



Addendum

to the

MODIFICATIONS TO THE REPORT OF THE ENVIRONMENTAL IMPACT ASSESSMENT

CENTRAL SALTILLO, S. A. DE C. V.

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1. INTRODUCTION

This *Addendum to the Modifications to the Report of the Environmental Impact Assessment* is a supplement to the information previously submitted to the *International Finance Corporation* (IFC) by Central Saltillo, S.A. de C.V. (April 2000).

The purpose of this document is to show the results obtained from the different studies and analysis performed with respect to the auxiliary well drilled by Central Saltillo, S.A. de C.V. (CSO), as a source of support for water supply for the correct operation of the Central Saltillo combined cycle thermoelectric power station, the main source being the well drilled by CSO in the property of the power station.

In addition, it is provided a comparison of the results obtained for the well in question with the characteristics of the first well drilled by CSO, well number 2, and with the characteristics of surrounding wells. The latter for the purpose of evaluating the possible implications with respect to the water treatment system foreseen for the power station, and with respect to the water potential that can be exploited by the local population for human consumption or for agricultural purposes.

REFERENCES

1. Central Saltillo Project 247.5 MW; Environmental Impact Assessment Report, August 1999.
2. Central Saltillo Project 247.5 MW; Modifications to the Report of the Environmental Impact Assessment – Change of the Water Supply Source, April 2000.

2. BACKGROUND

Central Saltillo, S.A. de C.V. is an affiliate of Electricité de France (EDF), company which is achieving the project named "Combined Cycle Thermoelectric Power Station Saltillo (Central Saltillo)", with a capacity of 247.5 MW. This project is built at the kilometer 19 of the Saltillo-Monterrey highway, in the Industrial Park Santa María, Municipality of Ramos Arizpe, State of Coahuila, Mexico.

On June the 18th, 1999, CSO, with the support of the company Dames & Moore of Mexico, and in compliance with the guidelines of IFC, carried out in the Municipality of Ramos Arizpe a first Information and Public Consultation Meeting, for the purpose of informing the community on the characteristics of the project and of clarifying any doubts and comments of the interested parties. For this same purpose, a meeting at Santa María, the town neighboring the power station, was held to inform and to take into consideration the opinion of the population residing around the power station.

Originally, the project considered for its water supply, the use of urban residual waters from Ramos Arizpe, previously treated in the facilities of the power station, by means of a biological type system with activated mud. A series of analysis performed with samples from this source showed strong variances in the composition of these waters, due to the presence of industrial residual water and to the contribution of rain water. If this source of water had been chosen, it would have seriously affected the water treatment system, which more than likely, would have held back the operation of the power station, reason why CSO was forced to find another solution.

It was determined that the best alternative consisted in using water from a deep well. In general in the area of the power station the water is of the salty type, not fit for human consumption or agricultural irrigation, characteristics that were confirmed with the first well drilled by CSO, inside the property of the power station. The characteristics of the water of this well were taken into consideration for the final design of the treatment facilities, reason why the use of the same to supply the power station is ensured, just as mentioned in the Modifications to Environmental Impact Evaluation Report (April 2000). The flow volume capability of this well covers the volume required for normal operation of the power station with natural gas (2.65 liters / second). However, the operation with diesel requires a higher water flow volume, estimated at 6 liters / second. Based on the foregoing and in the event of a contingency with the first well, a second auxiliary well was drilled, located close to the connection point of gas pipeline of the project with the Pemex's gas pipeline.

A geohydrological study of the region, performed during 1998 by the Civil Engineering Studies Management of the Federal Electricity Commission (CFE), allowed to predetermine the location point of the auxiliary well, as favorable to find sufficient water, in an area of free emergence, pursuant to the zoning set forth by

the National Water Commission (CNA), and where the quality of same is not adequate for human consumption or for agricultural purposes.

On April the 3rd, 2000 a Second Information and Public Consultation Meeting was held at the municipality of Ramos Arizpe, for the purpose of informing the community on the degree of progress of the project and, specifically, on the change in the water supply source. Information on the perforation and water quality was provided on the first well perforated by CSO, well number 2, and the location and perforation works on the auxiliary well, well number 3, were only mentioned, because at that time the final results on the characteristics of same were not yet available.

By the end of May 2000 the drilling of the auxiliary well, well number 3, was completed. During that same month, sampling and the corresponding analysis were carried out, which gave rise to the final technical evaluation during June and July 2000, performed by the engineers of the National Thermic Equipment Center (CNET) of EDF, in Paris, France.

In the following chapters the reports of the results obtained are listed after the drilling of the well and the analysis made of the water on well number 3.

REFERENCES

1. Central Saltillo Project, 247.5 MW; Environmental Impact Assessment Report, August 1999.
2. Central Saltillo Project, 247.5 MW; Modifications to the Report of the Environmental Impact Assessment - Change of the Water Supply Source, April 2000.
3. Paulino Dorantes López, José A. Castillo Aguiñaga. Geohydrological Study on the Parras Formation in the vicinity of the Saltillo Combined Cycle Power Station, Municipality of Ramos Arizpe, Coahuila. Federal Electricity Commission, Technical Subdirection Management of Civil Engineering Studies, Superintendence of Studies, Northern Zone, Department of Geohydrology, December 1998.

3. PERFORMED STUDIES, ANALYSIS AND REPORTS

3.1 DRILLING OF WELL NUMBER 3

Exhibit 1 contains a copy of the well drilling report, as does the location sketch of same.

The general characteristics of the well can be summarized as follows:

Total depth:	400 m
Diameter from 0 to 34 m:	26"
Diameter from 34 to 400 m:	12 ¼"
Volume available:	Between 6 and 7 liters / second.

3.2 SAMPLING AND RESULTS OF WATER ANALYSIS

Exhibit 2 shows the results of the analysis performed on the water samples from the well. A first sampling was carried out at 140 m deep and another at 170 m deep.

It should be noted that the project involves the use of a final pump to extract water at approximate 170 m deep, which implies that the most relevant results will be those obtained from sample taken at this depth.

