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# **1 GENERAL DESCRIPTION**

## **1.1 SLECO CO-INCINERATION PROJECT**

General announcement of this co-incineration plant project at the Indaver Beveren site  
**SEE WEBSITE ANNOUNCEMENT PAGE !!!!!**

The place of works for this project will be on the site of SLECO-Centrale N.V., p.a. Indaver N.V., Haven 1940, Molenweg, 9130 Doel - Beveren, Belgium .

## **1.2 SUBJECT OF THE CALL FOR TENDER**

### **1.2.1 Subject**

At this site in Doel / Beveren SLECO plans the construction of an installation for the co-incineration of industrial waste and biosludge or similar waste.

The present call for tender concerns the installation at Beveren of an incinerator plant of 466 000 tons/year - 143 MW. This plant will have 2 or 3 incinerator lines with a thermal capacity of 48 or 72 MW each, based on the **lower** heating value, and a throughput of 21 or 31.5 tons/hour .

The waste is for 50 % sludge from municipal sewage water purification and for 50 % from high calorific residue of selected and sorted industrial waste.

The technology will be based on a fluidised bed furnace with steam boiler, for maximum energy recovery, and an advanced flue gas treatment to meet the current emission regulations.

**The proposed technology must be proven by reference plant(s). Based on their references , the tenderer can then either offer a two line or a three line concept . Both concepts will be accepted and evaluated as equivalent by SLECO .**

The best proof is of course the proposed complete concept in one plant. However references of the different components in several installations will be accepted as long as the input and output parameters can be compared to our project.

The scale of the references must be between 50 and 200 % of our project .The reference(s) must be in operation for at least 6 months.

This call for tender is for the construction and start-up of an incineration plant, starting from grass roots. The tender consists of :

- Tender Part 1 : waste preparation/furnace/boiler/dust extraction ( 3 lines )
- Tender Part 2 : flue gas treatment ( 3 lines )
- Tender Part 3 : turbine package ( one common unit )
- Tender Part 4 : “balance of plant” / non civil ( one common unit )
- Chapter Civil ( one common unit ) applicable for four parts

The tenderers will be invited to submit proposals for one or more parts .

Contract will be awarded on the 1<sup>st</sup> of October 2001, although on the condition of the receipt of the permits. The environmental impacts study is already been declared conform. The planning application was filed on 15/3/2001.

Commissioning of the first line will take place within 20 months from ordering. Start-up and provisional acceptance of the first line is scheduled within 24 months from ordering . The other line(s) are to be completed off the critical path for the number 1 line ; their provisional acceptance target is within 30 months from ordering.

### **1.3 OTHER INCINERATORS ON THE SITE**

Two incinerators are in operation on the site since 1997. These are grate furnaces with a semi-wet flue gas cleaning.

A third grate incineration is under construction. Start-up is scheduled for 9/2001. This project included the extension of the flue gas cleaning of the existing lines with a wet stage according to the concept of this call for tender.

#### **1.3.1 Drawings**

The annex x. yy drawings :

## 1.4 TYPE OF AGREEMENT

The general contractor tender formula will lead to a **lump sum / turnkey contract** for a project starting from grass roots, including design, delivery and construction, testing , start-up, commissioning and provisional acceptance .

In case contracting of separate tender parts are more favourable , several **lump sum / turnkey contracts** will be signed for the aforementioned Tender Parts .In this case the general constructor will include one of the other separate parts in its tender.

The tenderers for individual Tender Parts must pay close attention to check all conditions ( both for the process and for the utilities ) at battery limits to ensure perfect fitting of all parts of the tender .

The battery limit definitions originate from the Process Flow Diagrams provided by the tenderers and are subsequently to be documented in section 6 Technical tables and on matchlines in layout drawings .

To facilitate this check , this technical specification book has not been split in separate volumes and the whole should be carefully studied by all the tenderers .

## 1.5 TENDER MEDIA , TENDER FORMAT

All information contained in this document has been made available by electronic means via e-mail .This will facilitate the preparation of the offer by the tenderer.

**The tenderer must merge his proposal within the texts of the Technical Specification Book to form his TENDER .**

However, in order to facilitate the analysis by SLECO , the tenderer must lightly shade (or any other agreed method) IN THE PROVIDED ORIGINAL SLECO TEXT FILES the sentences or paragraphs or tables or schemes ...that the tenderer has prepared and added to the SLECO text to form his TENDER.

## 1.6 TENDER SCOPE

The tenderers will offer

- Detailed engineering design of the installation based on the basic data given in this call for tender and taking into account the SLECO standards;
- Study of hazards and operateability;
- Complete construction of the installation ready for startup in accordance with the specifications of this document;

- The startup and fine tuning of the installation;
- Training of the SLECO personnel for production and maintenance;
- Complete technical documentation, maintenance and operating instructions;
- The guarantee as described in this document;
- Technical assistance during guarantee period;
- Performance tests.

The scope of the four parts of the tender includes the supply of equipment as well as the supply of all the guidelines and requirements needed in other tender parts (e.g. civil : guidelines, control system descriptions, ...) within their battery limits.

The tenders exclude EIAS (Environmental Impact Assessment Study), obtaining all licenses and permits being outside the scope of work. However the contractor will give complete support to provide drawings and calculation notes when required for the administration by SLECO .

## **1.7 TENDER DOCUMENTATION**

The tenderers are required to provide the following documents (only partially applicable to the civil contents):

- Comparable (in capacity, waste composition, waste mix & processwise ) reference plants as example and for benchmarking purposes .  
When this reference is not available, proof of the correct upscaling or combining of the properties of reference plants lies with the tenderer
- Detailed description of the various parts of the installation, following the table of contents, the paragraphs and tables of the present call for tender.
- Completed technical tables and data sheets.
- Layout drawings
- Process flow diagrams (c.w. mass balance, technical balance, electrical balance for main operating modes) of the various parts of the installation
- Motor lists. These lists are required, among others, for the permitting authorities.
- List of monitoring and control equipment.

- List of spare and wear parts and unit price and life time of wear parts ( as described under Services ).
- All elements , as specified and as required , to allow the calculation of operating cost ( i.e. total life time cost/ton for a 20 year period ).
- Technical documentation of the standard accessories.
- Views (N/S/E/W) of the plant and the technical installations.
- Shortlist with main project partners and suppliers.
- Bill of quantities / technical tables .
- Price schedules

### **1.7.1 Language**

The tenders and the technical descriptions will be written in English by preference. Commercial company leaflets may be sent in other languages.

