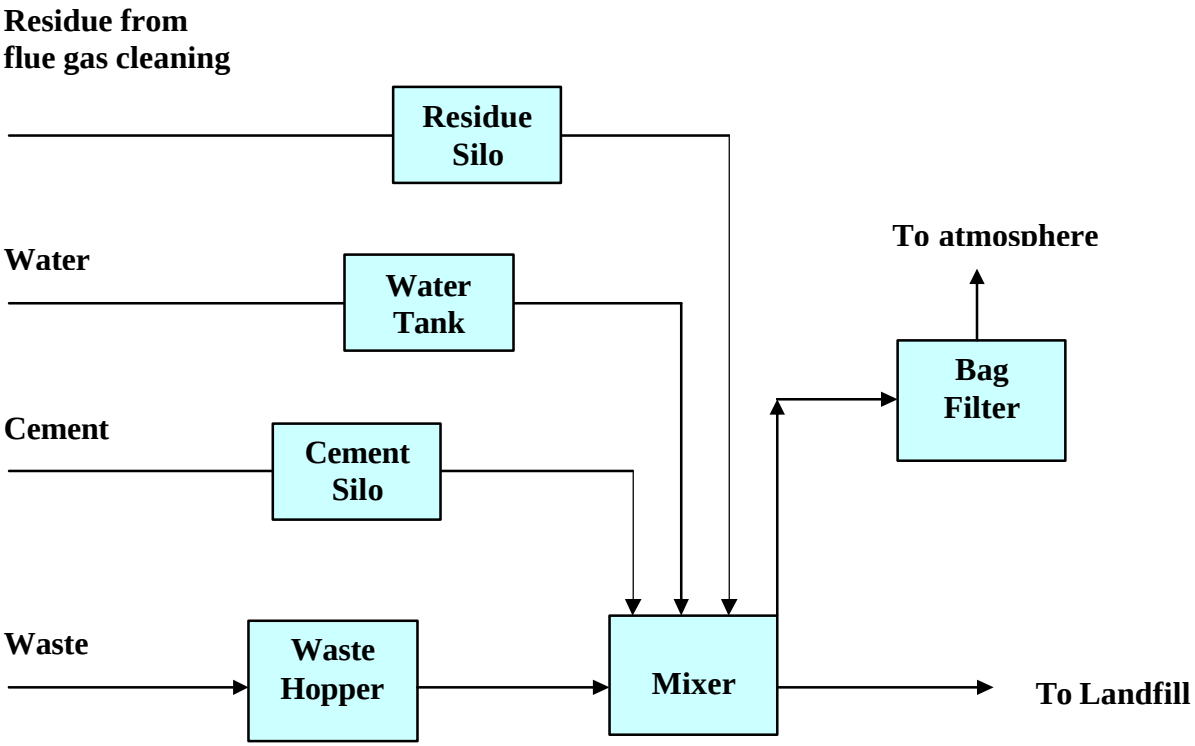
Chemcontrol a/s

Bulgarian National Hazardous Waste Centre
Block flow diagram
Solidification
Drawing No. 47081-AB4-294-008
Rev 1. 11122003/mdh