"ECO Industrial" was the laboratory responsible for coordinating the performance of the analysis in question. This laboratory is duly endorsed by the authorities for the realization for performing samples and analysis and, likewise, "ECO Industrial" has been acknowledged by the CNET of EDF, like an appropriate laboratory for the works that have been carried out and pending to be done.

"ECO Industrial" has used the services of other specialized laboratories for the performance of the required analysis. Thus, the analysis reports shown have been issued by IDQ-INDEQUIM Laboratories (*Investigación y Desarrollo Químico, S. A. de C. V.*), and ENTEC, and have been duly endorsed by the National Certification of Laboratory Test System (SINALP), the official organization responsible for certifying the different laboratories for the performance of this type of tests.

4.0 CLARIFICATIONS AND CONCLUSIONS

On August the 18th, 2000, the CNET informed the technical consultants of the IFC (Mott MacDonald's Bureau of Brighton, United Kingdom), by means of a fax, its considerations and conclusions on the feasibility of using both well number 2, as well as well number 3 for supplying water to the power station. Based on the results obtained for well number 3, the facilities foreseen for the water treatment station and the water storage, as they have been designed, allow the power station to operate solely with the water of well number 2 or with a mixture of the water from the two wells, number 2 and number 3. Additionally, the storage tanks of pretreated water allow for an autonomous system during 48 hours under the most critical conditions, that is during the diesel operation, which covers the period required for replacing the main pump of well number 2 with a spare pump. See Exhibit 3.

With respect to the water quality of well number 3 compared with that of the surrounding wells, the CNET transmitted CSO its comments by electronic mail on August the 28th, 2000, comments which were likewise transmitted for comments to the IFC. Exhibit 4 shows this official communication, as well as an extract of the map prepared by the CFE in its geohydrological study, for the location of neighboring wells and for a better interpretation of the conclusions. Briefly, it can be noted that the salinity calculated for well number 3 is higher than that of neighboring wells and, on the other hand, the difference in the content of nitrates between the water of well number 3 and that of neighboring wells confirms that the water bearing stratum are independent. Thus, it is concluded that due to this, when exploiting well number 3, and based on the volume foreseen, which is reduced, and also based on the water quality results obtained, the agricultural users of the place are not affected, and neither is a favorable source used to supply water fit for human consumption.

After receiving the information set forth above, on August the 30th, 2000, the IFC expressed, by means of a message of an electronic mail, certain doubts transcribed as follows:

"1. Based on the data presented on Table 3, page 13 of the report titled "Modifications to the Report of the Environmental Impact Assessment Central Saltillo - Change of the Water Supply Source" (April 2000), the high values of chlorides, sulfates and salinity were noted as the precursors for the water not to be used for irrigation purposes. The May 9 and May 19 analysis show that the values of chlorides and sulfates are extremely high (compared to the ones presented in the April 2000 report), but the salinity values are very low. Could you please provide your technical assessment for the water analysis on:

- *whether Central Saltillo and Dames & Moore Mexico are of the view that the water quality and quantity of the well number 3 is consistent with the water quality of the original well data provided by CFE, and if so, why;*

- *whether Central Saltillo is proposing to use this water for the power plant and if so, with what water treatment specifications (before and after treatment).*

2. Furthermore, the high values for chlorides and sulfates (for the well, or well number 3) are very high compared to the values presented in the municipal wastewater analysis (the very original plan as presented in the Executive Summary of the EIA, which was determined to be rejected). With what treatment technologies will the proposed treatment for the well water be able to treat this water to acceptable levels?"

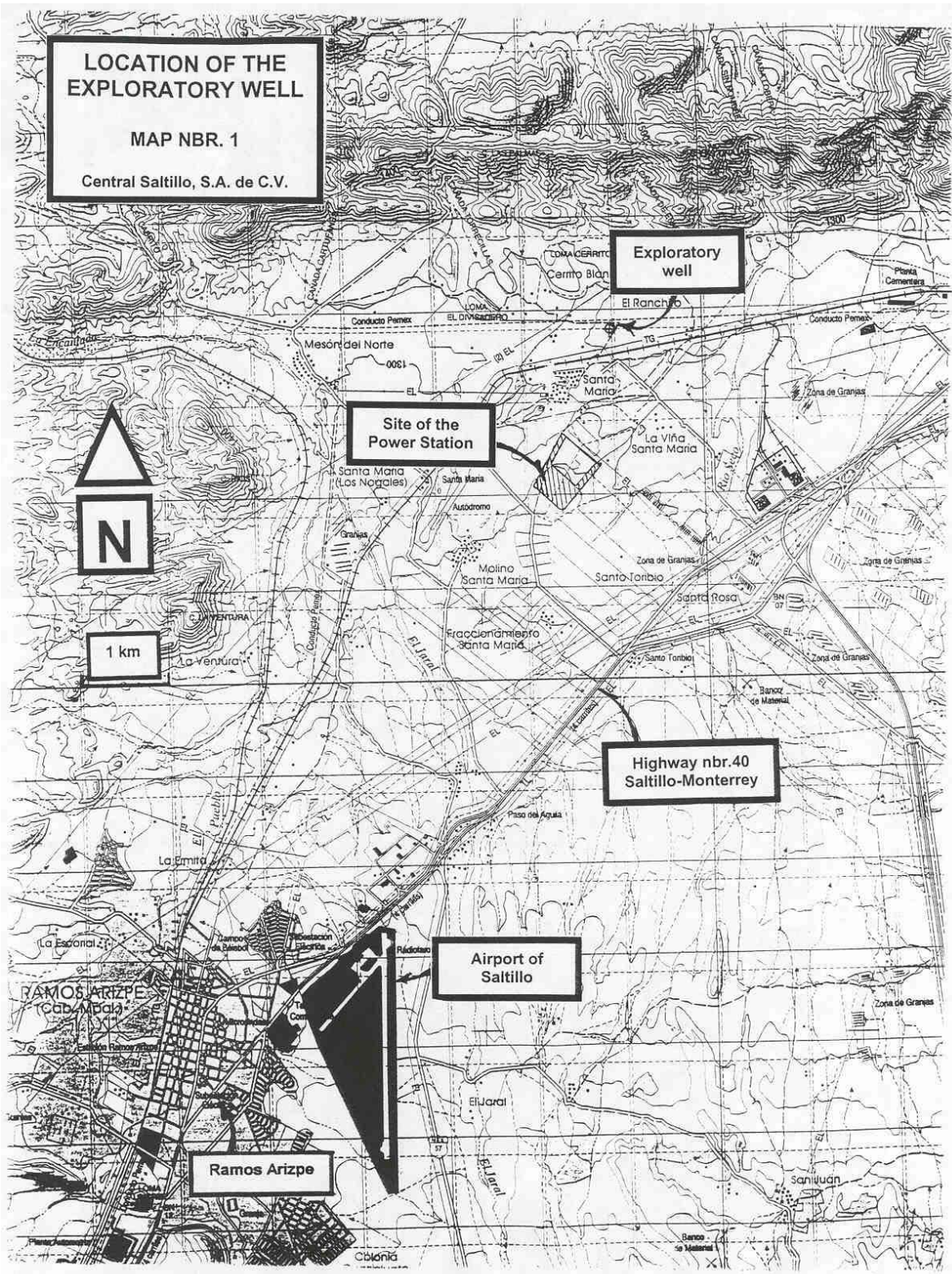
Exhibit 5 shows the original message issued by the IFC, and the explanations that were provided to the IFC by CSO as answers.

