Chemcontrol a/s

Lindholmvej 3
5800 Nyborg
Denmark

Polyconsult ECO Ltd.

Buckstone str. bl.31/a.14
1618 Sofia
Bulgaria

"Establishment of National Hazardous Waste Centre"

Prepared for the Ministry of Environement & Water, Bulgaria

under the

Phare

Project BG 9810-02-01 (003)

and

Danish EPA

Project No. M128/008-0071

"Phased implementation of National Hazardous Waste Center"

Feasibility Analysis

Phase 1-A and 1-B

					Client Doc. No.:	
Revision No.	0	1			Doc. No.	
Prepared By/Date	MDH/030903	MDH/280304			No. of Pages:	22+annexes
Checked By/Date					Project No.:	47091
Approved By/Date					File No.:	110

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1. Executive Summery

The purpose of this feasibility study is to evaluate whether establishing a Bulgarian National Hazardous Waste Centre is feasible. This is done by summarising the findings of the following submitted reports, which will indicate whether the project is feasible or not.

- Waste Survey
- Conceptual Design
- Financial Analysis

For further details please refer to the relevant report

EU Approximation

The study verifies that the Bulgarian regulation has been approximated to the major EU regulation. A detailed review of the approximation is included in the ISPA application.

The definition of hazardous waste is set out in Additional Provisions of the Reduction of the Harmful Impact of Waste Upon the Environment Act (SG No 86/1997; amended SG No 56/1999). Furthermore the classification and the codes for the hazardous wastes are regulated in Order No RD-323/1998 of the Minister of Environment and Water and the Minister of Health.

Both regulation fully corresponds to EU regulation applying the European Waste Catalogue codes.

Other relevant regulation for this project is regulation on landfill and incineration which also has been fully approximated to EU regulation.

Waste Survey

The finding of the waste survey is that there is considerable amount of hazardous waste generated in Bulgaria. According to the information sheets 1,959,965 tonnes was generated in 1999. Also the amount of accumulated waste reported is substantial amounting to 145,200,603 tonnes.

In order to establish a more realistic basis, mining waste and waste from Neftochem have been deducted in when estimating the realistic amount for the centre.

Taking these adjustments into consideration the 1999 realistic scenario for generated waste is reduced to 168,208 tonnes and the accumulated waste is reduced to 716,162 tonnes.

The finding of the survey is that most waste has to be taken to secure landfill as displayed below.

1999 – Realistic Scenario	
Treatment	**Tonnes**
Landfill	102,100
Incineration	52,177
Physical-Chemical treatment	3,936
Recycling	9,538
Asbestous Landfill	457
Total	**168,208**

Geographic distribution of the waste data shows that most of the waste is generated in the Sofia district (35%) followed by Lovetch (9.1%) and Plovdiv (6.1%). In the Sofia district the waste is generally for landfill (81%).

In the waste survey method has been used to forecast the future waste generation development predicts that this amount will increase to 235,000 tonnes in the year 2025.

Although the survey prove that large amount of waste is generated in Bulgaria it is, however, very uncertain whether these large quantities will be collected. Therefore it is recommend constructing a central centre having small treatment facilities. These facilities will, without doubt, be utilised to a high extend from the very beginning making the project economical sound and a success seen from the point of EU.

In 2003 the Executive Environmental Agency under the MoEW provided data on the total amount of waste generated (excluding mining waste) for 2000 and 2001 as reported on the information sheets. Due to financial constrains it has not been possible to undertake a detailed analysis of the data in the same way as was done for the 1998 and 1999 waste data although the raw data is available.

However a summery have been received from the MoEW, which shows that the amount of waste generated (excluding mining waste) during 2000 was 757,816 tonnes and for 2001 the amount was 755,766 tonnes.

The first waste survey found that 537,263 / 564,810 tonnes was generated in 1998 and 1999 when mining waste was excluded. Therefore it seems that the overall waste amount has raised slightly or more likely the industry has been acquainted with the reporting system and reporting more waste.

The increased waste amounts will, most likely, only influence little on the amounts which are available for the NHWC and therefore the prepared design and phased approach shall not be revised

In order to further verify the data provided by MoEW the amounts has been compared with the experiences from the member states of the EU which is published in the topic report

> "Hazardous waste generation in EEA member countries; Comparability of classification systems and quantities" prepared by the European Environment Agency; 2002

This reports states the hazardous waste generation in the member countries of the EU. When analysing the data it becomes clear that there is no obvious connection between the population; the number of employees, the Gross Domestic Product and the hazardous waste generation and shall therefore only be used for indicative purposes the findings will be of use to evaluate whether the design basis for the NHWC is in the appropriate order of magnitude.

The analysis shows that the capacity of the NHWC installations established in the first phase is in the low end of the calculated amounts, which ensure that the installations is very likely to be fully utilised.

Conceptual Design

Based on the waste survey a conceptual design report describing the operational procedures and the conceptual design has been prepared including site layout and block flow diagrams for each process.