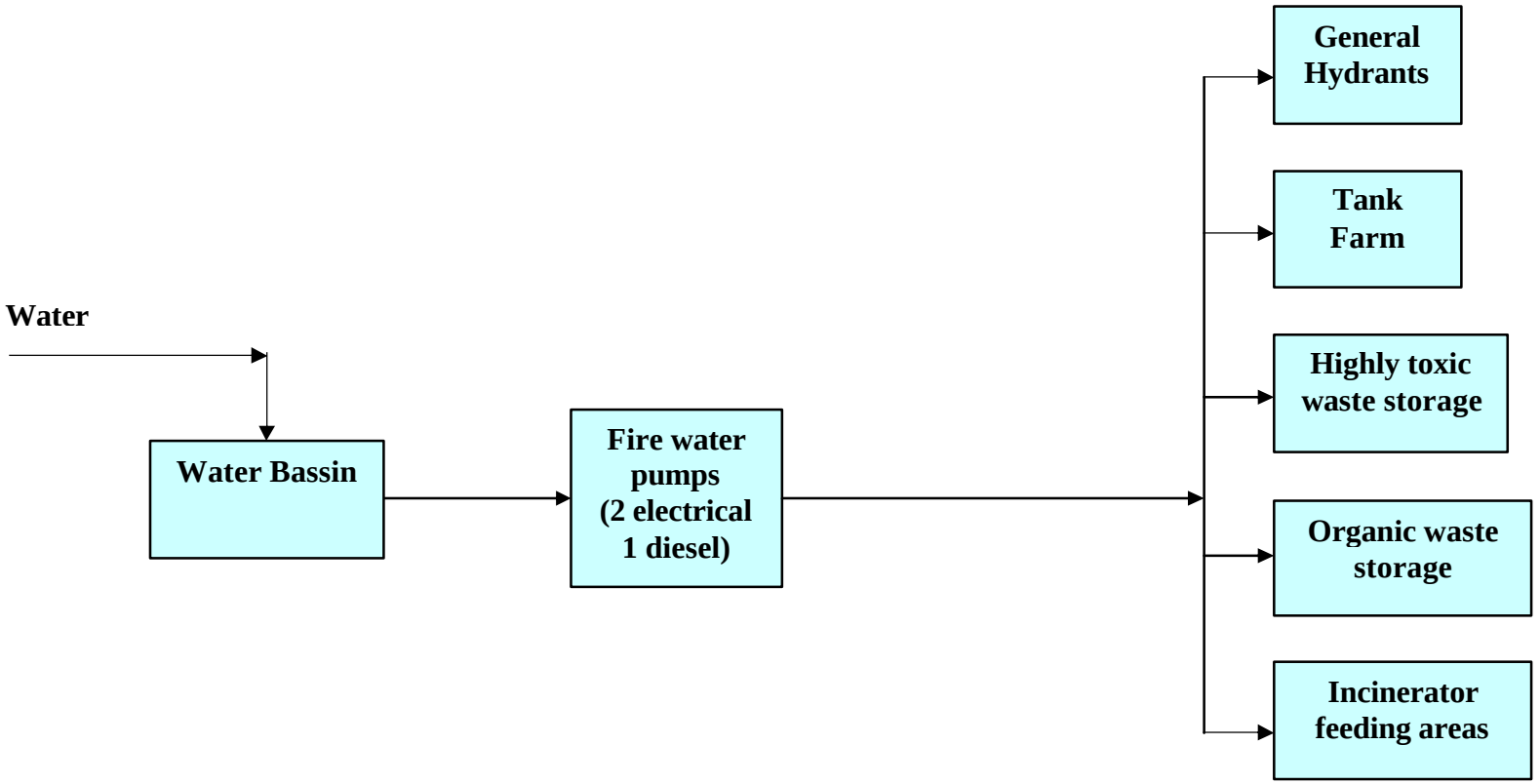
Chemcontrol a/s

Bulgarian National Hazardous Waste Centre
Block flow diagram
Tank Farm
Drawing No. 47081-AB4-264-006
Rev 1. 11122003/mdh



Chemcontrol a/s

Bulgarian National Hazardous Waste Centre
Block flow diagram
Solidification
Drawing No. 47081-AB4-294-008
Rev 1. 11122003/mdh