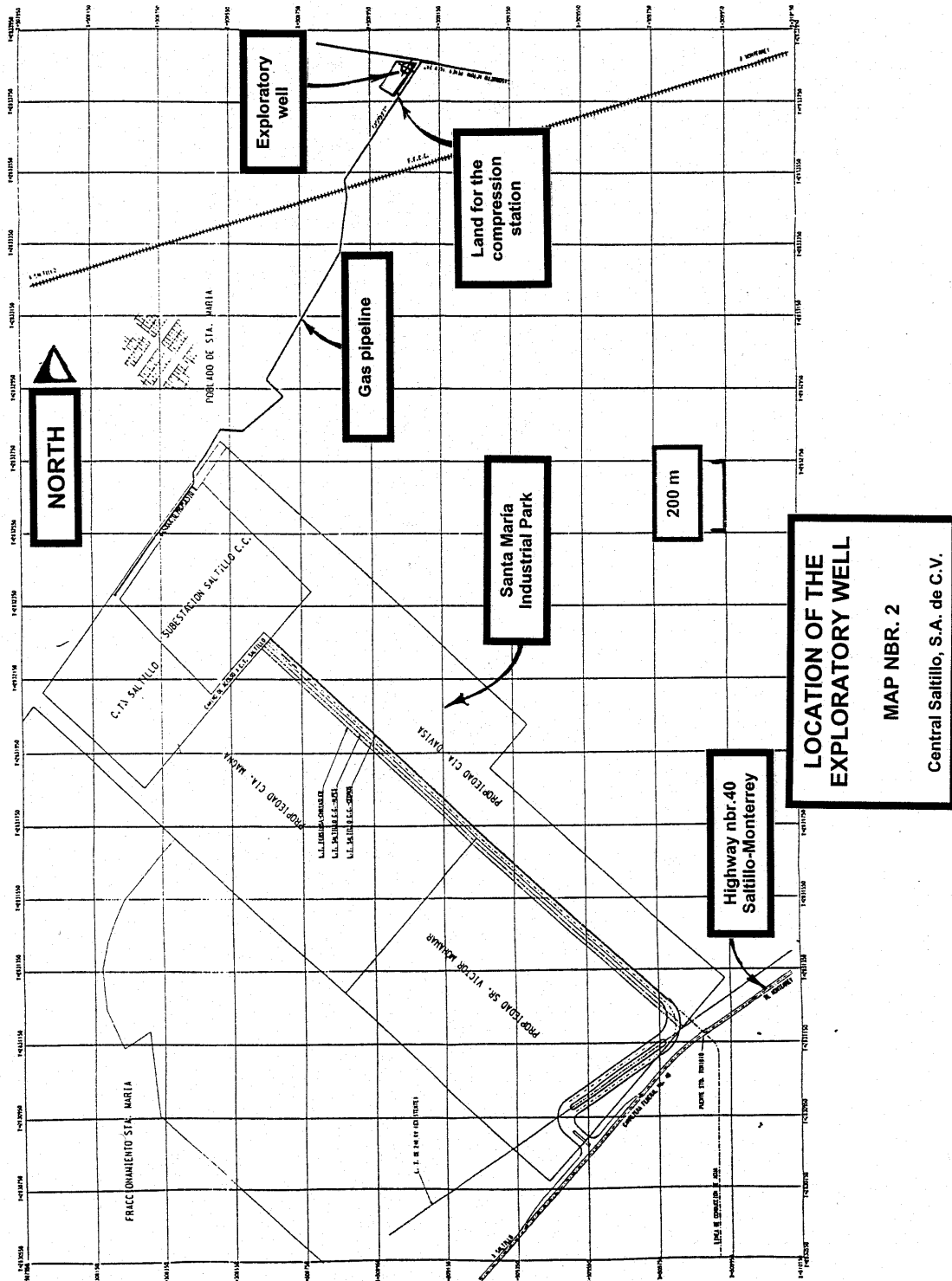
As a general conclusion, one can confirm that according to the data contained in this document, the quality and quantity of the water obtained from the auxiliary well, well number 3, are consistent with the data obtained from the main well located in the power station site, well number 2, which implies that the water treatment system foreseen for the power station, will be appropriately used with the administration of both wells. Also, the water of well number 3 shows characteristics that make it not fit for human consumption or for irrigation, which translates in that there is practically no impact on the water consumers for said purposes in that area.

