TABLE 1

K_1 Load Factor Parameter

CODE	INDUSTRIAL CATEGORIES	ADOPTED K_1
10	**Non-metallic minerals**	**1.15**
11	Steel	1.03
12	Mechanical	1.10
13	Electric and communication equipment	1.14
14	Transportation material	1.21
15	Lumber and Wood products	1.02
16	Furniture	1.33
17	Pulp and Paper Mills	1.45
18	Rubber products	1.10
19	Leather, furs and leather products	2.06
20	Chemicals	1.35
21	Veterinary and pharmaceutical products	1.19
22	Perfume, soap and candles	1.53
23	Plastic products	1.25
24	Textile Mills	1.19
25	Clothing and footwear	1.19
26	Food processing	1.55
27	Beverage	1.53
28	Tobacco	2.29
29	Publishing and printing	1.31
30	Miscellaneous	1.02
34	Civil construction	1.68
35	Public Utility Industrial Services	1.68
41.5	Gas stations	1.53
41.8	Supermarkets	1.65
54	Services (e.g. Disinfecting & Exterminating, Septic tank cleaners, Building Maintenance, etc.)	1.74

TABLE 2

Average Concentration Ranges of COD and TSS, in mg/L, for determination of K_1 Pollution Loads

COD / TSS	< = 300	301-354	355-425	426-555	556-720	721-1032	1033-1700	1771-4000
< = 450	1.00	1.02	1.05	1.11	1.20	1.35	1.66	2.55
455-591	1.03	1.05	1.08	1.14	1.23	1.38	1.69	2.58
592-765	1.10	1.11	1.15	1.21	1.30	1.44	1.76	2.65
766-1040	1.19	1.21	1.25	1.31	1.39	1.54	1.85	2.74
1041-1430	1.33	1.35	1.39	1.45	1.53	1.68	1.99	2.88
1431-2000	1.53	1.55	1.59	1.65	1.74	1.88	2.19	3.09
2001-3360	1.94	1.96	2.00	2.06	2.14	2.29	2.60	3.49
3361-7000	3.00	3.01	3.05	3.11	3.20	3.34	3.66	4.55

TARIFFS/K_1

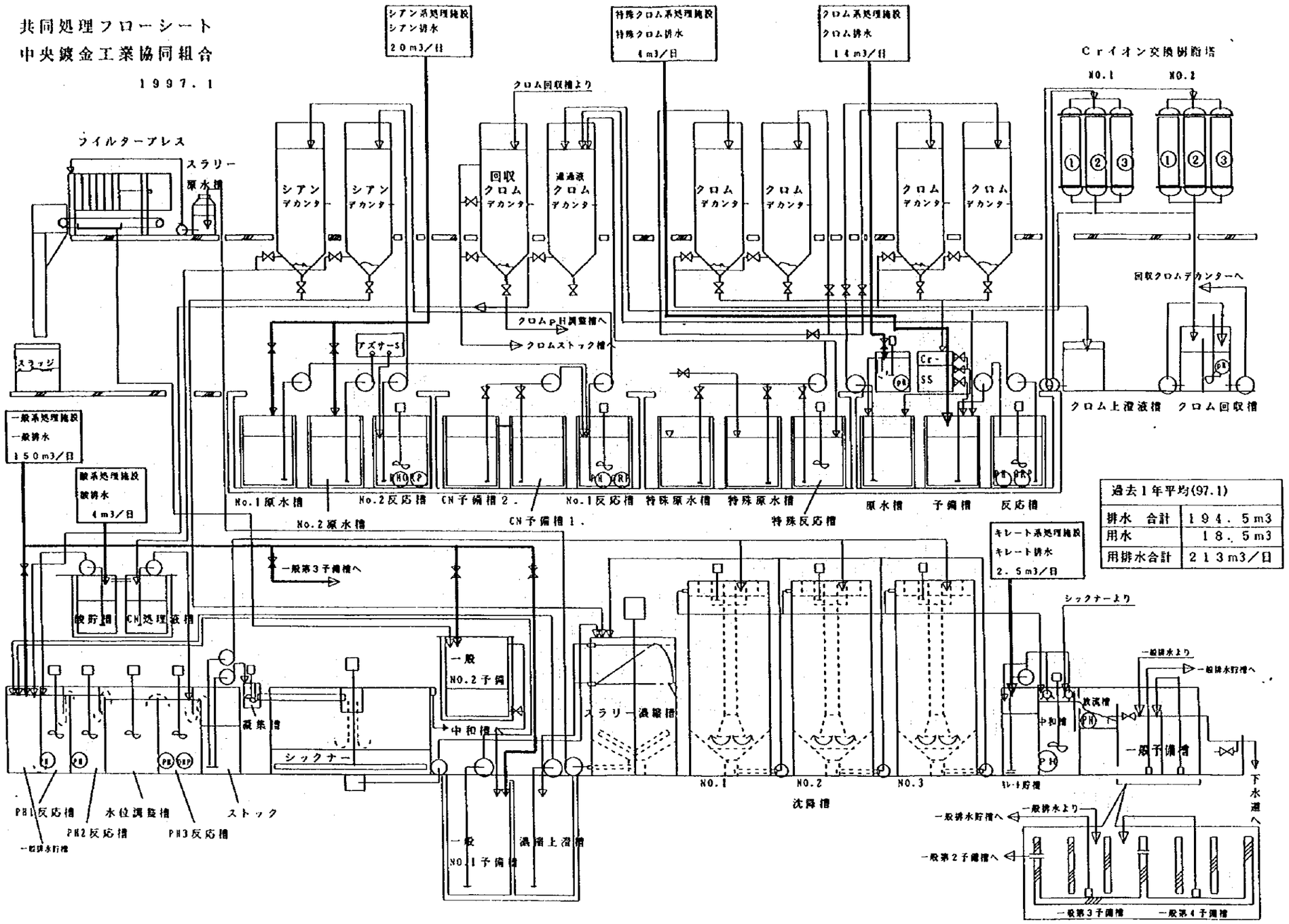
CONSUMPTION RANGES m³/month	TARIFFS R$
DOMESTIC	
0 to 10	5.50/month
11 to 20	0.85/m³
21 to 50	2.13 m³
over 50	2.36 m³
COMMERCIAL/ INDUSTRIAL/ PUBLIC	
0 to 10	11.00/month
11 to 20	2.13/m³
21 to 50	4.12/m³
over 50	4.40/m³

Presently, there is a special tariff for industries whose discharge flow is higher than or equal to 20 L/s, but there is a study group working on this problem to have these flows reduced.