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 design will ensure that emissions from the incineration facility are in compliance with the EU regulation. The design will also ensure that no discharge of water is intended. All water will be reused in the processes of the facility. In case water has to be discharge the quality will be maximum category II.

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.

Financial Analysis

A financial-economic analysis of the base case for phase 1-A and 1-B including a 15.000 tons per year incineration facility and overall 71.000 tons per year has been prepared

The conceptual design and tender documents has been used for calculating the construction cost as well as operation and maintenance cost. The calculations show that the facility will require an investment of 55,528,913 EURO including contingencies and funding for technical assistance and training. Maintenance of the plant will be around 1,5 million EURO

per year. Consumables for the centre will be around 1.3 million EURO per year. Manpower will also be a considerable cost of 850,000 EURO

The result of the financial analysis shows that a combination of ISPA grant, a favourable loan from a financial institution and a low discounting factor can result in waste tariffs which will generate enough revenue to ensure financial sustainability of the project and at the same time allow the waste generator to pay the fee.

The basic scenario is a 50% or higher ISPA grant; an international loan on favourable conditions (5% loan for 15 years including 5 year grace period) and considering a 5% discounting factor. These conditions results in the treatment fee's listed below which again provides a positive NPV.

It is considered that the Bulgarian industry will be able to pay these treatment fee's although it might will require a strong enforcement by the inspectorates.

Investment		**55,528,913**	
Grant	**50%**	27,764,457	
Loan	50%	27,764,457	
(5 years grace period, 5% interest, 15 years payback time)			
		Fee required to provide an IRR of 5%	
Disposal Method	Year	**2006**	**2027**
Secure Landfill NHWC (year 2015)		56	82
PCT		154	224
Incinerator incl fluegas cleaning, pre-treatment and tankfarm		174	253
Solidification		120	175
Secure Landfill Regional (year 2015)		52	76
Recycling		76	111
Net present value		**329,241**	

Feasibility

The basis for preparation and implementation of all hazardous waste management structures is the legislation. In Bulgaria it has been proven that the national legislation is in place and the relevant legislation has been approximated to EU legislation. The basis for a establishment of a successful system is thus in place.

The waste survey studies render it highly probably that a high amount of hazardous waste will be produced and captured by the foreseen Bulgarian NHWC. Even at an initial low capture rate (expected to increase over the years) the amount of hazardous waste will be sufficient for establishment of a viable National Hazardous Waste Centre.

The overall design of the Centre is prepared based on well proven technology, which have a proven track record of operability, safety as well as low environmental impact. The Centre will fully comply with the stringent EU requirements of emission etc..

The proposed project also include training of key operators (additional to training undertaken by the contractor) and technical assistance to the MoEW ensuring a proper review of design, supervision during construction and testing.

The integrated National Hazardous Waste Management Centre will therefore ensure safe and environmental correct disposal of all types of waste received to the benefit of humans, flora and fauna and the environment in general.

Also from an financial point the establishment of the NHWC is feasible. Considering a grant of 50% from the ISPA programme and favourable loan the treatment fees will result in low treatment fees which it is expected that the local industry will be able to pay allowing them to make use of the system even at the present low economical activity. The low treatment fee may even work as a catalyst which will further enhance the possibilities of further development of the industry in Bulgaria.

Considering the future membership of EU and the hereby increased industrial activity in Bulgaria the financial aspect for the NHWC looks even more promising.

The overall finding is that all factors for a successful implementation of the NHWC is in place. The project will be feasible even when charging low treatment fees which can be paid by the Bulgarian industry, providing Bulgaria a opportunity to comply with the EU environmental acquis and increase the quality of the Bulgarian environment.

2. EU Approximation

During the past several years the Bulgarian legislation has been changed considerably. It is almost fully approximated to the EC directives' provisions related to the waste management, to the air quality, and now to the water issues. An updated list of regulations related to environmental aspects is presented in the ISPA application.

The ***definition*** of hazardous waste is set out in Art. 2 (2), item 4 and paragraph 1, item 4 of the Additional Provisions of the Reduction of the Harmful Impact of Waste Upon the Environment Act (SG No 86/1997; amended SG No 56/1999). It fully corresponds with the EU definition.

The ***classification*** and the codes for the hazardous wastes are regulated in Order No RD-323/1998 of the Minister of Environment and Water and the Minister of Health.

The classification fully corresponds to that of EC.

As the NHWC have two parts: incinerator and landfill the requirements are in the following Bulgarian legal environmental documents.

The ***site*** for the NHWC and the ***landfill*** in particular are basically under the provisions of the following legal documents:

- Regulation No. 12 on the Requirements which Must be Met by the waste Treatment Facility (SG No. 152/1998);
- Regulation No. 13 on the Conditions and Requirements Towards the Construction and Operation of Waste Landfills (SG No. 152/1998).
- Regulation No. 1 on Study, Usage and Protection of the Ground Water (SG No 25/2000).

All of them fully correspond to the EC requirements.