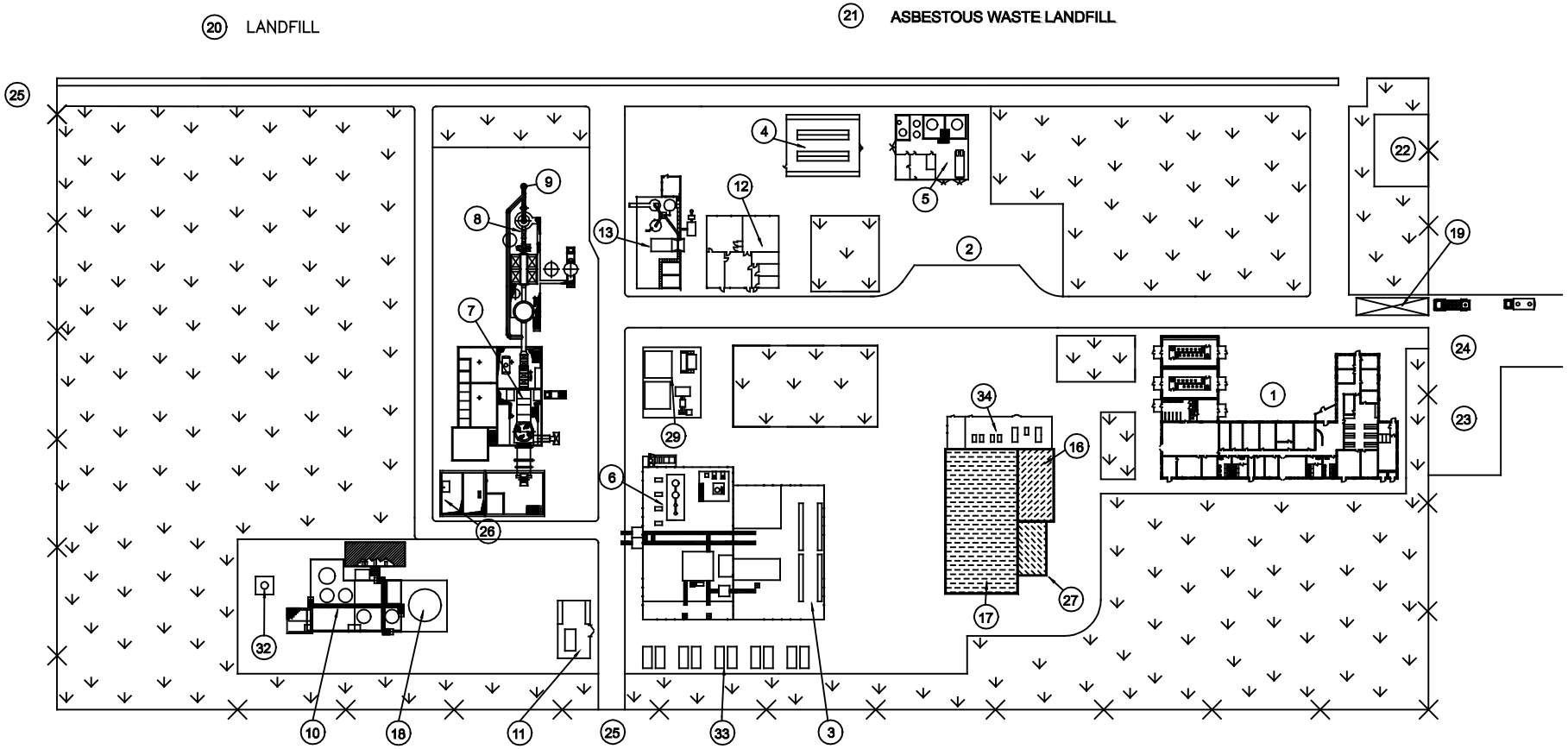


Chemcontrol a/s

Bulgarian National Hazardous Waste Centre
Block flow diagram
Fire fighting
Drawing No. 47081-AB4-154-003
Rev 1. 11122003/mdh