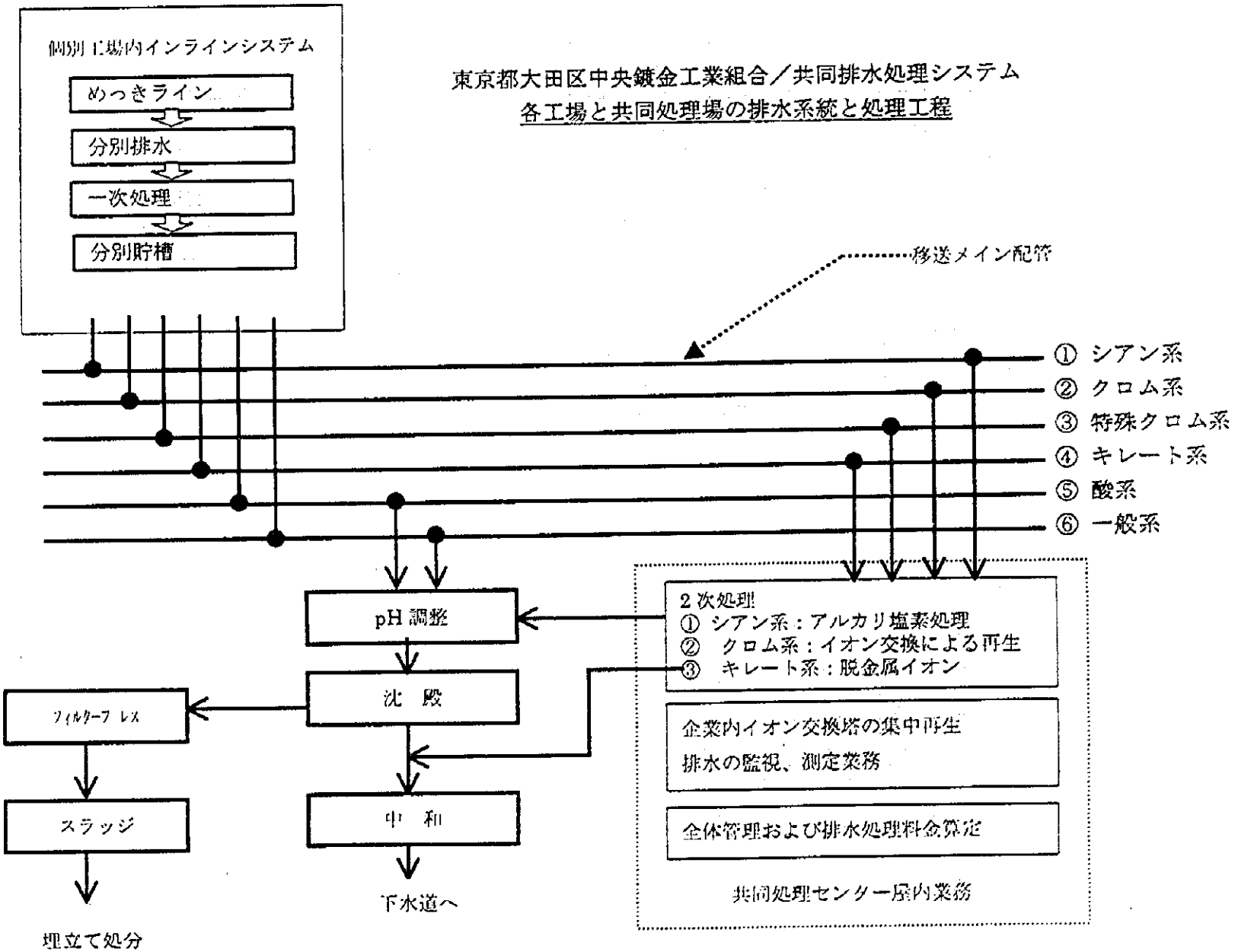
共同処理フローシート

中央鍍金工業協同組合

1997.1



過去1年平均(97.1)	
排水　合計	194.5m3
用水	18.5m3
用排水合計	213m3/日


東京都大田区中央鍍金工業組合／共同排水処理システム
各工場と共同処理場の排水系統と処理工程
個別工場内インラインシステム
めっきライン
分別排水
一次処理
分別貯槽
移送メイン配管
① シアン系
② クロム系
③ 特殊クロム系
④ キレート系
⑤ 酸系
⑥ 一般系
pH 調整
沈 殿
フィルタープレス
スラッジ
埋立て処分
中 和
下水道へ
2次処理
① シアン系：アルカリ塩素処理
② クロム系：イオン交換による再生
③ キレート系：脱金属イオン
企業内イオン交換塔の集中再生
排水の監視、測定業務
全体管理および排水処理料金算定
共同処理センター屋内業務

1. General worker's cost in São Paulo

	Min	Max	Un
(1) office worker	11,50	15,30	h
(2) mechanical designer	26,03	34,60	h
(3) civil and achitect designer	20,10	26,70	h
(4) electric and instrument designer	26,03	34,60	h
(5) shop worker	7,50	10,00	h
(6) site worker for construction	4,09	5,44	h
(7) driver	5,24	6,97	h
(8) Japan interpreter	100,00	300,00	h
(9) chemical analyser	12,30	16,36	h

2. Manufacturing cost in São Paulo

	Min	Max	Un
(1) Steel vessel	9.000,00	11.970,00	ton
(2) Steel Structure	4.000,00	5.320,00	ton
(3) Stainless Steel vessel (SUS 304)	11.500,00	15.295,00	ton
(4) FRP vessel	— 6,500 /cm³	—	
(5) Steel piping	2.600,00	3.458,00	ton
(6) Stainless Steel piping (SUS 304)	4.500,00	5.985,00	ton
(7) VP piping	—	—	
(8) Eletric cabling EPR/PVC	10.500,00	15.000,00	ton
(9) Eletric cabling PVC/PVC	5.200,00	7.500,006	ton