The ***incinerator*** is basically under the provisions of Regulation on the Requirements on the Treatment and Transportation of Industrial and Hazardous Waste, adopted with Decree N 53/1999 of Council of Ministers (SG No 29/1999).

It corresponds to the EC requirements.

Other relevant regulation to the NHWC requirements are:

- Regulation No. 6 on the Emission Standards for Admissible Content of Hazardous and Dangerous Waste Water Discharge in Water Bodies (SG No 97/2000)
- Regulation No. 7 on the Conditions for Discharge of Industrial Waste Water in the Sewage System of the Settlements (SG 98/2000).

All of them fully correspond to the EC requirements.

Additional environmental regulatory requirements come from the following documents:

- Clean Air Act (SG No 45/1996, amended No 45/1996, No 85/1997, No 27 and 31/2000)
- Water Act (SG No 67/1999, amended 81/2000)
- Regulation No 15 on Emission Limit Values (Concentrations in the Waste Gases) of Sulphur Dioxide,
- Nitrogen Oxide and Suspended Dust, Exhausted in the Atmospheric Air from New Large Combustion Plants
- Regulation No 9 on Limit Values of Sulphur Dioxide, Nitrogen Oxide, PM10 and PM2,5 and Lead in the Atmospheric Air

These documents fully correspond to the requirements set out in the provisions of the above mentioned EU Directives.

As the HWC being a facility with industrial operations it also shall comply to the national health and safety documents, which also has been approximated to the relevant EU directives.

The organisation of the Ministry of Environment and Water seems to be well organised and the Executive Environmental Agency under the MoEW collect waste data and prepare a yearly report on the status of the Environment.

Locally a number of inspectorates inspects the enterprises to ensure that they comply with existing regulation.

In general the impression is that the system is organised and approximated to the EU regulation.

3. Waste Survey

The waste survey has been completed and is submitted as a separate report. Further a review of new information has taken place also including new information related to amounts of hazardous waste generated in EU countries.

3.1 Waste Data

The data shows that there is considerable amount of hazardous waste generated in Bulgaria. According to the information sheets 1,959,965 tonnes was generated in 1999. Also the amount of accumulated waste reported is substantial amounting to 24,001,513 tonnes (excluding mining waste), of which 95% is for disposal at the landfill.

In order to establish a more realistic basis, mining waste and waste from Neftochem have been deducted in the realistic scenario of the survey. This is due to the mining waste being considered to represent a minor environmental risk. Regarding Neftochem the waste is excluded as the company already have incineration capacity and furthermore another project regarding on site incineration is ongoing. Furthermore, the amount of some of the other waste

types has been reduced to an amount, which can be expected to be sent for disposal at the NHWC (realistic scenario). The reductions are based on our experience from other countries, and the adjustments are important when establishing the capacities for the individual facilities has to be established.

Taking these adjustments into consideration the 1999 realistic scenario for accumulated waste is reduced to 716,162 tonnes and the amount of generated waste is reduced to 168,208 tonnes.

1999 – Realistic Scenario	
Treatment	Tonnes
Landfill	102,100
Incineration	52,177
Physical-Chemical treatment	3,936
Recycling	9,538
Asbestous Landfill	457
Total	168,208

Geographic distribution of the waste data (realistic scenario) shows that most of the waste is generated in the Sofia district (35%) followed by Lovetch (9.1%) and Plovdiv (6.1%). In the Sofia district the waste is generally for landfill (81%).

With respect to incineration waste the quantities are more or less equally spread between Lovech, Sofia, Gabrovo, Burgas, Pazardjik and Varna please refer to section 3.5.

For waste, which shall be treated by physical-chemical treatment the Sofia district generates 75% of the waste.

The waste survey has identified the largest waste generators in Bulgaria as follows:

1999 – Major Waste Generators Waste Generated (Realistic Scenario – 168,208 tonnes)			
Company	Predominant treatment	Tonnes	%
KREMIKOVTZI AD	LF	50,344	29.9
VELUR AD	INC-2	9,703	5.8
KZM AD	LF	9,477	5.6
OLOVNO-ZINKOV Komplex –AD	LF	8,790	5.2
Balkan Pharma	INC-2	5,530	3.3
NEFTOHIM	INC-2	5,310	3.2
KRZ	LF	4,657	2.8
SEVKO	INC-2	4,200	2.5

The majority of these companies are accumulating large quantities of hazardous waste, KREMIKOVTZI AD reporting an accumulated amount of 10,935,498 tonnes.

In addition to these companies UMPM (Union Minier Pirdop Mines) and Panagiurski mini EAD also are accumulating very large quantities of hazardous waste, Panagiurski mini EAD reporting the largest amount of all 63,766,368 tonnes.

The amount of waste identified based on the information sheet are close to the quantities found by other methods normally used for estimating waste amounts. However comparing the findings of this survey with the findings of the Kaiser study shows that the amount of waste has been reduced dramatically. One explanation might by that the studies was based on different legislation, thereby using other classification for hazardous waste.