Appendix 3

Preliminary Site Layout



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2. UNLOADING AREA
3. ORGANIC DRUM STORAGE
4. INORGANIC DRUM STORAGE
5. PHYSICAL-CHEMICAL TREATMENT
6. DRUM EMPTYING FACILITY
7. INCINERATOR
8. FLUEGAS CLEANING SYSTEM
9. STACK
10. TANK FARM
11. SPECIAL WASTE
12. WORK SHOP
13. SOLIDIFICATION
16. FIRE WATER BASSIN
17. PROCESS WATER BASSIN
18. CONTAMINATED WATER TANK
19. WEIGHT BRIDGE
20. LANDFILL CELLS
21. ASBESTOUS WASTE LANDFILL
22. BIO ACTIVE TREATMENT
23. PARKING AREA
24. MAIN GATE
25. EMERGENCY GATE
26. BUNKER
27. RAIN WATER BASIN
29. EMPTY DRUM & CLEANING STORAGE
32. INERT GAS TANK
33. BULK CONTAINER STORAGE
34. PUMP HOUSE & WATER MONITORING

FENCE

UNPAVED

Date	Rev	Drawn	Checked	App. by	Remarks
04.07.03	0	VIB			

PROJECT: National Hazardous Waste Centre Bulgaria

TITLE: LAYOUT
SITE PLAN BUILDINGS, PHASE I

Chemcontrol a/s
FICHTNER

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47091–BG3–124–126	1 of 1	0	1250

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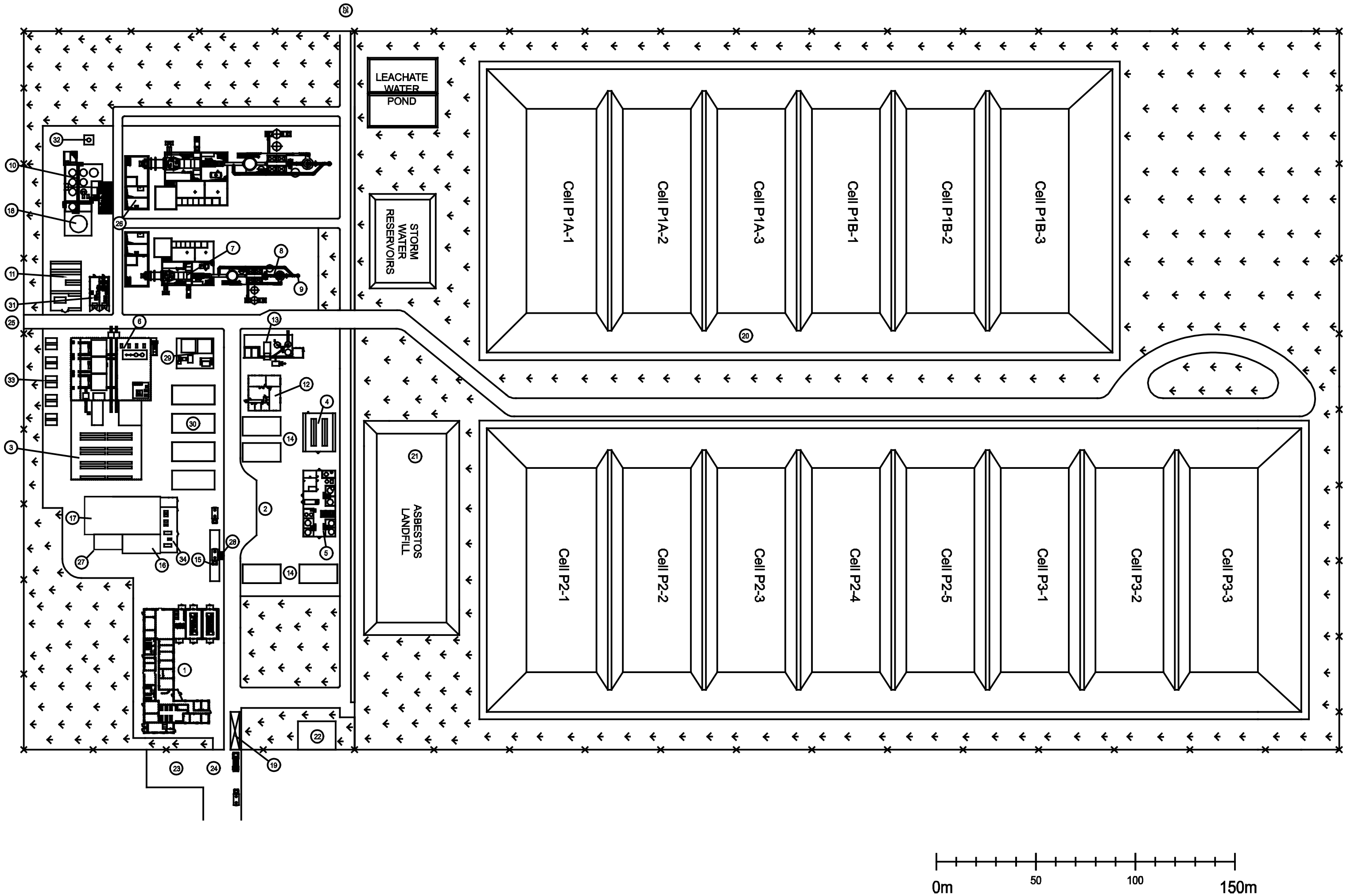