## **1.8 SHORT DESCRIPTION OF THE PROJECT**

### **1.8.1 Supply / feed of waste**

Waste is delivered by trucks to the covered reception hall. The trucks with high calorific waste tip their content in feeding hoppers to the preparation plant. The waste is transferred to the bunker after the preparation. The preparation is a calibration and scrap removing system. The bunker storage capacity for the prepared high calorific waste is gross 30 000 m<sup>3</sup> .

Trucks with water purification sludge tip their content directly into a concrete bunker. The bunker capacity for sludge is gross 5000 m<sup>3</sup>. This bunker is faced to the bunker for high calorific waste.

Three overhead travelling bridges will be used to mix, relocated and feed the prepared high calorific waste and sludge into the waste feeding hoppers.

### **1.8.2 Furnace**

The high calorific waste falls from the feeding hopper into the screw feeders of the fluidised bed furnaces.

Sludge is fed to a pump or dosing crew to feed into the fluidised bed.

The furnaces are equipped with a number of control loops in order to control the burn out and other properties.

The bottom ash is collected and sieved. The coarse fraction will be conveyed to the bottom ash storage. The fine fraction will be returned to the furnace..

Primary air will be taken from the bunker, the secondary air will be taken from above the boilers in the incinerator building.

The furnace will guarantee a flue gas temperature of at least 850 °C, a residence time of at least 2 seconds and an excess oxygen level of at least 6 % (dry flue gas). Standby burners on light fuel oil will automatically start and correct when the temperature drops below 850 °C. The same burners will be used to bring the incinerators to the legally determined conditions for burning waste.

### **1.8.3 Waste heat boiler**

The energy from the flue gases will be recovered for a big part in the waste heat boiler.

The flue gases first pass the radiant part. This radiant part will have 3 empty passes.

Then the flue gases pass a convective part with tube bundles. The tube bundles will be one protecting evaporator, 2 superheaters and economiser(s).

The superheated steam will be sent to turbine. The steam from the turbine will be further condensed by an aerocondenser to close the steam cycle.

### **1.8.4 Flue gas cleaning**

The flue gas cleaning is a semi-wet stage before a wet stage.

The semi wet stage consist of a spray dryer and baghouse filter. The purge from the wet flue gas cleaning (see further) will be evaporated in the spray dryer, after separation of gypsum.

Injection of activated carbon for the capture of heavy metals and dioxins.

Captivation of acid components will be done in the wet stage , being a quench, an acid scrubber and an alkaline scrubber. The wet stage will used lime and/or limestone as

neutralising agent making calcium based salts. Gypsum will be filtered. Calciumchloride will be dried in the semi wet stage.

The reduction of NOx-emission to 170 mg/Nm<sup>3</sup> will be done by injection of urea or ammonia (SNCR).

The flue gases leaving the wet stage will be reheated to 100 ° using a flue gas - flue gas heat exchanger.

### 1.8.5 Induced draught fan and stack

Each line will have an induced draught fan at the end to keep the whole incinerator line in underpressure.

## 1.9 TECHNOLOGY AND STANDARDS

The concept of the plant is according to the actual status of technology and reflects the operators experience on reliability and quality. Only proven technology will be considered. Tenderers will be the owner of the technology in the proposal. The proposal will be covered by relevant references.

Special attention is to be paid to :

- The standardization on the site Beveren
- Effluent free status of the site at
- Reduction of the plume from the stack

### 1.10 TECHNICAL DATA

Capacity per line	3 line concept	2 line concept	
Waste throughput	20.7	31.1	t/h
Thermal capacity	48	72	MW
<b>Waste bunker</b>			
Dimensions (l X w X h)	58 x 26 x 20	58 x 20 x 20	m
Number of tipping points	5	5	

Gross volume for high calorific waste	30 000	30 000	m <sup>3</sup>
Gross volume for sludge	5 000	5 000	m <sup>3</sup>
<b>Bottom ash bunker</b>			
Dimensions (l X w X h)	50 x 4 x 9	50 x 4 x 9	m
Net volume for bottom ash	1800	1800	m <sup>3</sup>
<b>Cranes</b>			
Number	3	3	
Grab type	hydraulic polyp	hydraulic polyp	
Grab volume	8/8/4	8/8/4	m <sup>3</sup>
Net grab capacity	4/4/4	4/4/4	t
<b>Furnace</b>			
Number	3	2	
High calorific waste buffer	30	30	m <sup>3</sup>
Sludge feeding buffer	30	30	m <sup>3</sup>
<b>Sludge storage</b>			
Dimensions	28 x 30 x 6	28 x 30 x 6	m <sup>3</sup>
Net volume	5 000	5 000	m <sup>3</sup>
<b>Waste heat boiler</b>			
Number	3	2	
Construction concept	3 radiant passes and convection part	3 radiant passes and convection part	
Steam production (nominal)			t/h
Steam temperature	400	460	°C
Steam pressure	41	68	bar
Temperature boiler feedwater	140	140	°C
Flue gas temperature outlet boiler	min 210 / max 250	min 210 / max 250	°C

<b>Turbine</b>			
Number	NA	NA	
Generator capacity (max)	NA	NA	MVA
Electricity to the grid			MW
<b>Spray dryer</b>			
Number	3	2	
Type atomization	free	free	
Flue gas temperature	140 - 175	140 - 175	°C
Flue gas flow (dry 11 % O <sub>2</sub> )	100 000	150 000	Nm <sup>3</sup> /h
<b>Bag house filter</b>			
Number	3	2	
Number of compartments per line	min 5	min 5	
Surface of sleeves	ca. 2.6	ca. 2.6	m <sup>2</sup>
<b>1 st Induced draught fan (when necessary)</b>			
Number	3	2	
Type	centrifugal	centrifugal	
Flue gas flow (dry 11% O <sub>2</sub> )	100 000	150 000	Nm <sup>3</sup> /h
Rotation speed maximum	1500	1500	t/min
<b>Flue gas flue gas heat exchange</b>			
Number	3	2	
Material between media	PTFE	PTFE	
<b>Quench</b>			
Number	3	2	
Type	Water only	Water only	
Emergency cooling	Fire water	Fire water	

<b>Acid scrubber</b>			
Number	3	2	
Reagent	lime(stone)	lime(stone)	
<b>Alkaline scrubber</b>			
Number	3	2	
Reagent	lime(stone)	lime(stone)	
<b>2 nd Induced draught fan</b>			
Number	3	2	
Type	centrifugal	centrifugal	
Flue gas flow (dry 11% O <sub>2</sub> )	100 000	150 000	Nm <sup>3</sup> /h
Rotation speed maximum	1500	1500	t/min
<b>Stack</b>			
Number	3	2	
Height	50	50	m
Internal diameter	2	2.5	m

### 1.11 SHORT LISTING OF INSTALLATIONS COMMON FOR 2 OR 3 LINES OR DEDICATED TO EACH INCINERATION LINE.

The following table indicates which equipment will be dedicated to one line and which will be common.