3.2 Future Generation of Waste

In order to predict the future generation of waste, 3 forecasts has been prepared. The 3 forecasts (high, medium and low) take into consideration the following factors:

- GDP
- Fee to be paid
- Improved enforcement
- Public awareness
- Introduction and cleaner technologies and waste minimisation
- Competition from other disposal operators,

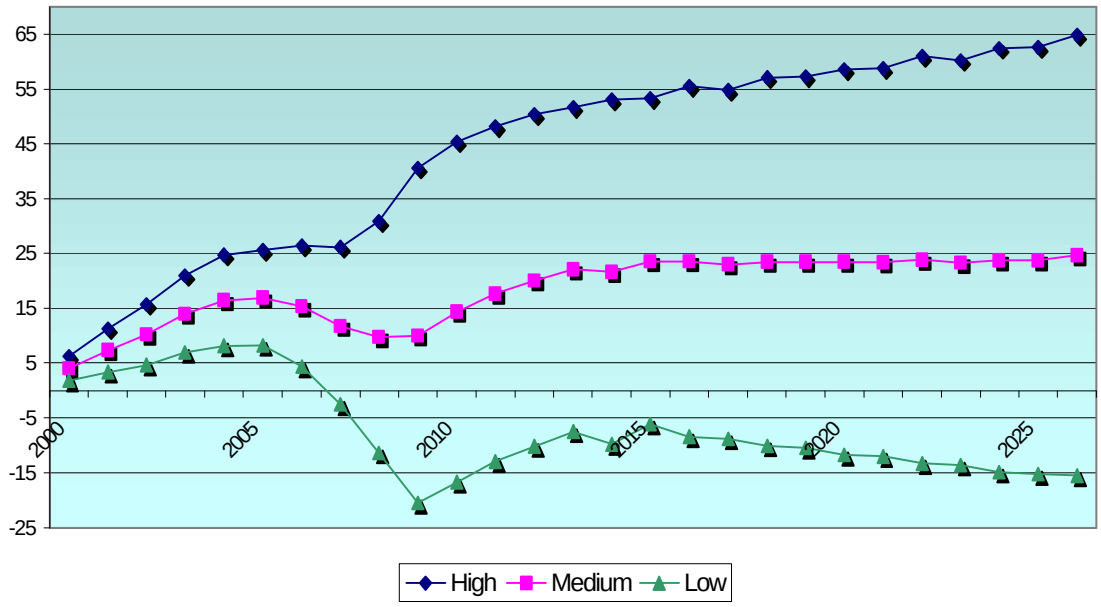


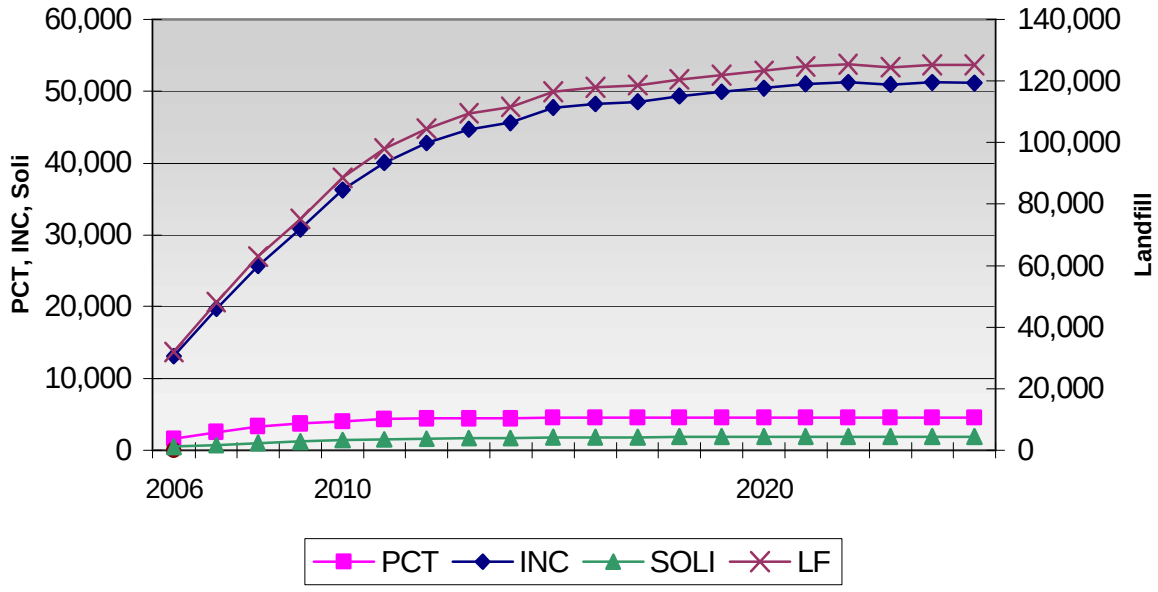
Figure 3.2-1 Sum of factors affecting the waste generation

Experience shows that in the first year of operation small quantities will be received due to a low capture rate. The rate used in this study has been based on experience from Kommunekemi, Malaysia and other facilities similar to the NHWC. The experience shows that the capture rate is

low during the first years of operation as the collection and disposal systems are new to the waste generators. However, the capture rate slowly increase and in the survey 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 95% of the generated amount.