1. ADMINISTRATION BUILDING
2. UNLOADING AREA
3. ORGANIC DRUM STORAGE
4. INORGANIC DRUM STORAGE
5. PHYSICAL-CHEMICAL TREATMENT
6. DRUM EMPTYING FACILITY
7. INCINERATOR
8. FLUEGAS CLEANING SYSTEM
9. STACK
10. TANK FARM
11. SPECIAL WASTE
12. WORK SHOP
13. SOLIDIFICATION
14. TEMPORARY STORAGE
15. TRUCK WASH
16. FIRE WATER BASSIN
17. PROCESS WATER BASSIN
18. CONTAMINATED WATER TANK
19. WEIGHT BRIDGE
20. LANDFILL CELLS
21. ASBESTOUS WASTE LANDFILL
22. BIO ACTIVE TREATMENT
23. PARKING AREA
24. MAIN GATE
25. EMERGENCY GATE
26. BUNKER
27. RAIN WATER BASIN
28. REFUEL
29. EMPTY DRUM & CLEANING STORAGE
30. SOLID WASTE STORAGE
31. FACILITY FOR HIGHLY TOXIC WASTE
32. INERT GAS TANK
33. BULK CONTAINER STORAGE
34. PUMP HOUSE & WATER MONITORING

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UNPAVED

Date	Rev	Drawn	Checked	App. by	Remarks
24.07.03	0	VIB			

PROJECT: National Hazardous Waste Centre Bulgaria

TITLE: SITE LAYOUT
PHASE III

Chemcontrol a/s
FICHTNER

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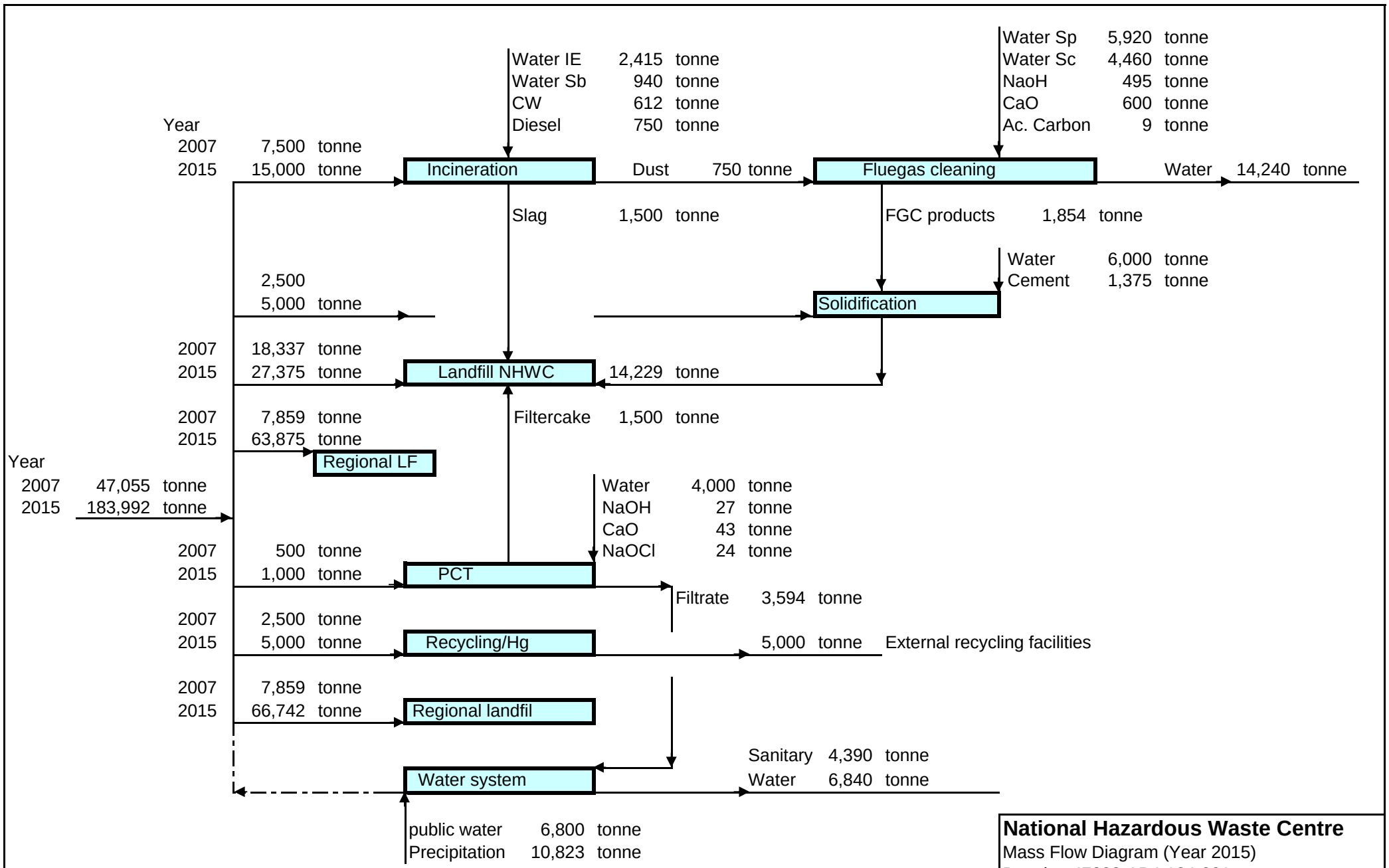