3. Transportation and Installation cost in São Paulo

	Min	Max	Un
(1) Car	111,00	148,00	Day
(2) Truck	53,41	71,00	h
(3) Traller	250,00	332,00	Month
(4) Crane Truck Munck (2 T)	66,78	88,80	h

4. Electricity Cost - R$ 0,15 / kWh

5. Chemical Products (cost / kg)

	Min	Max	Un
(1) NaOH concentração 15% (Hidróxido de Sódio)	0,48	0,64	kg
(2) H_2SO_4 concentração 75% (Acido Sulfúrico)	0,11	0,15	kg
(3) $FeCl_3$ (Cloreto Férrico)	0,18	0,24	kg
(4) $Al_2(SO_4)_3$ (Sulfato de Aluminio Liquido)	0,10	0,13	kg
(5) Granulado	0,15	0,20	kg
(6) NaClO (Hipoclorito de Sódio)	0,19	0,20	Kg
(7) $NaHSO_3$	---	---	---

6. Possibility of Procurement for each equipment and materials in São Paulo; (Yes or No)

(1) Centrifugal pump (material: FC: SCS: FRP: PVC:)	(yes)
(2) Measuring pump (type: Acid proof: Alkali proof:)	(yes)
(3) Submersible pump	(yes)
(4) Slurry pump	(yes)
(5) Air Blower	(yes)
(6) Agitator (Shaft material: SUS304: Rubber lining:)	(yes)
(7) Manual valve (material: FC: SUS: PVC: BC:)	(yes)
(8) Pneumatic valve (material: FC: SUS: PVC:)	(yes)
(9) Pipe (material: Carbon steel: Stainless steel: VP:)	(yes)
(10) Fitting (material: Carbon steel: Stainless steel: VP:)	(yes)
(11) Instrument	
1) Level meter	(yes)
2) PH meter and ORP meter	(yes)
3) Flow meter	(yes)
4) Pressure meter	(yes)
5) DO meter	(yes)
(12) Analyser for Monitoring	
1) DO analyser	(yes)
2) PH meter	(yes)
3) Turbidity meter	(yes)
4) Conductivity meter	(yes)
5) Spectrophotometer for water quality analysis	(yes)
6) Gas chromatography	(yes)
7) Atomic absorption spectrophotometer	(yes)
8) Others	—

Questionnaire 3

Materials Costs

1) Piping
Material - PRFV
Ø 700 – R$310,00/m to 412,30/m P = 18 kg/cm2
Ø 500 – R$ 226,66/m to 301,46/m PN-10
Ø 100 – R$ 19,10/m to 25,40/m PN-10
Ø 75 – R$ 13,13/m to 17,46/m PN-10
Ø 50 – R$ 7,78/m to10,35/m PN-10

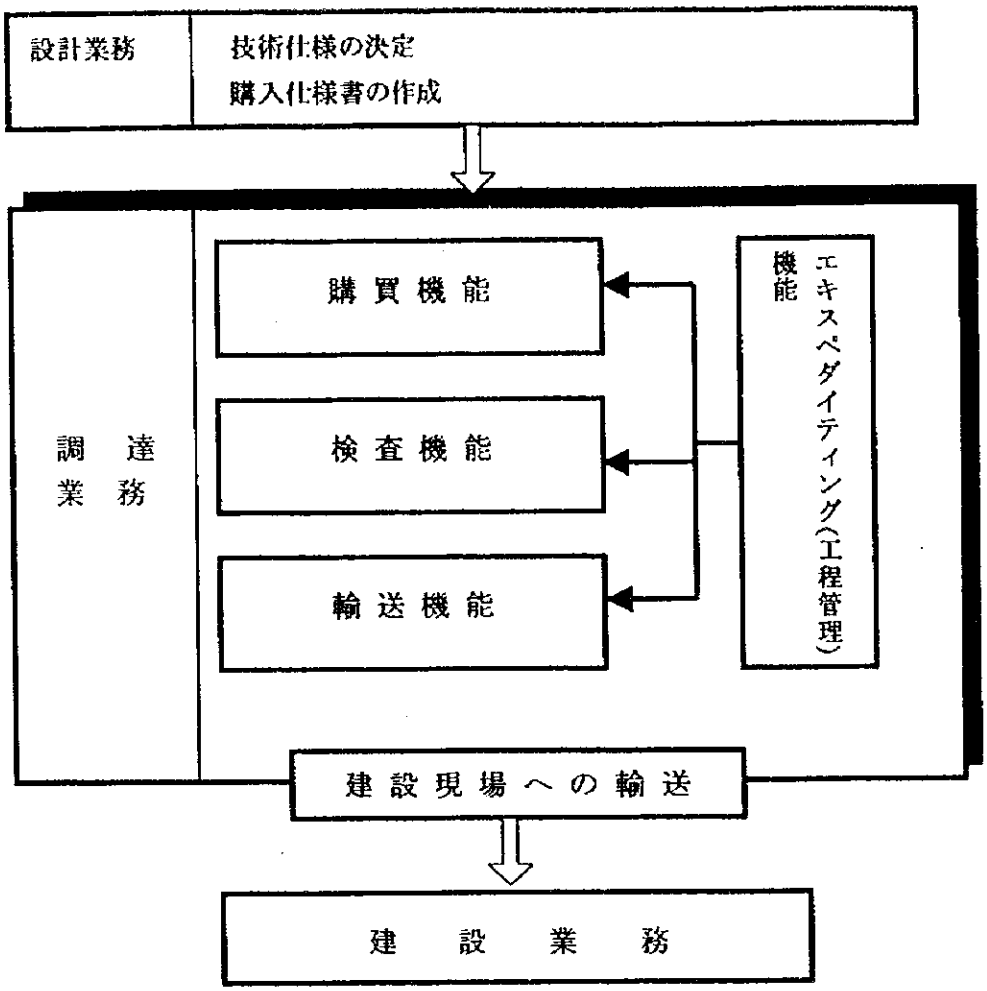
2) Piping
Material - PVC for water (class 12 – 6
Ø 100 – R$ 7,82/m to 10,40/m
Ø 75 – R$ 4,77/m to 6,34/m
Ø 60 – R$ 3,63/m to 4,63/m
Ø 50 – R$ 2,31/m to 3,07/m

Construction cost of the tank	R$ 250,00/m³
Reinforced concrete structure cost	R$ 750,00/m³
Concrete pile 9 to 15 inches	R$ 30,00 to 50,00/m³
Supplier's transportation cost	R$ 1,00/t x km
Construction cost of the engine room	R$ 850,00/m²

Obs.: 1. The cost of equipment transportantion and labour within the construction site is calculated in the service data sheets.