ITEM	CONFIGURATION
Waste preparation	common
Bunker for industrial waste	common

Reception biosludge	common
Sludge storage	common
Storage of high calorific waste	common
Fluidized bed furnace and boiler	dedicated
Turbine/generator	NA
Steam/condensate network	common
Demineralized/eralised water storage	common
Aerocondenser	common
Storage of bottom ash	common
Storage of fly ash	common
Flue Gas Cleaning	dedicated
Chemicals storage and conditioning	
. lime	common
. lime milk	common
. activated carbon	common
Big bag stations	common
Gypsum recovery	common
Connections to utilities	common
Induced draught fan	dedicated
Stack	dedicated
Emission monitoring	dedicated
control room	common
MCC room(s)	common
DCS system	common
Cable trays, piperacks, etc., foundations	common

## 1.12 BATTERY LIMITS

The tenderers must pay close attention to **check all conditions** ( both for the process and for the utilities ) **at battery limits to ensure perfect fitting of the packages** .

The battery limit definitions originate from the Process Flow Diagrams and are to be documented in section 6 Technical tables and on macthlines in layout drawings .

Based on these drawings, the tenderers must provide detailed listings of the battery limits of his quotation . The following table illustrates the scope definition for specific parts of the tender.

ITEM	PART OF TENDER			
	1	2	3	4
Preparation and bunkers	×			
Stack		×		
Storage of bottom ash	×			
Storage of chemicals		×		
Storage of boiler / dust filter fly ash	×			
Storage of residues of semi-wet flue gas cleaning system		×		
Steam-boiler	×			
DCS systems	×			
Demineralizederalized water storage			NA	x
Steam turbine and aerocondenser			NA	
Electrical MCC (main) / MCC				×
Instrumentation (field)	×	×	NA	×
Utilities				×
Connections to utilities and distribution of utilities within the construction area boundaries (drinking water, process water, fire-fighting water, gas, condensate, sewer, electricity).				

	×	×	NA	×
Building for process installation	×	×	NA	×
Turbine building	x			
Civil works including foundation, all constructions and technical buildings.	×	×	NA	×

NA: not applicable

## 1.13 WASTE CHARACTERIZATION

Two main sources of fuel are considered : industrial waste and municipal water treatment sludge. In normal operation the industrial waste and the municipal water treatment sludge will be incinerated together. The nominal fuel feed to the furnace will represent the sum of the two nominal streams.

The following table mentions some sources of the waste :

Basis for the design of the plant are the following capacities:

- HCRB ( hi calorific non recyclable residues ) 137 000 t/a
- HCRH ( hi calorific MSW digester residues) 63 000 t/a
- HCGV ( domestic bulky waste ) 33 000 t/a
- RWZI ( municipal water treatment sludge ) 233 000 t/a

The wastes have to be incinerated at an overall availability of 85.6 % respectively 7500 h/a according to the firing capacity diagram .

### 1.13.1 General industrial waste

**HCRB** ( hi calorific non recyclable residues ) 137 000 t/a

HCRB is a waste that remains after recovery of recyclable components. It consist of shredder residue, carpets, white and brown appliances, industrial waste, textiles, demolition material, wood, technical rubbers, tires, hi-cal sorting residues and bio waste.

Shredder waste is small sized waste with up to 2 % sulphur. Further shredding is not to be supposed to be required .

Carpets will be accepted in pieces of less than 1000 mm.

Residuals of the white- and brown appliances will be accepted unshredded. This means that sizes up to a refrigerator is to be expected.

Specific industrial waste will be accepted in pieces up to 1000 mm.

Wood and demolition waste will be accepted in pieces up to 1000 mm.

Technical rubber and tires come from shredding plant. Hence further shredding is not to be supposed.

Above mentioned waste types resort chemically under the HCRB, HCRH, or HCGB

The chlorine content of the waste mix will not exceed 1 % because otherwise a combustion temperature of minimum 1100 ° C is necessary.

HCRB is waste that will be smaller than 1000 mm in 3 dimensions.

The fuel of the first type will consist of a mix of general industrial waste, comparable to the dry fraction of household waste (packing materials, construction waste, but also small business refuse), with addition of relatively small quantities of specific types of dry waste (such as car shredding waste, carpet waste, technical rubbers) and some organic sludges.

Sorting of an extensive set of samples of the general industrial waste concerned had the following result :

<b>Sorting Results (mass %)</b>			
	<b>min.</b>	<b>max.</b>	<b>average</b>
Paper, cardboard	23	32	28
Hard plastics	5	9	6
Soft plastics	4	20	12
Metals	1	4	3
Wood	4	26	13
Textiles, leather, carpet	5	12	7
Laminates, brick packs etc.	2	5	3
Organic waste	1	7	3
Bituminous, roofing	0	6	1
Inert material (manual sort)	1	14	7
Remaining (fine material, sand,...)	10	22	17

NOTE : This is a gross waste composition before sorting or picking, for recycling or for fuel condition.

The lower heating values measured show that a range of 11000 kJ/kg to 20000 kJ/kg may be expected.

Lower heating value : 15 500 kJ/kg

**HCRH** ( hi calorific MSW digester residues) 63 000 t/a

HCRH is waste coming from a mechanical sorting plant. The material has gone through a shredder. Pieces less than 300 mm are expected.

Composition :

		<b>HCRH</b>
Dry Substance	%	77.7
Moisture	%	33
As	mg/kg DS	2.5
Be	mg/kg DS	0.2
Cd	mg/kg DS	10
Co	mg/kg DS	9
Cr	mg/kg DS	133
Cu	mg/kg DS	687
Hg	mg/kg DS	0.5
Mn	mg/kg DS	179
Mo	mg/kg DS	7
Ni	mg/kg DS	55
Pb	mg/kg DS	234
Sb	mg/kg DS	6
Sn	mg/kg DS	47
V	mg/kg DS	10
Zn	mg/kg DS	490

N	mg/kg DS	8 500
S	mg/kg DS	1 200
C	mg/kg DS	427 500
Cl	mg/kg DS	10 800

**HCGV** ( domestic bulky waste )                      33 000 t/a

HCGV is waste that will be smaller than 1000 mm in 3 dimensions.