It should be noted, that the data shown in this document correspond to samplings and tests carried out in due times. In the future, it will be possible to confirm these conclusions through the monitoring that will be made to control the water volumes and quality, because of the same water treatment system. This monitoring implies measuring the used water volume, as well as laboratory samplings and laboratory analysis.

EXHIBIT 1

Report on well drilling.





LOCATION OF THE EXPLORATORY WELL
MAP NBR. 2
 Central Saltillo, S.A. de C.V.

EXHIBIT 2

Results of the water analysis of well number 3.

EXHIBIT 3

**Confirmation of EDF/CNET on the feasibility of using
the two wells, numbers 2 and 3.**

EXHIBIT 4

Comments of EDF/CNET about the water quality of well number 3, compared with the water quality of surrounding wells.

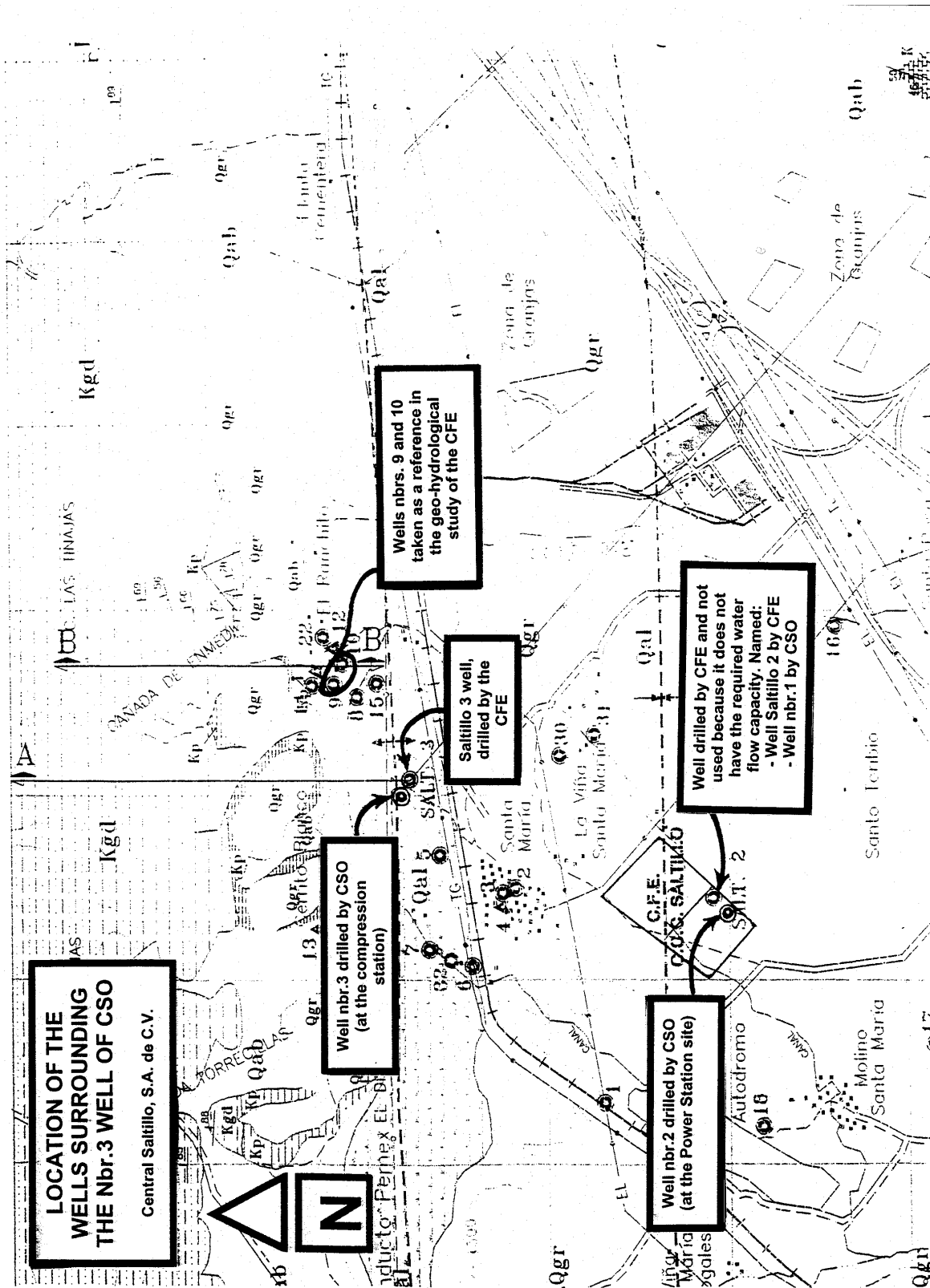


EXHIBIT 5

Clarifications submitted to the IFC.

**CLARIFICATIONS ON THE CHARACTERISTICS OF THE WELLS AND WATER
TREATMENT FOR CENTRAL SALTILLO, S. A. DE C.V.**

a) CSO confirms that, according to the conclusions obtained by the CNET engineers, from the point of view of water quality and quantity, well number 3 shows results from the analysis which are coherent and compatible with those obtained from well number 2 (also drilled by CSO) and with those set forth by the CFE in its geohydrological report issued during December 1998.

b) Attached to the document herein is a description of the water treatment before using same in the facilities of the power station. Appendix A.

c) Once the water is used in the process of its treatment and in the production of electric energy, there are two discharge types, both destined to the evaporation lagoon through piping. Hereinafter, we provide details on the structure and operation of the lagoon. A discharge comes from the osmosis treatment process and the second corresponds to the discharge from the boilers. The composition foreseen for the resulting discharge on the osmosis process is attached (Chart 1). This composition is valid for water treatment of the well on the site (well number 2). The composition of the water discharged from the osmosis process on the treatment of water mixture from wells numbers 2 and 3, is foreseen as set forth in Chart 2. It can be noted that the salinity obtained will be more than in the case of the water coming only from well number 2.

d) The composition of the boilers discharge is shown on Chart 3.

e) The main problem linked to sewage water as a source of water supply was in fact the great variability of its composition. These important variances in the composition were not compatible with the reliable operation of a biological treatment system and they hindered the possibility of guaranteeing an appropriate and constant water quality at the physical-chemical treatment exit, because this treatment can only be designed for a limited range of water quality. The high concentrations values of sulfates and chlorides in the sewage water represented a risk for biological treatment. As the biological treatment was discarded (water is drawn from the well instead of sewage water), the risk that considers the sulfates and chlorides no longer exists.

f) The sulfates and chlorides, in the case of the well water, are eliminated at the inverse osmosis level. The accepted limit values from the treatment system are as follow:

CHLORIDES:	320 mg/l
SULFATES:	1,706 mg/l

These values can be respected in the event the waters of the two wells are mixed, in proportion to the volume obtained from each, as shown on the enclosed chart (chart 4), wherein the following data is shown:

* Composition of the water of the CSO 2 well.