2. The cost of labour to operate the crane is included in the cost per hour of the equipment.

〈調達関連参考資料１〉



プロジェクトにおける調達の主要機能

①購買機能：引合書類の発行➡見積書の受理➡ベンダーとの打合せ・ネゴ
➡見積分析・評価➡注文書の発行➡検収・支払

②検査機能：検査仕様書の発行➡検査申請書受理➡検査の実施(工場での検査など)
➡検査結果の評価➡検査ﾚﾎﾟｰﾄの作成➡ﾌﾟﾛｼﾞｪｸﾄﾁｰﾑとの打合せ

③輸送機能：輸送計画作成➡ﾊﾟｯｷﾝｸﾞﾘｽﾄ作成➡通関手続➡船積手続

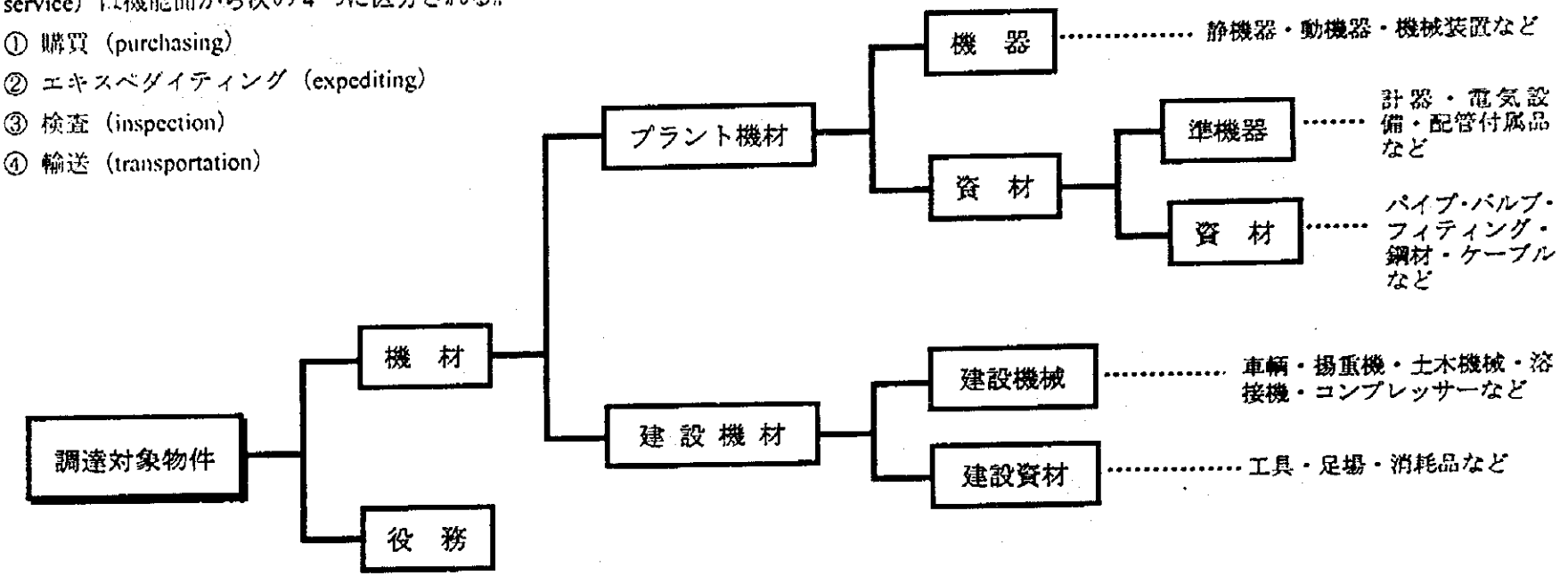
④ｴｷｽﾍﾟﾀﾞｲﾃｨﾝｸﾞ（工程管理）機能：調達ｽｹｼﾞｭｰﾙの作成➡ﾍﾞﾝﾀﾞｰの納期管理➡
納期督促➡納期変更についてのﾌﾟﾛｼﾞｪｸﾄﾁｰﾑ等との打合せ

（出典：ｴﾝｼﾞﾆｱﾘﾝｸﾞ／ﾌﾟﾛｼﾞｪｸﾄ・ﾏﾈｼﾞﾒﾝﾄ用語辞典）

調達（procurement）

プロジェクトにおける調達とは、設計段階で決定した仕様に基づいてプロジェクト遂行に必要な機器・資材あるいは役務などを社外から購入する業務に始まって、検査に合格した機器・資材を建設現場に輸送・搬入するまでの一連の業務をいう。一般に、用達業務（procurement service）は機能面から次の４つに区分される。

① 購買（purchasing）
② エキスペダイティング（expediting）
③ 検査（inspection）
④ 輸送（transportation）



調達対象物件の区分

（出典：エンジニアリング／プロジェクト・マネジメント用語辞典）

〈調達関連参考資料３〉

日本の公共団体の調達方式

地方自治体等、日本の公共団体からは下水施設、廃棄物処理施設等の建設事業が民間に対して発注されています。これらに関する調達を含む業務は凡そ次の様な手順位より進められます。

1. 事業主(プロジェクト契約の発注者を請負者側からみて客先(Client)と言う)である自治体から発注される下水施設、廃棄物処理施設等、請負者(contractorと言う)の選定に公平が優先される公共事業の場合、通常コントラクターは入札により選定されます。

2. 入札によらない随意契約もありますが、これはコントラクターがそのプロジェクトの計画段階からプロセスの研究、開発について、クライアントに協力してきたか、あるいは当該プロセスについて特許・ノウハウを有している場合、またそのプロジェクトに関し経験が深く競争者がほとんどいない場合、クライアントの要求するファイナンスが出来る場合、工期が急がれる場合などに行われます。