Based on the predictions on the future amount of waste generated and the capture rate the amount collected has been calculated (realistic forecast) as shown in the graph below. The types of waste shown are physical-chemical treatment (PCT), liquid and solid waste for incineration (INC-1; INC-2) and waste for solidification (Soli).

The graph shows that during the first years of operation the amount of waste collected will be relatively small. This will allow for treatment of some of the accumulated waste.



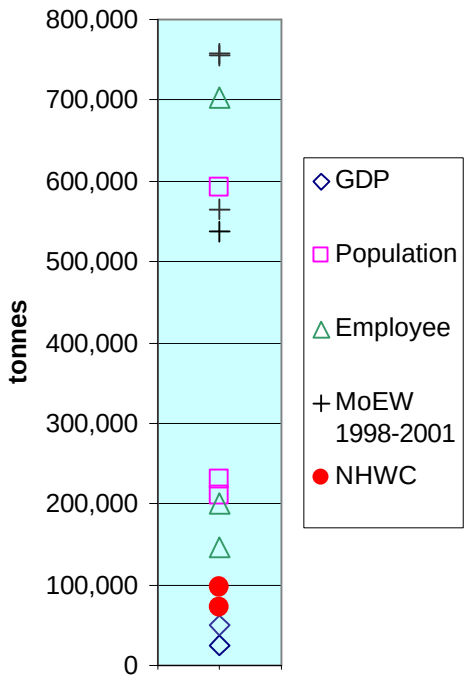
Forecast on Collected amounts of Future Waste Generation

In 2003 the Executive Environmental Agency under the MoEW provided data on the total amount of waste generated (excluding mining waste) for 2000 and 2001 as reported on the information sheets. It has due to financial constrains not been possible to undertake a detailed analysis of the data in the same way as was done for the 1998 and 1999 waste data although the raw data is available.

However a summery have been received from the MoEW, which shows that the amount of waste generated (excluding mining waste) during 2000 was 757,816 tonnes and for 2001 the amount was 755,766 tonnes.

The first waste survey found that 537,263 / 564,810 tonnes was generated in 1998 and 1999 when mining waste was excluded. Therefore it seems that the overall waste amount has raised slightly or more likely the industry has been acquainted with the reporting system and reporting more waste.

The increased waste amounts will, most likely, only influence little on the amounts which are available for the NHWC and therefore the prepared design and phased approach shall not be revised



In order to verify the data provided by MoEW the amounts has been compared with the experiences from the member states of the EU which is published in the topic report

"Hazardous waste generation in EEA member countries; Comparability of classification systems and quantities" prepared by the European Environment Agency; 2002

This reports states the hazardous waste generation in the member countries of the EU. When analysing the data it becomes clear that there is no obvious connection between the population; the number of employees, the Gross Domestic Product and the hazardous waste generation.

Further comparing the data from different countries great precaution shall be taken as the figures relate to different years and most likely the reporting systems within the different countries also vary tremendously. Therefore, conclusions based on these data shall be made with great caution. However for indicative purposes the findings will be of use to evaluate whether the design basis for the NHWC is in the appropriate order of magnitude.

As seen form the figure above. There are big variations within the various countries when the waste amount is related to the size of the population; the number of employees and the Gross Domestic Product. In most cases Greece reports the smallest amounts and although the countries are not identical it must be expected that the amounts generated in Bulgaria will be closer to these figures than highly industrialised countries having implemented a hazardous waste management system for a number of years.

As it can be seen the capacity of the NHWC installations established in the first phase is in the low end of the calculated amounts which ensure that the installations is very likely to be fully utilised. The lowest symbol represent the total amount of waste managed over the 20 years period. This means that the landfill waste although only in operation for 10 years the waste amounts has been divided over the entire period of 20 years in order to compare the capacities. The upper symbol is the capacity designed for in the original proposal.

4. Conceptual Design

4.1 Capacity

Based on the expected amounts collected the facilities of the National Hazardous Waste Centre has been designed to handle and dispose the following quantities during phase 1.

Disposal Method	Design Basis (Tonnes/year)
Secure Landfill (10 Years) (total capacity 800,000 tonnes)	70,000
Asbestos Landfill (total capacity 5,000 tonnes)	250
Solidification	5,000
Liquid waste for incineration	2,250
Solid waste for incineration	12,750
Physical-Chemical Treatment	1,000
Recycling	200

For the incineration facilities the capacity is lower than the amount of waste which is expected to be collected. However, the capacity of 15,000 tonnes per year installed in the first phase will allow for operation in the initial phase. In phase 2 (year 2015) it is foreseen to construct a second incinerator having a capacity of 30,000 tonnes/year. The total capacity of 45,000 tonnes per year is considered appropriate and complies with the findings of the waste survey. The financing for this installation is not considered yet however it is consider very likely that grants or other funding will be possible to achieve. The financing may also be achieved by changing the treatment fee so that the investment can be made from internal generated funds.