- * Composition of the water of the CSO 3 well (170m)
- * Composition of the resulting water, generated by the mixture of the CSO 2 and CSO3 wells, in proportion to their volume (chlorides: 231 mg/l, sulfates: 1458 mg/l).

It should be noted that for the gas operation, the CSO 2 well will be used as the basic well; the CSO 3 well will be occasionally used mixing its water with that of the CSO 2 well during the gas operation; and systematically during the diesel fuel operation, which is limited to 360 hours per year. The construction and design provisions of the raw water storage tank are such that they guarantee a homogeneous mixture of the two waters (two water feeding entry ports on the top part of the tank and an pumping discharge in the low part of the tank).

g) The salinity values in g/l shown on Chart 4, are calculated values, being of the sum of the ions in solution, taking as measuring unit to determine the water treatment limits g/l (gram per liter). The salinity of 3.5 g/l of the CSO 3 well is coherent with the salinity of the neighboring wells, although it is lightly over the maximum noted in neighboring wells (3.1 g/l) and much higher than the salinity of the CSO 2 well (1.26 g/l).

h) From the analysis results, the values obtained by INDEQUIM were not directly taken into account, because there is no simple and direct conversion of the unit taken from the RAS Index to g/l. In addition, this unit was not considered for the design and sizing of the water treatment installation. It should be noted that the RAS Index is a specific unit that only estimates the probable effect of the sodium on the physical characteristics of the ground.

i) Evaporation Lagoon: the evaporation lagoon is located northwest from the site of the property and it will work as the storage system and final disposition of the water discharged from the inverse osmosis treatment plant and will allow same to ensure a “zero discharge” scheme, that is to say there will be no discharges in receiving bodies of residual water from the operating process of the power station.

The lagoon will be lined with a H.D.P. waterproof membrane, 1.5 mm thick at the base as well as at the slope; saline residual water will run from the inverse osmosis treatment and from the steam generation purges through a tubing line.

The salts stored in the evaporation lagoon will not have the hazardous characteristic set forth by the standards, however, they will be subject of analysis to evidence they are not hazardous. In the remote case that it could be determined that they have some of the hazardous characteristics as set forth in the Mexican standards, the same shall be classified and placed in a temporary warehouse designed according to the applicable regulations.

The sludge generated in the evaporation lagoon are salts and will be stored in the lagoon during the life foreseen for the power station. If after their analysis it is

determined that they are hazardous residues, they will be sent to an authorized site for final disposition specified for said residues.

Chart 1

Nbr.of project AI-04-99

Client: EDF

Location: Saltillo, Coah.

Date: 2-Aug-00

Analysis of concentrate (or discharge).

		mg / l	
Calcio	Ca ⁺⁺	47.90	
Magnesio	Mg ⁺⁺	29.10	
Sodio	Na ⁺	1,501.90	
Potasio	K ⁺	5.50	
Amonia	NH ₄	0.00	
Bario	Ba ⁺⁺	0.00	
Estroncio	Sr ⁺⁺	0.20	
Carbonatos	CO ₃ ⁼	11.50	
Bicarbonatos	HCO ₃ ⁻	98.50	
Sulfatos	SO ₄ ⁼	1,810.30	
Cloruros	Cl ⁻	1,038.00	
Fluor	F ⁻	1.50	
Nitratos	NO ₃ ⁻	0.00	
Silice	SiO ₂	41.40	
Sol. Tot. Disuel.	TDS	4,585.80	mg / l
	pH	8.5 - 9.5	

Chart 2

Nbr. of Project AI-04-99
 Location: Saltillo, Coah.

Client: EDF
 Date: 2-Aug-00

Analysis of concentrate (or discharge).

Raw water from:		Well CSO 2	Wells CSO 2 and 3 mixed according to the water flow		
		mg / l		mg / l	
Calcio	Ca ⁺⁺	47.90		50	
Magnesio	Mg ⁺⁺	29.10		580	
Sodio	Na ⁺	1,501.90		1500	
Potasio	K ⁺	5.50		8	
Amonia	NH ₄	0.00		0	
Bario	Ba ⁺⁺	0.00		0	
Estroncio	Sr ⁺⁺	0.20		1	
Carbonatos	CO ₃ ⁼	11.50		12	
Bicarbonatos	HCO ₃ ⁻	98.50		100	
Sulfatos	SO ₄ ⁼	1,810.30		6000	
Cloruros	Cl ⁻	1,038.00		3000	
Fluor	F ⁻	1.50		3	
Nitratos	NO ₃ ⁻	0.00		0	
Silice	SiO ₂	41.40		40	
Sol. Tot. Disuel.	TDS	4,585.80	mg / l	11,300	mg/l
	pH	8.5 - 9.5		8.5 - 9.5	

Chart 3

AGUA DESCARGADA POR LA CALDERA WASTE WATER FROM BOILER

pH	9,5 to 10,5	pH
total iron	<1 ppm	Fierro total
total copper	<0,3 ppm	Cobre total
conductivity	<7000 microS/cm	Conductivida d
silica	<100 ppm SiO ₂	Silices
phosphate	10 to 20 ppm PO ₄	Fosfatos
hydrazine	traces	Hidrazina
appearance	clear	Apariencia