3. 入札による場合、入札書類が必要ですが、これは通常自治体が契約した(雇った)コンサルタントにより作成されます。

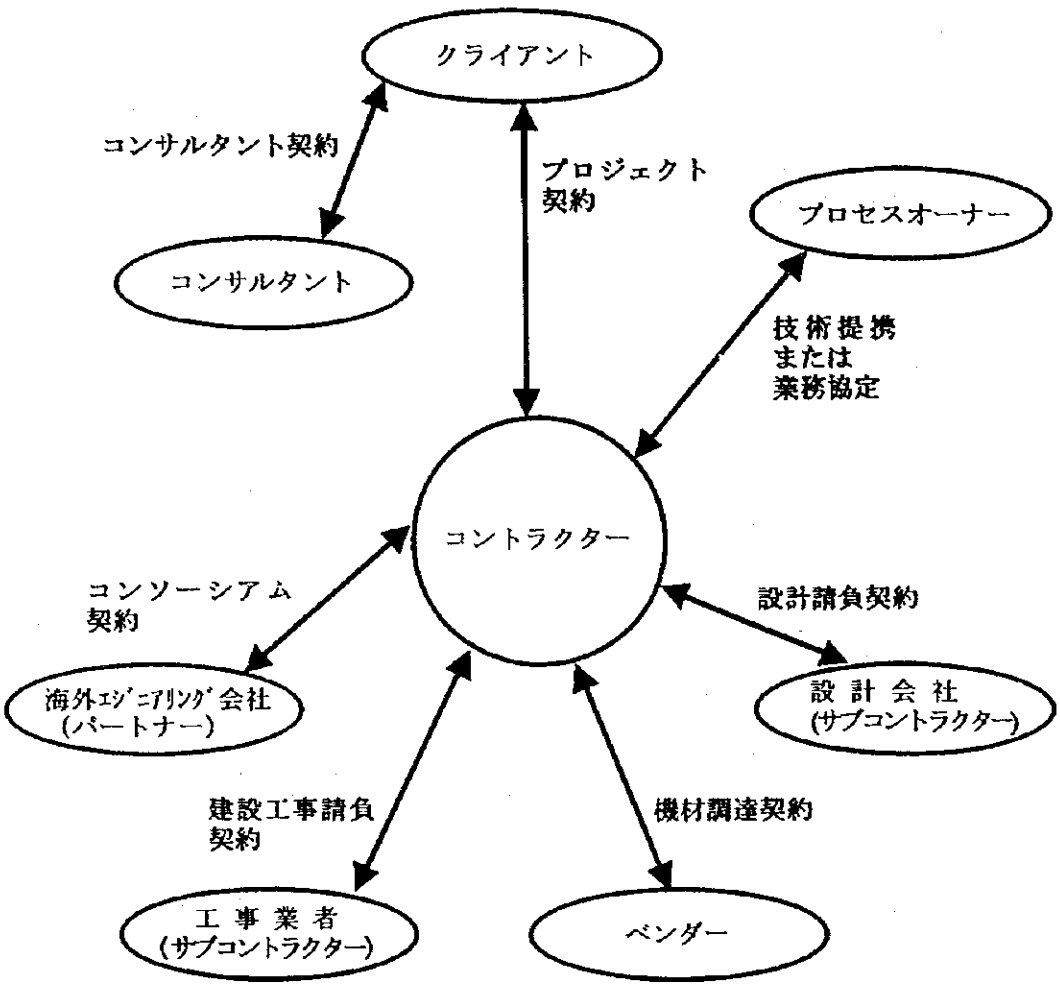
4. 入札書類には、プロジェクトの内容、範囲、仕様、納期、保証項目、工事現場に関する情報、契約条件、入札方法などが規定されています。処理廃水条件についてはここで規定されることになります。

5. コントラクターが選定された後は、通常このコントラクターがプロジェクトの全責任を負い遂行します。従って、プロジェクト遂行に必要な資機材の調達は、このコントラクターにより、資機材の調達契約を結んだベンダーを通じて行なわれます。さらに、設計、工事に関しても、サブコントラクターを使うのが一般的です。

6. コントラクターが行なう調達業務の内容に関しては、資料１に示したた通りです。

7. これらの関係を次ページに示す。

〈調達関連参考資料３〉


クライアント
コンサルタント契約
プロジェクト
契約
プロセスオーナー
コンサルタント
技術提携
または
業務協定
コントラクター
コンソーシアム
契約
設計請負契約
海外ｴﾝｼﾞﾆｱﾘﾝｸﾞ会社
(パートナー)
設計会社
(サブコントラクター)
建設工事請負
契約
機材調達契約
工事業者
(サブコントラクター)
ベンダー