The capacity of the landfill will only accommodate for 10 years of operation and it is obvious that further landfill cells has to be constructed. Funding of these cells can be achieved in the same way as explained aboe for the incineration unit.

For the financial analysis it is estimated that the facility will be able to collect generated waste and accumulated waste so that 50% of total operational capacity can be achieved the first year. The following years it is estimated that this figure increases to 75 and 100%

4.2 Basic Design

A conceptual design report has been prepared and submitted for use in the EIA project. Based on this report the basic design and the tender documents has been prepared.

For use in the basic design a more detailed baseline, than specified in the conceptual design has been established as shown below

Operation

Incinerator 7000 h/y, 24 h/d
PCT 1 shift
Solidification 1 shift

Amount of Waste

Disposal Method	Design Basis (Tonnes/year)	Bulk (%)	Drum (%)
Secure Landfill - 10 Years (total capacity 800,000 tonnes)	70,000	40	60
Solidification	5,000	40	60
Asbestos Landfill (total capacity 5,000 tonnes)	250	40	60
Liquid waste for incineration	2,250	20	80
Liquid waste for poison plant	0	0	100
Solid waste for incineration (subdividing)	9,950	10	90
Solid waste for incineration (bunker)	2,800	70	30
Total Incineration	15,000	-	-
Physical-Chemical Treatment	1,000	10	90
Recycling	200	10	90
Total	91,450		

Storage Capacity

	Days
Organic drums storage	14
Inorganic drum storage	20
Tank farm	10
Special waste	20
Container storage	10
Bunker	2.5

Open for reception of waste: 250 days

Weight of waste: 185 kg/drum (including weight of drum (25 kg))
6 tonnes/container

Length of working day: 7 hour (excluding breaks)

Chemical Composition of Waste.

PCT:	Alkaline:	20%
	Acidic:	40%
	Chromium waste	30%
	Cyanide waste	10%

Incineration liquid waste:	High calorific > 18MJ/t	30%
	Low calorific < 18 MJ/t	70%

Incineration solid waste	Liquid	5%
	Solid	95%

The 5% liquid is liquid which has separated during storage and transport and lays on top of the solid waste. The liquid shall be removed in the suction stations

Special waste:	Liquid:	75%
	Solid:	25%

The Basic design includes:

- 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 organic waste
- Incineration facility (rotary kiln and flue gas cleaning equipment including continuous monitoring equipment)
- Physical-Chemical treatment facility
- Area for handling of Special Waste (expired medicine and mercury distillation equipment)
- Facility for highly toxic waste for feeding of pesticides to the incinerator
- Solidification facility
- Secure Landfill
- Landfill for Asbestos waste
- Effluent monitoring station
- Transfer Station

Data on emission from a similar incinerator has been forwarded to the EIA team, verifying that the incineration unit will comply with EU regulations.

The mercury recovery system is an evaporation process where the mercury containing waste is heated to 650 degree Celsius and recovered by condensing the mercury. Non condensable gasses shall be cleaned in mercury collecting activated carbon filter before release to the atmosphere.

The logistic system will include a limited number of truck which shall collect the most hazardous waste types. The drivers shall be specially trained to handle any emergency occurring during the transport and the truck shall be equipped with safety gear allowing the driver to act as the first responder. For less hazardous waste specially selected local transport companies shall be hired for the transport to the NHWC.

4.3 Layout

A site layout has been prepared. The general concept is to unload the waste at a central place close to storage facilities. From the storage facilities as little transport as possible shall be necessary for taking the waste to the treatment facilities.

The solidification plant is situated close to the landfill as to minimise the transporting of the solidified material.

For safety reasons the administration building is placed at some distance from the treatment facilities.

The total area taken up by the centre is around 20 hectares, including space for construction of further landfill cells and increasing the incineration capacity by construction of a second line.

5. Financial Analysis

A financial-economic analysis of the base case for phase 1-A and 1-B including a 15.000 tons per year incineration facility and overall 71.000 tons per year has been prepared. Detailed information is available in the document “Financial Analysis phase 1-A and 1-B”

5.1 Investment Cost Estimate

The investment is incurred during the construction period between 2004 and 2009. The disbursement of the funding is shown separately in the table below. The investments include all necessary logistics and transportation in order to collect the waste from the generators.

Investment	**1-A (Euro)**	**1-B (Euro)**
Total Technical installations	**38,558,450**	**8,002,000**

Besides the investment in technical installations funding is included for contingencies (8% of the technical installations equal to 3,724836 Euro) and technical assistance (6% of the technical installations equal to 2,793,627 Euro). Further funding is allocated for training of key staff (additionally to the training provided by the Contractor) and supply of spare part is included at 2,450,000 Euro.