Chart 4

	Well on plant area (CSO 2)	Well on compression station area (CSO 3)	Mix of well CSO 2 and CSO 3	maximum for treatment
parameter	Analysis of INDEQUIM	Analysis of EDF	Analysis of INDEQUIM pump at 170 m	
aluminium (mg/l)		0.05		
barium (mg/l)	<1	< 0,1	< 0,083	< 0,09
Bromide (mg/l)		<1		
calcium (mg/l)	51.27	47.4	368	275.05
fer (mg/l)	1,29 *	0.057	0,39 *	0.06
magnesium (mg/l)	14.95	13.8	211	153.46
manganese (mg/l)	< 0,1	0.02	0.015	0.04
ionised silica (mg/l)	10.44	7.6	9.74	9.95
sodium (mg/l)	377.68	295.3	350.17	358.24
chlorides (mg/l)	81	76.2	294	231.49
sulphates (mg/l)	440	420	1882	1458.80
carbonates (mg/l)	19.8	< 24	0	5.81
bicarbonates (mg/l)	356	368	387	377.90
nitrates (mg/l)	13	<1	3.4	6.22
fluorides (mg/l)	1.01	1.15	1.5	1.36
potassium (mg/l)	1.37	1.6	2.02	1.83
strontium (mg/l)	1.56	1.31	1.82	1.74
conductivity (µS/cm)	1588		3100	2656.26
TSS (total suspended solids) (ppm)	34	14	13	19.16
turbidity (NTU)	10.6		< 5	
pH	8.02		7.6	7.72
temperature (°C)	27.9			
salinity (g/l)		1,26 (calcul)	3,5 (calcul)	2,88 (calcul)
salinity (RAS)	65.69		4.2	
TOC (mg/l)				
Water flow from well (l/s)	2.7		6.5	9.2
* Total iron (suspended and dissolved)				

APPENDIX A

Description of the water treatment of the well

9.a. Results of water quality to be used

Analysis of raw water

The following are the results of the raw water analysis performed on the water from the two wells that will supply this resource to the Power Station. In addition, the parameters provided by the Comisión Federal de Electricidad as included.

Well on the site (makes reference to the well described in item a), number two, of the official document specified as well 1): the chart shows the results of the two analysis made, one by a laboratory in Saltillo and another laboratory in France.

Well for the compression station (it is the well to which reference is made in item a), number two, of the official document specified as well 2): the chart shows the results of the sampling analysis at 170 m (the 140 m analysis should not be taken into account as it is not representative of the final operation conditions of the well).

The maximum concentrations defined in the water treatment installation agreement, the values defined values before withdrawing option A (decarbonation) that contributes more flexibility on the part of the facilities are set forth as reference.

Parameter	Well on site	Well	Parameters	
	Analysis INDEQUIM	Station comp. Analysis EDF	On the agreement SO3501 Analysis INDEQUIM Pump at 170 m	(CFE-CSO) Max. Value
Aluminum (mg/l)		0,05		
Barium (mg/l)	<1	<0,1	<0,083	0,05
Bromine (mg/l)		<1		
Calcium (mg/l)	51,27	47,4	368	395,2
Iron (mg/l)	1,29	0,057	0,39	0,2
Magnesium (mg/l)	14,95	13,8	211	199,2
Manganese (mg/l)	<0,1	0,02	0,015	0,2
Ionized silica (mg/l)	10,44	7,6	9,74	40
Sodium (mg/l)	377,68	295,3	350,17	248
Chlorine (mg/l)	81	76,2	294	320,2
Sulfates (mg/l)	440	420	1882	1706,9
Carbonates (mg/l)	19,8	<24	0	-
Bicarbonates (mg/l)	356	368	387	439,2
Nitrates (mg/l)	13	<1	3,4	38,4
Fluoride (mg/l)	1,01	1,15	1,5	1
Potassium (mg/l)	1,37	1,6	2,02	15,6

Strontium (mg/l)	1,56	1,31	1,82	20
Conductivity (µS/cm)	1588		3100	4690
Total suspended solids (ppm)	34	14	13	8
Turbidity (NTU)	10,6		<5	15
Ph	8,02		7,6	7,4
Temperature (°C)	27,9			35
Salinity (g/l)				3,1

In the case of well 2 that shows concentrations slightly higher than the maximum concentrations defined in the agreement, we foresee the same treatment with certain small adaptations to the pretreatment that do not alter the current procedures of the installation.

On the other hand, the reagent consumption will be slightly modified in the case of the use of well 2, in reasonable proportions.

9.b. Description of the physical and chemical treatment

The information contained in the preliminary design book, describes in detail the physical and chemical treatment considered for the water treatment station and the following is a transcription of the issues described in said preliminary design book, chapter 2, regarding the mechanical engineering.

WATER SUPPLY AND TREATMENT

OPERATIONS OF THE SYSTEM

The water supply system's operation cover the water needs (quantity and quality) of the power station. These needs are as follow:

- Raw water / GHB system: pretreatment feeding and supplement of the fire safety system.
- Industrial water / GHD system: demineralization site feeding and fire water tanks.
- Service water / GHE system: contribution to coolers by evaporation, washing of the stopped compressor, various uses (washing).
- Demineralization water / GHC system: contribute to the condensation tank of the air condenser (to feed the water-vapor thermodynamic cycle), TG injection running on diesel for the control of NOx, continuous washing of running compressor.
- Fresh water / GKB system: domestic uses.

DESCRIPTION OF THE SYSTEM AND ITS OTHER COMPONENTS

As can be appreciated from the general water management scheme (plan SAXOG**---WPF001), the water supply system is mainly integrated by the following elements:

- Installation of raw water pretreatment (GB* system) that produces industrial water.
- Dimineralization installation (GC* system) that produces service water and dimineralized water.
- Potabilizing installation (GKB system) that produces drinking water. This system also includes the corresponding storage tanks.*

To cover the requirements of the power station, the different treatments produce the following water flows:

- Pretreatment: 20 m³/h continuously.
- Dimineralization: Inverse osmosis: 3 x 6 m³/h
- Electrodeionization: 2 x 7 m³/h
- Potabilization: 2 x 1 m³/h

RAW WATER SUPPLY

Water supply to the site is provided starting from water extracted from the two wells, one located on the site and the other near the gas compression station.