付　属　資　料

資料１　主要面会者一覧

資料２　Memorandum of Understanding（第１次プロ形調査）

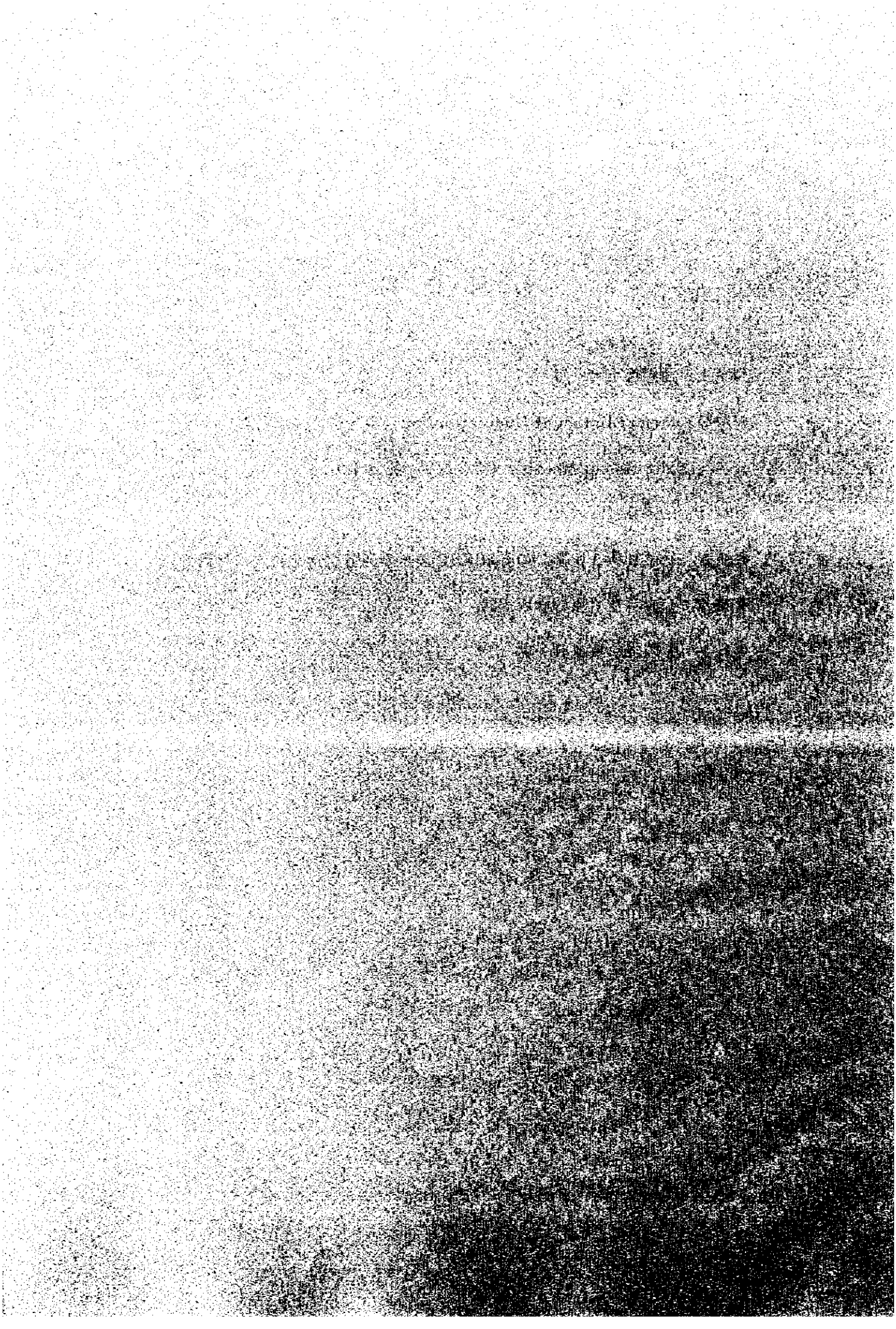
資料３　Minutes of Meeting（第２次プロ形調査）

資料４　SABESP からのレター（第２次プロ形調査）

資料５　クエスチョンネアの SABESP からの回答（第２次プロ形調査）

資料６　サンパウロ州の排水規制

資料７　その他収集資料一覧



資料1　主要面会者一覧

●主要面会者（敬称略）

第1次プロ形

○SABESP

Alipio Teixeira dos Santos Neto	Gerente de Departamento, Departamento de Desenvolvimento Tecnologico-TDD
Rosane Ebert	Coodenador de Desenvolvimento Tecnologico RMSP/ Interior/Litoral - TDD/DT

○FIESP

Emilio Yooiti Onishi	Department Manager, Department of the Enviornment and Land use

○JICAサンパウロ事務所

林　典伸	所長
村上ビセンテ	ローカルスタッフ

○JICAブラジル事務所

吉田　憲	所員

第2次プロ形

○SABESP

Ariovaldo Carmignani	Presidente
Paulo Ferreira	Diretor Tecnico e Meio Ambiente
Silvana de Almeida Nogueira Cotrim	Superintendente, Superintendencia de Pesquisa e Desenvolvimento Tecnologico-TD, Diretoria Tecnica e Meio Ambiente
Geraldo Juliao dos Santos	Superintendente, Unidade de Negocio de Tratamento de Esgotos Oeste-AEO
Alipio Teixeira dos Santos Neto	Gerente de Departamento, Departamento de Desenvolvimento Tecnologico-TDD
Rosane Ebert	Coodenador de Desenvolvimento Tecnologico RMSP/ Interior/Litoral - TDD/DT
Angelica Yumi Hirata	Coodenador de Planejamento e Desenvolvimento Tecnologico - TDD/PL

○在ブラジル日本大使館

水谷　周	公使
志村　勝也	一等書記官
郷　佳也	一等書記官

○在サンパウロ日本国総領事館

牧　昇次郎	総領事
長谷川　浩一	領事

○ブラジル産業廃棄物処理技術プロジェクト

山口　直治	専門家

○JICAサンパウロ事務所

林　典伸	所長
池城　直	次長
村上ビセンテ	ローカルスタッフ

○JICAブラジル事務所

蓮見　明	所長
白石　英一	次長
篠山　和良	所員

Memorandum of Understanding

A JICA project formulation team ("the Team") comprising Hiroshi Kato and Akihiko Suzuki, and accompanied by Satoshi Yoshida of JICA Brazil Office, visited Sao Paulo, Federal Republic of Brazil, from July 29 to 30, 1998. The purpose of the visit was to investigate the possibility of starting a joint study project on industrial pollution abatement in Sao Paulo.

Meetings were held on the said two days between the Team and representatives of Sanitation Company of the State of Sao Paulo (SABESP) and the Federation of Industries of the State of Sao Paulo (FIESP): they were Alipio Teixeira dos Santos Neto, Edson Jose Andriguetti, Rosane Ebert, and Americo de Oliveira Sampaio of SABESP and Emilio Yooiti Onishi of FIESP. Vicente Murakami and Cristina Maki Nonoguchi of JICA Sao Paulo Office also attended the meeting .

This memorandum of understanding ("the MOU") has been prepared to summarize the points discussed and the common understandings reached among the participants of the meeting, for confirmation. Given the preliminary nature of the discussions, however, participants of the meeting agree that the MOU does not in any way bind the organizations they respectively represent.

Sao Paulo, July 31, 1998

Alipio Teixeira dos Santos Neto
Manager,
Technological Development Department
SABESP

Hiroshi Kato
Project Formulation Study Team
JICA

Emilio Yooiti Onishi
Department Manager
Department of the Environment and Land Use
FIESP

I Justification and Shared Willingness to Start a Study Project for Industrial Pollution Abatement in Greater Sao Paulo

The representatives of SABESP and FIESP ("the Brazilian side") presented the following points:

(1) Water pollution problem in Sao Paulo, and especially that of the Tiete River, is getting serious with the urbanization and industrialization of the area as well as the population increase;

(2) The environmental authorities of the State of Sao Paulo, together with the industrial organizations, have been making steady efforts for the abatement of such pollution problems and with considerable success;

However,

(3) Some serious problems still remain, such as water pollution caused by hazardous industrial waste water discharged by small medium sized enterprises ("SMEs") , which, up to now, are not completely monitored by the environmental authorities and are only poorly equipped to process hazardous waste water, unlike large enterprises, which are generally equipped with waste processing facilities.