The nature of this waste is close to the nature of HCRB. Hence the same composition as described is to be supposed.

The average results of sorting tests, of elementary analysis and heating value tests on a series of samples are represented by the following “nominal industrial waste data“, given as reference for calculation purposes:

**Table : Elementary Analysis of Wastes**

<b>Composition</b>		<b>HCRB</b>	<b>HCRH</b>	<b>HCGV</b>
C	w%	37.2	37	37.2
H	w%	5.3	5.3	5.3
O	w%	21	21.0	21.0
N	w%	2.6	2.6	2.6
S	w%	0,34	0,09	0,09
Cl	w%	0,54	0,85	0,85
Ash	w%	20	20	20
Water	w%	14,0	14,00	14,00
LHV	kJ/ kg	15500	15500	15500

### 1.13.2 Municipal water treatment sludge (Biosludge)

**WZI** ( municipal water treatment sludge ) 233 000 t/a

This fuel is dewatered biosludge from various municipal AND private industrial water treatment plants :

Quantity of dry substance : 56.000 ton/year DS/hour  
 Dry substance ratio : 18 - 35 %, average 24 % DS  
 Combustible part of dry substance : 40 - 70 %, average 60 %  
 Average lower heating value :  
     combustible (organic) fraction ca. 20 MJ/kg  
     dry substance fraction ca. 12 MJ/kg  
     wet sludge ca. 1 MJ/kg  
 pH value range 5 - 12

The following elementary analysis is given as reference (%mass) :

Elementary analysis			
Industrial Waste	in mass %		
	on organic	on dry	on total
C	50.70	30.42	7.30
H	5.9	3.54	0.85
O	34.8	20.88	5.01
N	4	2.4	0.58
S	3.3	1.98	0.48
Cl	1.3	0.78	0.19
Ash		40.00	9.60
Water			76.00
	100.00	100.00	100.00
LHV (MJ/kg)	20.0	12.0	1.0

While it has to be possible to burn industrial waste alone during more or less extended periods of time, this is not required for this biosludge. The total quantity of 56000 tons Dry

Substance (DS) per year will thus have to be incinerated in 7500 hours, in three furnaces, with a nominal input of ca. 10.4 tons /hour wet sludge.

The thermal load of the furnace by this fuel is 2.9 MWth.

### **1.13.3 Design basis**

Total incineration capacity: 233 000 t/y industrial waste  
+ 56 000 t/y (DS) sludge

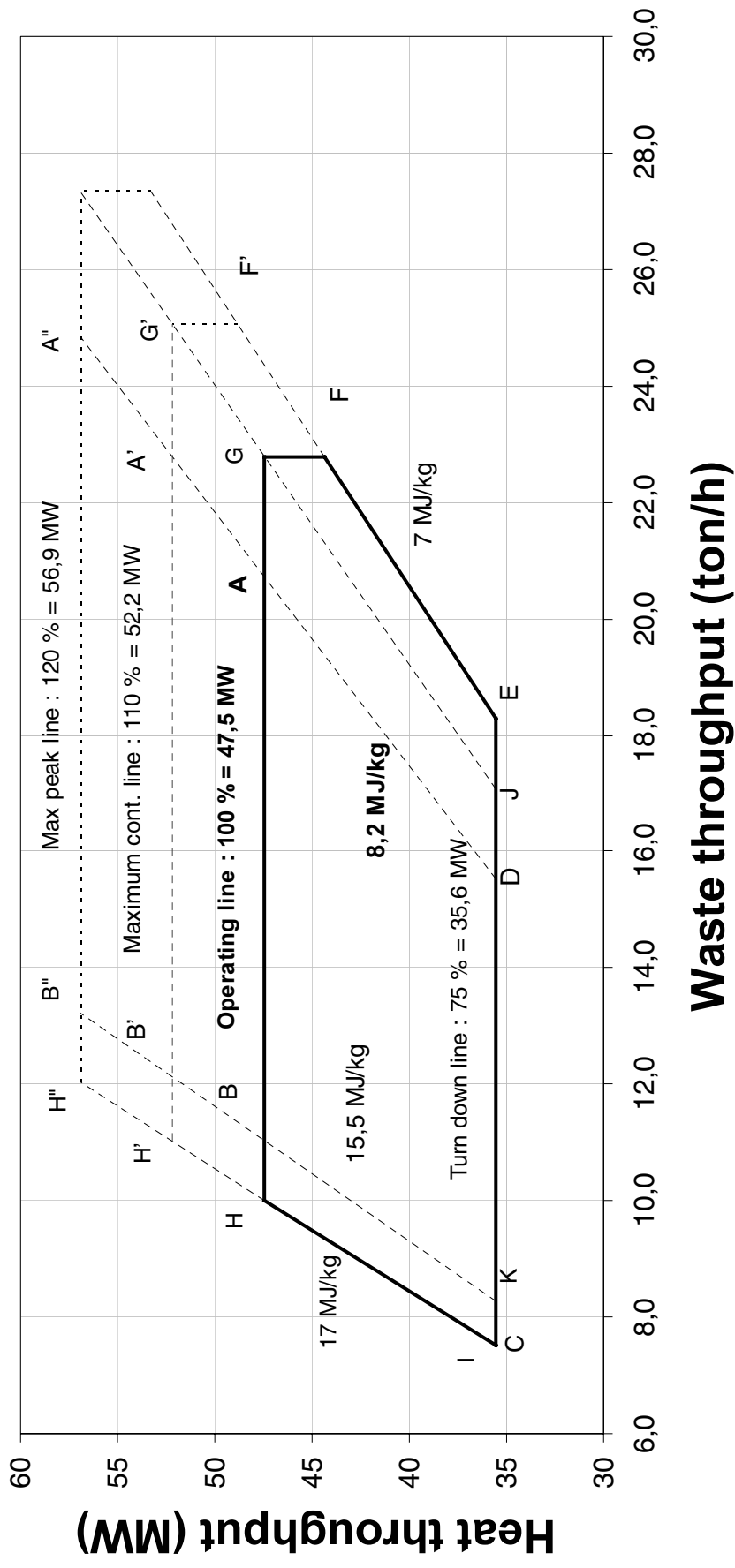
Nominal Throughput: 62 t/h of mixed co-incineration waste (LHV =8200  
kJ/kg)