The total invest is:

Investment	**1-A (Euro)**	**1-B (Euro)**
Total	46,006,633	9,522,280
GRAND TOTAL		**55,528,913**

5.2 Operation and Maintenance Cost Estimate

The operation and maintenance cost has primarily been estimated based on the preliminary flow calculations for the different facilities. However, also the Kommunekemi experience regarding maintenance cost and consumables has been considered.

Local prices have been used to some extend, but for a number of consumables world market prices has been used. For the final financial calculations a more precise operation and maintenance cost will be calculate, to a higher degree taking local prices into consideration.

5.3 Financing

To allow Bulgaria to construct a NHWC which can offer the service of disposal of hazardous waste collected nation wide, at treatment fee's which the Bulgarian industry can afford, it is assumed that 50% of the investment for the NHWC is provided by an ISPA grant.

The remaining cost is assumed to be financed by a loan obtained from the EIB or an other financial institution. The basic scenario of the financial analysis consider a 5 year grace period for loan payments but addition of interest during these 5 years, an interest rate of 5% and a pay back period of 15 years for the loan.

It is further assumed that the ISPA grant will be released successively during the construction period (year 2005 till end of 2009) implying that each payment will become one loan.

	2005	**2006**	**2007**	**2008**	**2009**
Investment (Euro)	*2,637,398*	*26,096,359*	*16,172,876*	*7,063,090*	*3,559,190*

Table 5.3 – 1 Payment schedule

5.4 Tariffs

As the "polluter pay principle" shall be applied the treatment fee shall reflect the cost involved for the individual disposal methods. In the financial analysis the fee is calculated by considering the following components: Dept service for Loan; Operational cost and Maintenance

As the calculated treatment fee do not consider the objective of achieving a positive net present value a correction factor is introduced which allows to adjust the calculated treatment fee to treatment fee's which provides a positive NPV in the range of 300,000 Euro.

The analysis applies a 2% yearly increase of the treatment fee to bring the fee closer to European prices. For the scenario considering 50% ISPA grant, 5% interest rate and a 5% discounting factor the fee increases as follows: The fee for landfill waste is given for 2016 as this is the last year when revenues for this type of waste is collected due to the capacity of the landfill is exhausted.

Disposal Method	2007 (€)	% of EU prices	2028 (€) 2016 (LF)	% of EU prices
Incineration	174	27 - 42 %	253	40 - 62 %
Solidification	120	35 - 52 %	175	51 - 76 %
Physical chemical treatment	154	37 - 55 %	224	54 - 80 %
Landfill NHWC	56	28 - 70 %	82	41 - 103 %
Landfill Sofia	52		76	
Recycling	76	30 %	111	44 %

Table 5.4-1 Development in Treatment fee's (Euro/tonne)

In order to evaluate weather the Bulgarian industry will be able to pay for the disposal, treatment fee's from a number of existing disposal facilities has been gathered. When comparing the Bulgarian treatment fee's, even including the yearly increment of 2% these treatment fee's are low compared to European fee's as seen in table 4.1-4 below.

The fee's provided for other disposal facilities shall only be seen as a guideline as the fees structures normally are very complex and most times divided into a number of groups related to various waste types. Further a number of additional cost may be applied where this additional cost is known they have been included in the figures presented.

Another very important aspect to remember is that the fees mentioned for European facilities normally will allow the facilities to reinvest in new facilities when the lifetime of the equipment expires. This aspect has been excluded for the NHWC. Further the European facilities have to provide a profit to the owners of the facilities an aspect which is not applicable for the NHWC.

5.5 Sensitivity Analysis

A full sensitivity analysis has not been prepared for the project. However the financial model developed allows for modifications of the basic assumptions used in the model and the results from these changed assumptions provides indications on the sensitivity of the project. The following scenarios have been prepared.

	Basis (1)	**Variation**	**Result**
2) Size of Investment	100%	125%	Fee + 15%
3) Interest rate for loan	5%	8%	Fee + 5%
4) Lack of waste collected	100%	75%	Fee + 22%
5) "Worst case" combining the above variations and 8% discounting rate			Fee + 58%

6. Socio-Economic Cost Benefit Analysis

A Socio-Economic Cost-Benefit Analysis concerning the NHWC has not been conducted. Neither an economic net present value nor an economic internal rate of return has been calculated. This state of affairs was approved by the MOEW of Bulgaria. This is in line with the "Guide to Cost-Benefit Analysis of Major Projects" in the context of EC Regional Policy 1997 edition section 3.8.5 for hazardous waste treatment facilities. There are a number of well known conceptual difficulties associated with the quantification and thereafter valuation of costs and benefits in the area of hazardous waste projects. This refers in particular to the controversial issue of quantifying and valuing the morbidity and mortality effects of the NHWC. In addition, the above analysis shows that the financial analysis produces a positive NPV, although under benevolent conditions.