(4) Such un-processed hazardous waste water from SMEs, discharged to the sewage system intermittently but in big quantities, is giving an excessive burden to the exiting water processing plants.

With this situation in mind and, recalling that there have been successful collaborative relations between the Brazil and Japan in general and in the field of environmental issues in particular, the Team and the Brazilian side ("both sides"), confirmed that they have shared willingness to formulate a study project under JICA scheme, to meet the pressing needs for water pollution abatement in greater Sao Paulo.

II Study Framework

Having confirmed, as above, the need for countermeasures for hazardous industrial waste water from SMEs in greater Sao Paulo area, both sides tentatively agreed that a study project designed as follows would be highly meaningful:

(1) The study ("the Study") will address negative impacts caused by the hazardous industrial waste water from SMEs, and will study the most economically feasible

and environmentally sound system to cope with such problems.

(2) The Study will also introduce a model plant for demonstrating of such systems. The model plant will likely be a common facility to be shared by a number of SMEs, rather than a plant installed in individual enterprises. This idea, which departs from the original Japanese project proposal, was felt justified in view of its economic viability, for individual plants are usually unaffordable for SMEs.

(3) It is expected that the model system, if proven successful, will be replicated in other areas for wider application under the guidance of the environmental authorities and the industrial organizations such as FIESP.

III Further Actions

The Team stated that that upon its return to Japan, it will further analyze the possibility of designing the Study along the lines described in II above, with the data provided by the Brazilian side on the priority target sub-sectors and their effluents. Both sides agreed that they will have next discussions, provided that this analysis turn out to be positive.

MINUTES OF MEETING

OF

THE TECHNICAL STUDY ON THE INDUSTRIAL

WASTEWATER TREATMENT

IN

THE GREATER SAO PAULO

Sao Paulo, December 18, 1998

三平 圭祐

Keisuke MIHIRA
Leader
The Technical Study Team
Japan International Cooperation
Agency (JICA)

Arlovaldo Carmignani
Presidente
Companhia de Saneamento Basico do
Estado de Sao Paulo (SABESP)

Paulo Ferreira
Diretor Tecnico e Meio Ambiente
SABESP

Silvana de Almeida Nogueira Cotrim
Superintendente, Superintendencia de
Pesquisa e Desenvolvimento
Tecnologico-TD, Diretoria Tecnica e
Meio Ambiente, SABESP

Japan International Cooperation Agency ("JICA") is in the process of examining suitable methods for effective implementation of development study concerning industrial pollution control in large urban areas in developing countries. In this context, a Japanese technical study team ("the Team") headed by Mr. Keisuke MIHIRA, JICA, visited the State of Sao Paulo in Federative Republic of Brazil, as an representative example, from November 19 to December 18, 1998 and made a survey on the present situation of industrial wastewater treatment in Sao Paulo, in collaboration with Companhia De Saneamento Basico Do Estado De Sao Paulo ("SABESP").
These minutes of meeting summarize the points discussed in the meetings held between the Team and SABESP with respect to the result of the technical study of the wastewater treatment in the Greater Sao Paulo.

I The Results of the technical study on the Wastewater Treatment in the Greater Sao Paulo City

The Team submitted a report to SABESP as the result of the technical study on the wastewater treatment in the Greater Sao Paulo City, as shown Annex-I.

It was expressed by the Team and agreed by SABESP that introduction of common treatment system would be an appropriate method for dealing with the existing problems caused by the disposal of industrial wastewater from small and medium sized enterprises in the urban area of developing countries.

It was expressed by SABESP that the report is acceptable and fully utilizable for the purpose of examining the measures for abatement of water pollution in the Greater Sao Paulo City.

II Evaluation of the Results of the technical study

Concerning the idea, "introducing the common wastewater treatment facility" proposed in the report, the Team commented that followings were essential to confirm the feasibility of the idea

1)factory visit study, including the sampling and analysis of waste water, which could not be done in the technical study, and,
2)further detailed information of factories, say, the products and the production process
3) others (see Annex-I)

SABESP replied that , because the idea would be effective enough to abate water pollution in the Greater Sao Paulo City, particularly as the measure for hazardous

wastewater discharged from small & medium sized enterprises, SABESP would try to take further steps to examine the feasibility of the idea, with the above-mentioned comment.

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

The Study
for
Industrial Wastewater Treatment
In Sao Paulo of the Federative Republic of Brazil

December, 1998

The Consultant Study Team

The JICA Consultant Team comprising Shinsuke SATO, Masayuki SATO and Hidetoshi ICHINO conducted a survey under the title of "the study for industrial wastewater treatment" from November 19 to December 18, 1998 in Sao Paulo metropolitan area. This study aims to confirm the feasibility of a industrial wastewater facility which will treat industrial wastewater discharged into sewage systems in Sao Paulo. The followings are the major results and findings obtained during the survey period of Consultant Team:

1. Current Status of Receipt of Industrial Wastewater at each Sewage Treatment Plant

At present, five sewage treatment plants, namely E. T. E. Barueri, E. T. E. ABC, E. T. E. PQ. Novo Mundo, E. T. E. Sao Miguel and E. T. E. Suzano, treat sewage waters generated within Sao Paulo city under the control of SABESP. These sewage waters consist of mainly domestic wastewater, industrial wastewater and landfill leachate. Most of sewage waters are received through sewage pipe system at each sewage plant. However, the plant also receives a significant quantity of haulted sewage waters, including domestic, industrial and landfill leachate, generated at the places where the sewage pipe system is not installed. These waters are transported to sewage treatment plants or pumping stations such as E.E. Piqueri and unloaded by tank trucks. Some of these waste/sewage waters, especially industrial wastewater, are highly contaminated by pollutants such as heavy metals and chemical substances which can not be disposed of by a conventional activated sludge method, and therefore have a possibility to make negative impact on the sewage treatment plants occasionally. SABESP is concerned about and urged to take appropriate measures against these facts. The table listed below shows the current status of receipt of industrial wastewater at each sewage treatment plant:

	Barueri	ABC	N. Mundo	S. Miguel	Suzano
Receipt of Industrial Wastewater	○	×	×	△	○
Receipt by Sewage Pipe	○	-	-	△	○
Receipt by Tank Truck	○(1)	-	-	×	△

○ : Received significant amount, △: Received small amount, ×: Not received
(1): Most of wastewater are received by way of Piqueri pumping station.