Total thermal input: 143 MW

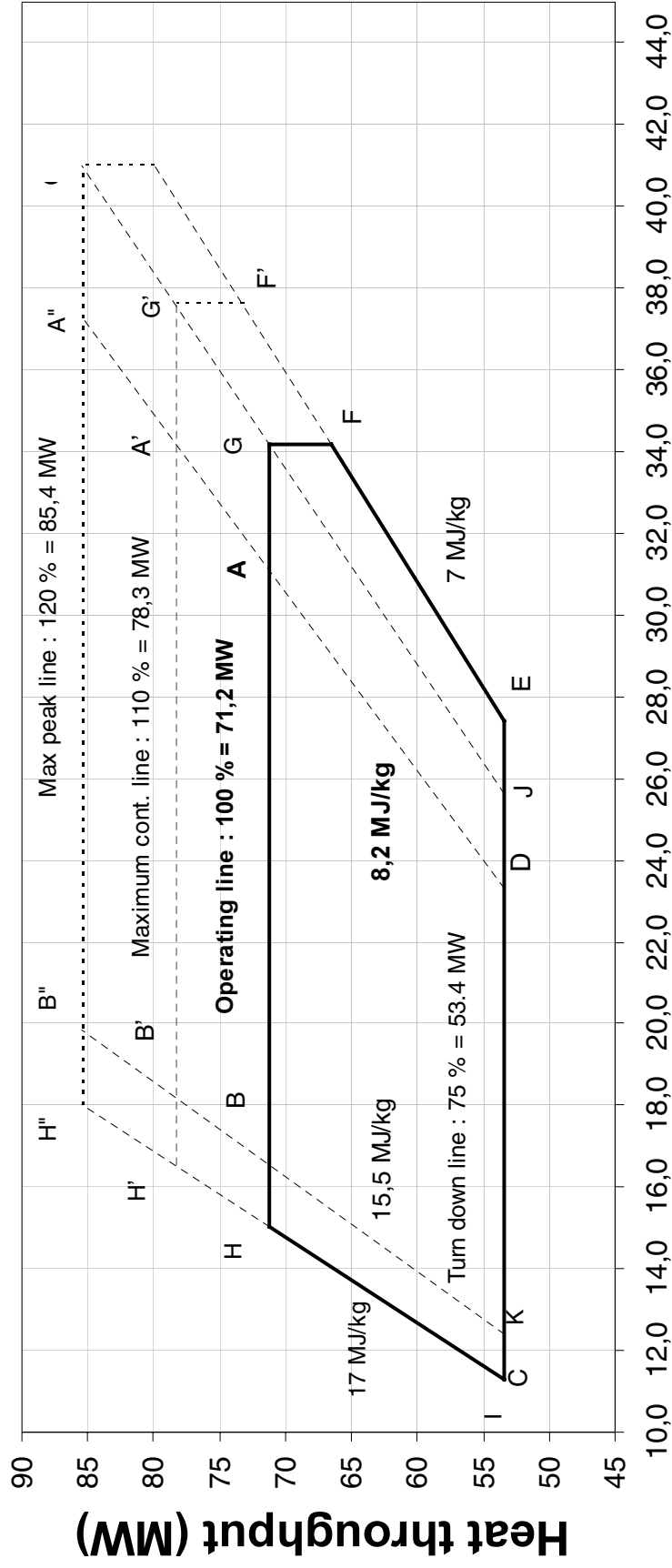
## **1.14 COMBUSTION DIAGRAM (BOTH FOR 2 AND 3 LINE CONCEPT)**



# COMBUSTION DIAGRAM WBO Beveren : 48 MW



# COMBUSTION DIAGRAM WBO Beveren : 72 MW



## Waste throughput (ton/h)

- 24/42 -

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### 1.14.1 Range of operation

The attached combustion diagram indicates the range in which the incinerator plant will be operated.

Lower heating value (total fuel feed ) in extreme conditions (the thermal efficiency being of secondary importance) :

Minimum : 7 MJ/kg (to be specified by the tenderer) with for instance air preheating

Maximum : 17 MJ/kg (to be specified by the tenderer) with for instance water injection

It is to be understood that no major additional equipment should be proposed to widen the accepted heating value range.

The following operating conditions are related to points on the diagram :

- A : Nominal conditions
- E : Nominal or wet sludge with minimal quantity of (average) industrial waste
- C : Minimal power without sludge (somewhat higher lhv of industrial waste)
- B : Nominal power without sludge and LHV of industrial waste 15.5 MJ/kg

In a general way, the equipment should perform reliably and with a good thermal efficiency when one of the parameters (quantity, moisture, inert fraction, heating value, physical characteristics) of one of the fuels is maximal or minimal. The other fuel is then assumed to have nominal characteristics.

Some limitation of the total sludge feed is acceptable when the dry substance ratio is lower than 24%.

Peaks up to the maximum values for a period of up to one hour will be absorbed with respect to all guarantee values and environmental values and without any negative effect to the installation.

The combustion diagram is designed on a theoretical basis. The tenderer will comment on the limits of the diagram in function of the technology he proposes. Goal is to have a wide diagram with proven technology at a reasonable cost.

### 1.14.2 Operational condition for final combustion

Legislation imposes that the flue gases, downstream of the last injection of combustion air, and for all operating conditions in which waste fuels are present in the furnace, will be kept :

- for at least 2 seconds,
- at a temperature of at least 850 °C,
- in the presence of at least 6 % (volume % dry gas) of O<sub>2</sub> .

The tenderer will submit a drawing indicating the zone where these conditions will be met.

The combustion characteristics will be chosen, in relation to the design of furnace and boiler (e. g. wall cooling), to minimise slagging of the surfaces. The tenderer will comment on the effect of temperature and other parameters on clogging. Flue gas temperatures (physical temperatures) of 1000 °C or higher are to be avoided.

### 1.14.3 Operational condition of steam boiler

The boiler will be designed for the following conditions :

- Steam pressure at turbine inlet : 41 / 68 bar
- Steam temperature : 400 / 460 °C +/- 5°C
- Minimal exhaust flue gas temperature : 200 °C
- Nominal exhaust flue gas temperature (after cleaning) : 210 °C
- Maximal exhaust flue gas temperature : 250 °C
- Maximal gas side pressure drop : 5 mbar
- Maximal gas velocity in convection part (based on projected free surface) : 5 m/s
- Maximal flue gas temperature at the first superheater inlet : 650 °C
- Operation without manual cleaning : 8000 h

- The minimum lifetime of the superheater at nominal thermal power: 40 000 h

It is possible that the choice of an efficient and economical boiler design may lead to a limitation of the zone in the combustion diagram where these conditions can be obtained. The tenderer will comment in function of the technology he proposes.