For the well located in the vicinity of the gas compression station, the water is run to the site by means of a pumping station and an aqueduct. The supply volume is 20 m³/h at an approximate pressure of 2 bars. The site well can provide a supplement of 10 m³/h.

INSTALLATION DE GB¹ PRETREATMENT OF RAW WATER

The pretreatment of raw water can be appreciated from the diagrams of the piping and instrumentation (plan SAX0GB*3501WFD181 and SAX0GB*3501WFD114). The pretreatment system treats raw water and produces 20 m³/h of industrial water.

The installation of raw water pretreatment is composed of two stages: a physicochemical and a filtration treatment.

Typically the physicochemical treatment comprise the following stages:

- Decarbonization with lime.
- Clotting by injection of ferric chloride + flocculation by polymer injection (eventually), followed by sedimentation and filtration.
- The decarbonated sludge generated by the treatment are dehydrated in a band filter and later stored for an eventual valuation (agricultural uses).

STORAGE OF FIRE PREVENTION WATER AND INDUSTRIAL WATER

The common water storage for fire prevention and industrial water is distributed in two 2070 m³ useful deposits.

¹ The storage tank sizing is designed in such a way as to allow for continuous supply in the event of an emergency by means of tank trucks, in case the treatments would be disabled.

INSTALLATION DE GC DIMINERALIZATION

The dimineralization system can be appreciated in the pipes and instrumentation plans (plans SAX0GC*3501WFD116, SAX0GC*3501WFD117 and SAX0GC*3501WFD118).

The installation is laid out with three treatment lines, 5 m³/h each, and treats industrial water to produce two types of water:

- Partially treated water (service water) which, on the one hand, is stored in the service water tank and, on the other, feeds the potabilization installation.
- Fully treated water, stored in the dimineralization tanks.
- The treatment is structured as follows:
 - supply pumps.
 - First filtration and softening treatment.
 - Inverse osmosis.
 - Electrodeionization (for the complete dimineralization of water).
 - Storage system and distribution of reagents.

The start-up and stops are automatically made, based on the storage deposit levels.

STORAGE OF DIMINERALIZED AND SERVICE WATER

The storage of dimineralized water is distributed in two useful tanks, 400 m³ each.

The storage of service water is of 350 m³, useful.

INSTALLATION OF GKB POTABILIZATION

The installation partially treats the dimineralized water to the exit from the inverse osmosis and produces the fresh water.

The treatment is a chlorination with sodium hypochlorite. The fresh water storage is 2 x 4 m³.

DESIGN BASIS

The general G** system covers the following requirements:

- Produces the different water qualities required to operate the power station, starting from the raw water that supplies the site.
- Covers the water needs of the power station, whatever its necessities (dimineralized water flow + service water: 5.77 t/h operating with gas and 15.35 t/h operating with diesel, for a full load operation under design conditions during the summer design).
- Covers these needs on a continuous basis, which implies a 100% availability to be automatically operated and to minimize the maintenance manual interventions to ensure availability.

The main water needs (maximum) taken into consideration are:

- Contribution for the boiler: 1.44 m³/h.
- Contribution for the air condenser: maximum 4 m³/h.
- Injection running with diesel: 11.41 m³/h.

These demands condition:

- the selection of treatments.
- The sizing of the treatment and storage facilities, as well as the redundancy of materials.
- The exploitation mode of the treatments

RAW WATER GB* PRETREATMENT INSTALLATION

The raw water pretreatment system has been sized to cover the needs of the site; to supply the dimineralization post, the potabilization post, fire prevention water, service water. A single 20 m³/h line is foreseen located between the pretreatment and treatment systems. In the case of unavailability of this line, the industrial water storage tanks guarantee 2 days of autonomy (in addition to the necessary volume in the event of fire), which allows for water to be contributed by means of tank trucks, without the need to stop the facilities.

All the pumps are redundant: during normal operation, one is in operation and the other one on hold. The change of one pump to another is automatically carried out. This type of operation has the following advantages:

- A treatment known and proven at an industrial level.
- Continuous procedure.
- Automatic operation.
- Manual involvement of little importance (evacuation of mud).

The start-up and the shut-down of the treatment are automatically carried out based on the storage deposit levels.

STORAGE OF FIRE PREVENTION WATER AND INDUSTRIAL WATER

The normal fire prevention and industrial water storage:*

- Ensures the fire prevention water reserve (3 x 1320 m³).
- Supplies the demineralization post (3 x 750 m³).
- The storage tanks are equipped with the necessary instruments to control the start-up and shut-down of the pretreatment installation.

INSTALLATION OF GC DIMINERALIZATION**

The system covers the following needs:

- Service water: contribution for the coolers by evaporation, various uses (washing).
- Dimineralized water: contributes to the condensation tank of the air condenser (feeding of the water-vapor cycle), injection to the TG running with diesel for the control of NO_x.

The sizing should allow to cover the maximum dimineralized water and service water needs, which corresponds to the diesel operation, because to control the No_x emissions levels, an additional water contribution is required for injection at the TG.

The system is integrated by:

- Three lines for inverse osmosis treatment, each 6 m³/h. When operating with gas, a single line is in operation. When operating with diesel, the three lines are in operation.

* There is a useful raw water storage, 2070 m³, to be used as fire prevention water in the event of an emergency.

- Two treatment lines for electrodeionization, each 7 m³/h. When operating with gas, a single line is in operation. When operating with diesel, the two lines are in operation and the necessary supplement is contributed thanks to the stored industrial water.

All the pumps are redundant: when normally running one is in operation and the other one on stand-by. The pump change from one to the other is automatically carried out.

This treatment has the following advantages:

- A well known and prove treatment at an industrial level.
- A continuous procedure.
- Automatically operates.
- Does not use reagents (acids or soda) for inverse osmosis.