Appendix 4

Mass Flow Diagram (year 2015)


Water IE 2,415 tonne
Water Sb 940 tonne
CW 612 tonne
Diesel 750 tonne
Water Sp 5,920 tonne
Water Sc 4,460 tonne
NaoH 495 tonne
CaO 600 tonne
Ac. Carbon 9 tonne
Year
2007 7,500 tonne
2015 15,000 tonne
Incineration
Dust 750 tonne
Fluegas cleaning
Water 14,240 tonne
Slag 1,500 tonne
FGC products 1,854 tonne
Water 6,000 tonne
Cement 1,375 tonne
2,500
5,000 tonne
Solidification
2007 18,337 tonne
2015 27,375 tonne
Landfill NHWC
14,229 tonne
2007 7,859 tonne
2015 63,875 tonne
Filtercake 1,500 tonne
Regional LF
Year
2007 47,055 tonne
2015 183,992 tonne
Water 4,000 tonne
NaOH 27 tonne
CaO 43 tonne
NaOCl 24 tonne
2007 500 tonne
2015 1,000 tonne
PCT
Filtrate 3,594 tonne
2007 2,500 tonne
2015 5,000 tonne
Recycling/Hg
5,000 tonne
External recycling facilities
2007 7,859 tonne
2015 66,742 tonne
Regional landfil
Sanitary 4,390 tonne
Water 6,840 tonne
Water system
public water 6,800 tonne
Precipitation 10,823 tonne
National Hazardous Waste Centre
Mass Flow Diagram (Year 2015)
Drawing 47092-AB4-124-001
47092/EIB