The tenderer will also specify the thermal efficiency of the furnace and of the furnace-boiler-filter combination he will guarantee.

#### 1.14.4 Flue gas condition at exit of the boilers

The composition of the flue gas at the exit of the boilers is estimated as mentioned below, with variations possible in flue gas characteristics :

The figures given in this chapter are yearly averages. These values will be used for the calculation of the yearly operating cost of the plant.

'10 HM' means '10 heavy metals'. This is the sum of Sb, As, Pb, Cr, Co, Cu, Mn, Ni, V and Sn.

NO<sub>2</sub> is given with an SCNR system.

yearly average	unit	3 lines : per line	2 lines : per line
O <sub>2</sub>	vol %	8,5	8,5
N <sub>2</sub>	vol %	67,2	67,2
CO <sub>2</sub>	vol %	7,5	7,5
H <sub>2</sub> O	vol %	16,8	16,8
Dust	mg/Nm <sup>3</sup>	600	600
HCl	mg/Nm <sup>3</sup>	760	760
SO <sub>2</sub>	mg/Nm <sup>3</sup>	1400	1400
HF	mg/Nm <sup>3</sup>	20	20

NOx	mg/Nm3	170	170
PCCD/PCDF	ngTEQ/N m3	5	5
Cd + Tl	mg/Nm3		
Hg	mg/Nm3		
sum 10 HM	mg/Nm3		
flow actual	kg/h	143000	214500
flow actual	Nm3/h	115000	172500
flow dry 11 % O2	Nm3/h	103000	154500
temperature	°C	230	230

## 1.15 AVAILABILITY

Unavailability is the loss of plant power capacity (waste : LHV X throughput) due to planned shut downs and failures. Unavailability is given as lost capacity/total capacity. The overall plant capacity is 143 MW, distributed 3 lines. The capacity lost due to planned shut downs and failures and attributable to the tenderer will be divided by 143 MW to obtain the number of unavailable hours.

Example :

<b>Normal operation</b>	<b>Line 1</b>	<b>Line 2</b>	<b>Line 3</b>	<b>Total</b>
MW	47.5	47.5	47.5	142.5
<b>Example with failures during 1 hour</b>	Line 1	Line 2	Line 3	Total measured
MW	47.5	23.75	0	71.25
<b>Availabilty during 1 hour</b>				<b>50 %</b>

The heat throughput is only the heat coming from waste. The heat from auxiliary fuel will be subtracted from the total heat as measured through the plant heat balance.

The waste will be accepted as it comes into the preparation or sludge bunker. The tenderer is invited to give comments on the waste before it is incinerated. This must avoid discussions about waste composition after it is incinerated.

Planned unavailability for the whole plant will not exceed 660 h per year. The planned shut downs will always be combined with the shut downs of other parts of the plant..

The unplanned unavailability (failures) for the whole plant will not exceed 600 h per year.

Failures that do not cause capacity loss will not be considered as unavailable.

## 1.16 QUALITY AND PERFORMANCE CRITERIA

### 1.16.1 Emission limits for flue gases

The requirements are based on the emission limits of VLAREM II (Flemish environmental legislation).

The limits are based on mass/Nm<sup>3</sup> referred to standard conditions: 273 K, 101.3 kPa, 11 % O<sub>2</sub>, dry gas.

The following emission hourly limit will be guaranteed at any time:

Parameter	Guarantee limit
CO	100 mg/Nm <sup>3</sup> *

The following emission limits will all be guaranteed for the 24 h - average (any 24 h - period):

Component	Unit	yearly average	maximum flue gas flow	maximum flue gas pollutants	peaks
Dust	mg/Nm <sup>3</sup>	5	5	5	10
HC	mg/Nm <sup>3</sup>	8.5	10	10	10
HCl	mg/Nm <sup>3</sup>	8.5	10	10	10
SO <sub>2</sub>	mg/Nm <sup>3</sup>	42.5	50	50	50
HF	mg/Nm <sup>3</sup>	0.85	1	1	1
NO <sub>2</sub>	mg/Nm <sup>3</sup>	170	200	200	200
PCDD/PCDF	ng TEQ / Nm <sup>3</sup>	0.085	0.1	0.1	0.1
Cd + Tl	mg/Nm <sup>3</sup>	0.0425	0.05	0.05	0.05
Hg	mg/Nm <sup>3</sup>	0.0425	0.05	0.05	0.05
sum 10 HM	mg/Nm <sup>3</sup>	0.425	0.5	0.5	0.5

'All the half hourly average emissions' measured in each of the stacks must comply to

Component	Unit	emission
Dust	mg/Nm <sup>3</sup>	10
HC	mg/Nm <sup>3</sup>	20
HCl	mg/Nm <sup>3</sup>	60
SO <sub>2</sub>	mg/Nm <sup>3</sup>	200
HF	mg/Nm <sup>3</sup>	4
NO <sub>2</sub>	mg/Nm <sup>3</sup>	200

### 1.16.2 Burnout and quality of bottom ash, boiler ash and flyash

All ashes must be separately collected and brought dry and cool (< 60 °C) to the battery limits.

The unburned material, determined by the loss on ignition, is maximum 0,3 wt %.

The proposed dust removal equipment (type, size distribution) will be the result of an optimisation in view of the following considerations :

- fly ashes with a composition respecting the Vlarem II legislation may be landfilled without further processing, other fly ashes need downstream processing to respect the legislation;
- downstream processing of fly ashes with large salt content or fly ashes mixed with residues is significantly more complicated;

The operational cost implications to be taken into account are given in 0.15. The tenderer will define and guarantee the performance (size distribution, efficiency) of the proposed equipment.

## 1.17 NOISE

### 1.17.1 General

The environmental noise regulations included in VLAREM II are to be strictly adhered to. The tender must take all provisions to manage and control the situation by making a "NOISE EVALUATION STUDY". This study must be updated throughout the entire life of the project.

The general principle to be adhered to is : “The noise level control will be taken care of at the sources.”