Nonetheless, it is evidently true that the NHWC will generate a number of economic benefits, such as:

1. Improvement of the environment. Groundwater, surface water, air and soil will benefit from the NHWC as illegal dumping and improper treatment will be avoided. This will in the long run prevent a number of people from becoming sick or even die.
2. Improve the public health balance of Bulgaria, at least of the regions at stake;
3. Generate additional employment during the construction phase and thereafter as an industrial unit to a sizeable workforce.
4. Spur economic growth especially in the location of the Centre; this is generated via additional employment, increased consumption and growth in investment.
5. Attract foreign investors who consider environmental issues as important. Creating further employment and economic growth.
6. Increase the real estate value of areas so far affected by the current treatment of hazardous waste.
7. Facilitate the accession of Bulgaria to the EU meeting the environmental standards of the Union.

6.1 Cost Effectiveness Analysis

Due to the difficulties in preparing a cost benefit analysis a cost effectiveness analysis has been prepared accordingly to the ISPA manual comparing the proposed NHWC and several alternatives. The cost effectiveness analysis is included in the financial analysis document.

Export
One alternative is to export some of the waste to other European countries having facilities capable of disposing the waste. The most potential facilitity is the plant in Viena, Austria.

Export of hazardous waste is basically against the spirit of the Basel Convention, which is also ratified by Bulgaria. It is however possible but requires special approval from Bulgaria and the country in which the treatment facility is located.

The calculated treatment fee's for the NHWC are considerably lower than the fee's presently charged in the rest of Europe shown in table 4.1-4. Further a considerable cost for transportation of the waste will be added around 110 €/tonne considering that the waste is transported to Vienna.

The transport of large quantities of hazardous waste raises a number of questions. First of all it may raise political discussion whether a country will allow for import of large quantities of waste. Further the transport will cause air pollution and additionally the long transportation routes poses a risk for accidents which may impact the citizens living next to the roads.

Local treatment at existing facilities
A second alternative is to treat the waste in minor regional facilities already existing in Bulgaria.

Making use of other decentralised existing treatment facilities might be considered although this also raises a number of questions.

As these installations typically not are designed for disposal of hazardous waste will make it likely that they do not comply with EU regulations. Also the staff at the facilities will not be trained to handle the waste and serious accidents may occur.

Controlling all the existing facilities will require a tremendous effort from a central unit which shall coordinate the collection, negotiate contracts with disposal facilities which in short time may realise that they have a monopoly allowing them to raise the fee's.

Local treatment at existing facilities combined with export
A combination of the 2 above is probably the most likely scenario. Making use of decentralised existing Bulgarian disposal facilities for certain fractions of waste and export of the more "difficult" waste to facilities in Europe.

The calculations however shows that this solution also will be very costly. The cost is calculated to three times more than if disposed of at the NHWC.

7. Feasibility

It has been verified that the Bulgarian legislation, for the components reflecting the establishment of the NHWC, is fully approximated to EU regulation, furthermore a effective governmental organisation has been establish and in operation for a number of years, meaning that the institutional build up is in place. Initial steps towards the ownership of the NHWC is also initiated by establishing of a state ENTERPRISE dealing with operation of environmental issues.

The conclusion on the waste survey, and the review including new data from the MoEW, is that enough hazardous waste is generated in Bulgaria to justify the establishment of a Bulgarian National Hazardous Waste Centre, especially when the NHWC is implemented in a phased approach only constructing small disposal facilities in the initial stage, the uncertainty related to the amount of waste is addressed..

The design suggested for the NHWC is based on well proven and established technologies identical to facilities found in Western Europe. Then installations will comply with EU regulations for landfills, incineration of hazardous waste and air emissions, ensuring that the provided system is up-to-date. The capacity of the suggested facilities are designed according to a slightly conservative forecast in order to avoid construction of a large facility which may only operate at reduced capacity. The proposed project also include training of key operators (additional to training undertaken by the contractor) and technical assistance to the MoEW ensuring a proper review of design, supervision during construction and testing.

The integrated National Hazardous Waste Management Centre will therefore ensure safe and environmental correct disposal of all types of waste received to the benefit of humans, flora and fauna and the environment in general.

We trust that the capacities and facilities mentioned above will guarantee that the hazardous waste generated and accumulated in Bulgaria is treated and disposed of in a safe and environmental sound way for the years to come.

Also from an financial point the establishment of the NHWC is feasible. Considering a grant of 50% from the ISPA programme and favourable loan will result in low treatment fees which it is expected that the local industry will be able to pay allowing them to make use of the system even at the present low economical activity. The low treatment fee may even work as a catalyst which will further enhance the possibilities of further development of the industry in Bulgaria.

Considering the future membership of EU and the hereby increased industrial activity in Bulgaria the financial aspect for the NHWC looks even more promising.

The overall finding is that all factors for a successful implementation of the NHWC is in place. The project will be feasible even when charging low treatment fees which can be paid by the Bulgarian industry, providing Bulgaria a opportunity to comply with the EU environmental acquis and increase the quality of the Bulgarian environment.