Start-up and shut-down are automatic based on the storage deposit levels.

STORAGE OF DIMINERALIZED WATER AND SERVICE WATER

The storage dimineralized water is distributed in two tanks useful tanks, each with 400 m³. This corresponds to a 48 hour run with diesel. In the event of disability of the water treatment system, the power station will be supplied with dimineralized water within a period of less than two days.

The service water storage is 350 m³, corresponding to a 48 hour run with gas, plus some washings.

These capabilities allow the supply to be provided by means of tank trucks, in the event of disability of the installation.

The storage tanks are equipped with the necessary instruments to control the start-up and shut-down of the dimineralization installation.

INSTALLATION OF GKB POTABILIZATION

This installation treats the partially dimineralized water when exiting inverse osmosis and, thus, produces fresh water.

It is sized at twice 1 m³/h, which covers the needs of the power station's personnel for fresh water.

The treatment is a chlorination with sodium hypochloride. Its is interesting because it is simple and not very expensive.

The fresh water storage is 2 x 4 m³, amount which covers the needs of 20 people for two days.

The start-up and shut-down of the treatment is carried out automatically, based on the storage tank levels.

CONTROL

A local control system is specifically devoted to the water supply installations. It is located in a place on the water treatment building.

During normal operation, the facilities are automatically operated, without permanent supervision. The start-ups and shut-downs of the facilities are automatically controlled, based on the level measurements of the corresponding storage tanks.

A connection ensures the dialogue between the local water treatment control and the centralized control: displacement of the start-up and shut-down controls, alarms and water quality.

INSTRUMENTATION

The facilities include the instruments necessary to automatically operate, measure volumes, measure of levels. The water quality of the supplies is also controlled continuously (measurement of conductivity, silica, pH), to detect an eventual faulty operation of the treatments.

In order for the water supply system to ensure its operations, it is necessary for the following systems to be operational:

- Water supply to the site with raw water (except during the two autonomous days of the tanks).
- Electric feeding supply.
- Distribution of compressed air.
- Centralized control (administration of the measurement levels of the tanks and alarms).

In the event the system does not ensure its water supply operation, it is imperative to supply water to the site, by means of tank trucks or with the demineralized water so that the energy production is not stopped.

SYSTEM OPERATING MODES

The list of test procedures, as well as the logical performance of same will be submitted to CFE at a later date.

Before starting-up each system, each of the following checks should be made:

- The control system should be available.
- All the valves should be in the correct position for operating.
- Raw water should be available (checking of pressure).
- The pneumatic circuit to operate the valves should be available.
- There should be a sufficient quantity of chemical reagents.

Start-up of each system is carried out as follows:

- At central control, the “emergency shut-down” button should not be tight and the alarms should be deleted.
- The tank mixers should be placed in operation.
- The start-up switch should be set in the start-up position.
- When the system operates in a stable form, place the switch in the automatic position.

During normal operation, the facilities automatically start-up at low levels of the corresponding tanks.

The raw water pretreatment installation operates at 100% (a single treatment line), as well as the potabilization installation.

With respect to the fuel and the combined cycle water needs, one, two or three line(s) of demineralization operate: the demineralization is sized for 3 x 33% (inverse osmosis) + 2 x 50% (electro deionization) of the diesel operation needs and 3 x 100% (inverse osmosis) + 2 x 100% (electrodeionization) of the gas operation needs during the winter.

Normal shut-down of the systems is automatically carried out by placing the switch in the shut-down position. For the inverse osmosis system, the pump shut-down is

only carried out after the systems have been blanked. The systems manually activated must be stopped.

Alarms are foreseen for all the facilities. These alarms allow to system to stop and maintain the safety the equipment, in the case of a faulty treatment operation. The appropriate actions are automatically executed based on the alarms generated.

MAIN PARAMETERS

The systems parameters are those of their components: following cf. §.

NOMINAL FLOWS

- GB* pretreatment installation: 20 m3/h
- GC* demineralization installation: 3 x 6 m3/h
- GKB potabilization installation: 2 x 1 m3/h

WATER QUALITIES

Raw water from the well in the site.

Barium	<0.1	mg/l
Calcium	51.27	mg/l
Iron	0.057	mg/l
Magnesium	14.95	mg/l
Manganese	<0.1	mg/l
Silicon	10.44	mg/l
Sodium	378	mg/l
Strontium	1.56	mg/l
Chlorides	81	mg/l
Sulfates	440	mg/l
Conductivity	1588	µS/cm
PH	8.02	
Carbonates	19.8	mg/l
Bicarbonates	356	mg/l
Turbidity	106	NTU
Nitrates	13	mg/l
Fluorides	1.01	mg/l
Total suspended solids	34	Ppm
Potassium	1.37	mg/l
Salinity (calculated)	1.26	g/l

GHD Industrial water:

- Dicarbonated raw water.

GHC demineralized water:

pH	7	
Conductivity	<0,2	μS/cm
SiO ₂	<20	μg/l

Conditioned with ammonia:

pH	9	
Conductivity	2,8	μS/cm

Service water:

pH	7 at 8,5	
Hardness Ca ²⁺	50 to 100	mg/l CaCO ₃
Hardness T	<100	mg/l CaCO ₃
K ⁺ + Na ⁺	<50	mg/l CaCO ₃
Alkalinity	50 to 150	mg/l CaCO ₃
Cl ⁻	<50	mg/l
SiO ₂	<25	mg/l
Fe	<0,2	mg/l
Fats and oils	<2	mg/l
S.D.T.	<500	mg/l
Suspended solids	<5	mg/l

Fresh water (OMS standards):

pH	6,5 at 8,5	
turbidity	<5	NTU
Cl ⁻	<250	mg/l
Hardness T	<500	mg/l CaCO ₃
Na ⁺	<200	mg/l
SO ₄ ²⁻	<400	mg/l
S.D.T.	<1000	mg/l

Consumption of compressed air: 17.6 Nm³/h

Electric consumption: 8 kWh/m³ of demineralized water produced