This means that the equipment (where required) will be fitted with noise dampers, insulating panels, enclosures, etc.

### **1.17.2 Guidelines**

- At 1 m from each individual equipment item the soundpressure specification will be less than or equal to 80 dB(A).
- Within any building or room, the maximum sound pressure will be less than or equal to 85 dB(A) with all equipment in operation and measured at any place at a 1 m distance from any equipment.
- Sound pressure at 5 m from any building or equipment located outside will never exceed 65 dB(A), with an exception for the aero condenser.

## 1.18 SAFETY AND QUALITY

Safety and quality are the priorities in the code of practice of SLECO. Therefore, for this project, safety and quality are of prime importance.

Safety and quality are to be considered in relation to the individual employee, to the installation, to the local environment at SLECO and to the global environment, and this during the future operation and maintenance of the incineration installation as well as during its design and construction.

Consequently, in the design stage, the contractor is required to perform a safety study.

The contractor will take special care at the design of each unit to ensure safety and quality during construction and operation of the plant.

As soon as P&Id's for design are available, a Study for hazards and operability will be carried out.

The technique for recording, judging and reporting quality remarks is defined in the 'Agreement'.

Written documentation of all safety and quality aspects is an important contribution to the realisation of safety and quality. The contractor will be responsible for a complete, sound and on time documentation of all aspects of the installation.

Not a single equipment item, process vessel or part of it may be taken in operation, neither for testing nor for operation, unless all necessary legal documents, checks and approvals have been certified.

The safety aspects are documented by:

- by reports of Belgian legally required inspections, following the requirements of ARAB (Algemeen Reglement op de ArbeidsBescherming, i.e. Belgian general regulation on labor protection) and AREI (Algemeen Reglement op de Electrische Installaties, i.e. Belgian general regulation on electrical installations) legislations,
- by the permits,
- by the advises of the insurance company and of the NVBB (Nationale Vereniging voor Beveiliging tegen Brand, i.e. Belgian national association for fire protection)

All equipment will be CE-certified.

The file of certificates is an integral part of the contract which has to be complete before the provisional take-over.

Of prime importance for the quality of the contract are the criteria for the outputs of incineration: the quality of the flue gases, the ashes, the boiler fly ash and the flue gas cleaning residue's.

The limits, as mentioned in the previous paragraph, have to be guaranteed and are crucial for the final take-over.

## **1.19 THE BASIC DESCRIPTION**

### **1.19.1 Basic offer**

The following chapters describe the basic technical specifications as requested by SLECO:

- Technical description
- Services and Performances
- Guarantees and acceptance
- Technical tables

These technical specifications invite the tenderer to offer his technology, know-how and variations within the limits of the description and specifications.

The tenderer is requested to make an offer within these limits, to motivate his suggestions for the items which have been left open or which have been left to the suggestions of the tenderer.

The tenderer is requested to fill in the technical tables or the bill of quantities in conformity with these specifications. Price schedules are to be included in that chapter.

SLECO reserves the right not to consider offers which are not replying to these basic technical specifications.

### **1.19.2 Options**

The tenderer is invited to offer options, as an alternative or as a supplement to these basic specifications. SLECO has already suggested subjects which might be offered as an option.

Options can only be considered if they provide an economic or technical advantage when compared to the basic concept. The tenderer will motivate the advantages and disadvantages of the options in respect to performances, investment and/or operation cost. The tenderer will also clearly describe the influence of the proposed option on the other parts of the installation.

The tenderer will himself draft the technical tables which will contain at least the same information as the technical tables of the basic installation. All influenced parameters will be given in the technical tables.

The bill of quantities for the options will be given as clearly separated prices. The bill of quantities will consider the price changes (savings and/or extras) on all the influenced items of the installation. As such the price of the option can simply be added to or subtracted from the basic price.

## **1.20 UNIT COST FOR RAW MATERIALS, ENERGY AND RESIDUE TREATMENT**

ITEM (for guidance only)	UNIT	COST : BEF
lime (as CaO)	ton	4.200
limestone	ton	1.300
activated carbon	kg	50
caustic 50 %	ton	6.000
electricity	kWh	1,3
fuel	ton	14.000
residue for landfill	ton	2.000
residue for processing before landfilling	ton	5.000
bottom ash fluidized bed	ton	350

## **1.21 SERVICES AND PERFORMANCES**

### **1.21.1 Engineering - erection**

#### **1.21.1.1 Engineering before purchase order**

During the contract negotiations (before purchase order) the tenderer will clarify the technical details of his tender in dialogue with SLECO, especially concerning the following subjects :

- process flow diagrams (PFD)
- emissions performance diagram
- mass & thermal balances
- consumptions
- plant lay out
- concept of automation and instrumentation
- civil works
- safety
- battery limits
- architecture
- equipment specifications
- spare parts list
- wear and tear parts list

(this summary is not limitative)

Each of these subjects is to be clarified to a sufficient degree to ensure a complete quantitative and qualitative description.

#### 1.21.1.2 Engineering after purchase order

During detailed engineering the contractor will present the following technical documents for approval to SLECO :

- Engineering planning
- Construction planning
- Process flow diagrams (PFD's)

- Piping and instrument diagrams (P&ID's) in accordance with INDAVER standards
- All layout drawings (equipment layout included)
- Drawings of all stairs and platforms
- All single wire diagrams of electrical installations
- All interlock tables
- Study for hazards and operability
- Drawings with interconnections to the battery limits
- All drawings with safety installations such as safety showers, fire fighting tools, sprinklers, hoses, ...
- The complete list with critical interlocks
- Foundation drawings and calculations / steel structure drawings and calculations / architectural details, finishing specifications
- Piping layouts
- Example of standard for terminal list
- Training documents
- Complete spare part list with actual part numbers.
- Complete wear part list with actual part numbers and guaranteed minimum life time.
- start up procedure
- commissioning checklists
- performance test procedures, program and acceptance criteria

In principle, all components may only be purchased after written approval of SLECO. The approval by SLECO does not relieve the contractors from his responsibility nor guarantees in any way.

Following documents are to presented to SLECO for information :

- All software with explanation and remarks
- All cable lists and wire lists

- All technical documentation of purchased components
- Hook-up drawings of instruments

During the period of detailed engineering frequent progress meetings, at least twice a month, will be organised to evaluate the quality and progress of the engineering work. Place is at the construction site. Time is to be agreed between both parties.

From the beginning of the erection on site to the date of provisional acceptance by SLECO a weekly site meeting will be organised.

Meetings will be attended to by qualified personnel of the contractor, of all disciplines, with at least one representative of the contractor having decision authority.

### **1.21.2 Plant Operations**

The contractor will start the "cold start-up" with own personnel. At the end of "cold start-up" the contractor will go on with "hot start-up" and "line out". Cold start-up is finished when all equipment has been tested without incineration. During this status the contractor runs the installation with his own personnel and SLECO personnel witnesses the operation.

The contractor will invite SLECO personnel to assist to the warm start up as soon as he considers it appropriate.

The provisional acceptance tests will be run under responsibility and supervision of the contractor, but all operations will be executed by trained SLECO personnel.

Up to the provisional acceptance the contractor will run the plant in full continuous mode (24 h/day and 7 days/week) under his responsibility and with trained SLECO personnel.

After the provisional acceptance SLECO will run the plant in full continuous mode with its own personnel and under SLECO responsibility except during the test week for final acceptance, which will be run by SLECO personnel but under the responsibility of the contractor.

### **1.21.3 Training of personnel**

The personnel of SLECO will be trained by the contractor.

The training will provide the steps as defined in art. 18 of the CONTRACT ADMINISTRATION BOOK.

The training will be given in Dutch. This is a legal obligation.

#### **1.21.4 Assistance during plant operation**

After provisional acceptance by SLECO the contractor will ensure the required technical assistance during the plant operation for the guarantee period.

During the first two months of the plant operation by SLECO the contractor will provide a sufficiently skilled technician for the dayshift. The technician will be able to give advice regarding of operation, preventive and curative maintenance and trouble shooting for all parts of the installation. The technician will record for SLECO all his advises and comments concerning the installation and its operation on a daily base. A qualified technician will be available permanently, on site within one hour after a call of SLECO.

During the next two months a qualified technician will visit and inspect the installation at least once a week and add his comments in the daily record book kept by the operators of SLECO. During this period a qualified technician will be available within 24 h. This technician must be able to formulate conclusions after his investigation and must be authorised to take action immediately on his conclusions.

Again, please refer also to the CONTRACT ADMINISTRATION BOOK.

#### **1.21.5 Spare parts and wear parts**

The tenderer will attach a list with indication of the origin of the major components of the installation (pumps, vessels, fans, electrical parts, motors, instrumentation, valves, ...).

Standardisation, brand uniformity and parts compatibility must minimise the stock of parts and the number of suppliers for parts and services.

Spare parts and wear and tear parts as well as the services to replace them must be easy available by local suppliers. The contractor will guarantee an after sales service within 24 hours after a call of SLECO and from a service centre less than 200 km from the installation site. This service centre must have spare/wear parts and qualified personnel available to start an intervention at the latest 24 hours after SLECO's request.

##### **Spare parts :**

The tenderer will give a list of the spare parts with a value of more than 300.000 BEF. Spare parts are parts of the equipment, which have to be taken in stock to guarantee the immediate start of the repair of the installation during the start up and the guarantee period but which are not wear and tear parts, i.e. for which the wear and tear is so that the normal life time is much longer than the guarantee time of two years.

The tenderer will give technical description of those spare parts and wear and tear parts that are unique for the proposed kind of installation. Unique means that the part is not commercially available standard equipment. The tenderer will give the cost for the part and the labour time to replace it.

The tenderer will give the total value of all spare parts.

**Wear parts :**

The tenderer will give a list of the most important wear and tear parts with a value of more than 300.000 BEF.

The tenderer will give the total value of all wear parts. The tenderer will indicate a minimum life time for each wear part he will propose.

**General**

In a separate item of the bill of quantities the contractor will propose the most important spare/wear and tear parts to be purchased together with the installation. There will be a price for each part separately.

During detailed engineering and after the selection of each part of the installation the contractor will supply at least 3 months before provisional acceptance test a complete documentation with all actual numbers of spare / wear parts.

When the delivery time for a spare part or a wear and tear part is longer than the time between approval of the spare parts list respectively wear and tear parts list and the provisional acceptance test, SLECO cannot be held responsible for the unavailability of these parts in his warehouse during provisional acceptance test and up to end of delivery time.

**1.21.6 Technical file**

Prior to provisional acceptance and before operation by SLECO the contractor will supply SLECO with 4 copies of the technical file. A fifth copy will be supplied on software carrier.

The contractor will keep the final technical file in as built status as long as the installation changes due to contractual requests.

The technical file will be in complete accordance with the specifications defined in the chapter "Table of content of technical files".

The realisation of the technical file will be started as soon as the P&Id's are approved for design. The file will contain all relevant information at the current time. It will be accessible for SLECO and for the contractor.

## 1.21.7 Maintenance

### 1.21.7.1 Information on maintenance in the tender

Not the investment cost on its own but the overall cost of operation is essential to the economical feasibility of the project. The overall cost of operation is, in turn, highly influenced by the cost of maintenance.

The tenderer will specify the yearly maintenance cost. This cost includes labour, tools, spare parts and wear and tear parts.

### 1.21.7.2 Information on Maintenance during construction

SLECO will use a maintenance management system (not part of TENDER SCOPE). All information on maintenance will be archived using this system. Every equipment part will be stored in the systems data base. A 'tree structure' will make every part and every equipment traceable. The system is then useful to do warehouse stock control, maintenance history recording, etc... The entry of the data in the software will be done by SLECO .

The contractor will provide all information on maintenance on EXCEL and WORD files in such a way that it is fully compatible with this information system. The language is preferably Dutch, but may be English, French or German. Other languages are not allowed.

At least three (3) months before the start of the provisional acceptance tests, the spare parts and wear/tear parts information will be completed. The list will contain all necessary information for accurate ordering. All information in the spare parts and wear/tear parts list will be in Dutch.

The contractor will compose a complete preventive maintenance program, including :

- a list of periodical lubrications,
- a list of periodical vibration measurements,
- a list of periodical thickness measurements,
- a list of periodical calibrations,
- a periodical inspection tour.

All control charts will give the normal tolerance range.

The program will start as soon as the first equipment part runs.

Before provisional acceptance, all preventive maintenance activities will be carried out by the contractor.

The contractor will provide a review of all the repetitive periodical activities for the annual shut down period for maintenance, including works to be executed, necessary spare parts, check outs, calibrations, etc.

The contractor will compose a list of all legally imposed periodical controls for safety.

All this information is an integral part of the technical file, which is an integral part of the scope of works which has to be completed before provisional acceptance.