Above table shows that the Barueri sewage treatment plant receives a considerable amount of industrial wastewater through the Piqueri pumping station by tank truck. And this also indicates that the industrial wastewater unloaded at Piqueri pumping station has the possibility to exert a serious influence on Barueri sewage treatment plant. Based on SABESP's information, about 700 companies are registered for the transportation of wastewater into Piqueri pumping station. At present, the wastewater of about 160 companies per month are carried into Piqueri pumping station in average, and the amount of these are estimated to be roughly 700 m^3 per day.

2. Industrial Wastewater to be treated

The subject of wastewater to be treated by the common industrial wastewater treatment plant will be those of small and medium sized industrial wastewater transported to Piqueri pumping station by tank truck. These wastewater contain the pollutants such as chromium (Cr), cyanide (CN) and phenols which are not disposed of by a conventional activated sludge method. In order to design and construct the most suitable and effective wastewater treatment facility, it is indispensable to know and grasp an accurate characteristics of the wastewater. List of industrial wastewater in Piqueri pumping station submitted by SABESP (see attached list) contains water quantity, water analysis data and classification of industrial sub-sector. For the detailed design of the wastewater treatment plant, more accurate wastewater analysis data should be required and the classification of industrial sub-sector should be broken down into more detailed categories. Then the wastewater to be treated will be narrowed down from present 80 companies to about 40 or 50 companies. After that detailed wastewater analysis will be made to grasp an accurate water characteristics for the remained 40 or 50 companies.

3. Site selection for Wastewater Treatment Plant

As mentioned above, wastewater which are carried into Piqueri pumping station now will be the subject of wastewater to be treated by the common industrial wastewater treatment plant. The site proposed for the construction of the plant will be:

- in the site of Piqueri pumping station,
- in the site of Barueri sewage treatment plant, or
- other places.

For the selection of the construction site, following should be considered:

- to be the inside of the territory of Barueri sewage treatment plant,
- to be the site where sewage pipe to Barueri sewage treatment plant is installed, and
- to be the site easy to access by tank truck.

The area of the land required for the construction of the plant is presumed roughly 1,200 square meters (40m × 30m).

4. Wastewater Analysis

Water quality analysis should be carried out as mentioned in order to grasp an accurate water characteristics in the future. Part of this analysis will be done by JICA study team and part of that will be consigned to local consultant. In this study, three samples of industrial wastewater of Piqueri pumping station are consigned to the two local consultants to confirm the procedure of analysis services such as sample collection, transportation, contract, etc. The local consultant consigned are:

- Ambiental Laboratorio E Equipamentos Ltda., and
- Labortechnic Tecnologia Ltda.

5. Concept of Industrial Wastewater Treatment

Principal concept for the design of industrial wastewater treatment facility is to know the characteristics of the wastewater as accurate as possible and apply the suitable treatment method in accordance with the characteristics of the wastewater. For the effective and appropriate treatment, wastewater are classified by their contaminants contained in them in general. In this study, a conceptual design for industrial wastewater treatment have been made based on the list submitted by SABESP which contains the data of 80 companies wastewater. Attached sheets show the process flow diagram (PFD) and the equipment list of this industrial wastewater treatment plant. Following shows the description of outline of the plant.

Wastewater carried into Piqueri pumping station by tank truck are classified into five groups according to their characteristics, namely groups of chromium contained, high oil concentration, phenols, acid and alkaline. Firstly rough solid and oil are removed

by screen and oil pit from each wastewater.

Hexavalent chromium in chromium contained wastewater is reduced to trivalent one in the reduction tank. This treated wastewater is mixed with high oil wastewater group and oil and chromium are removed by flotation unit. Sludge contained removed chromium and oil is stored in the sludge storage tank and dehydrated using filter press dehydrator. Filtrated water is returned to receiver tank of chromium contained water. The treated wastewater by the flotation unit is mixed with the wastewater groups from phenols, acid and alkaline. Mixed wastewater is treated by another reduction, coagulation and sedimentation process. In this process heavy metals are removed and COD/BOD component is decreased. Separated sludge by sedimentation/clarifier is put into sludge storage tank and dehydrated by dehydrator.

6. Sludge Disposal

Treatment of wastewater produces sludge. Especially in case of the treatment of industrial wastewater containing hazardous substances such as heavy metals, careful attention should be paid for the sludge disposal. In Brazil, solid wastes including sludge are classified into three categories (NBR 10004) according to their characteristics, namely class I - hazardous, class II - non-inert and class III - inert. Class I - hazardous sludge is classified further in detail by its elements contained. Disposal of the sludge is also defined by the Brazilian standard according to their characteristics. There are several options for the disposal of sludge such as landfill, incineration, fertilization, cement solidification, raw/fuel material for cement kiln, etc. However the principal or basic concept of sludge disposal is stabilization of sludge using above mentioned methods. In this study the sludge produced from the treatment of industrial wastewater will be disposed of and stabilized appropriately comply with the Brazilian standard.

7. Local Procurement

Data and information related to the local procurement have been collected to confirm the possibility of the procurement of materials such as construction materials, equipment, etc which are to be used for the construction of the industrial wastewater treatment plant. Data and information collected indicate that most of materials for the construction of the plant can be procured in Sao Paulo area in general. However,

further discussion including the agreed date of delivery should be done on determining the specification of equipment.

8. Items to be required toward Next Step

As mentioned above already, the following items should be required in the next stage for the progress of the project:

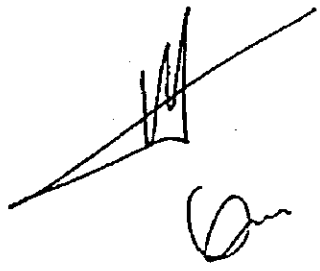
- The subject of industrial wastewater to be treated should be specified. For this purpose, the classification of industrial sub-sector listed in the attached SABESP's data should be broken down into more detailed categories as accurate as possible at first by SABESP side to make a short list of the wastewater.

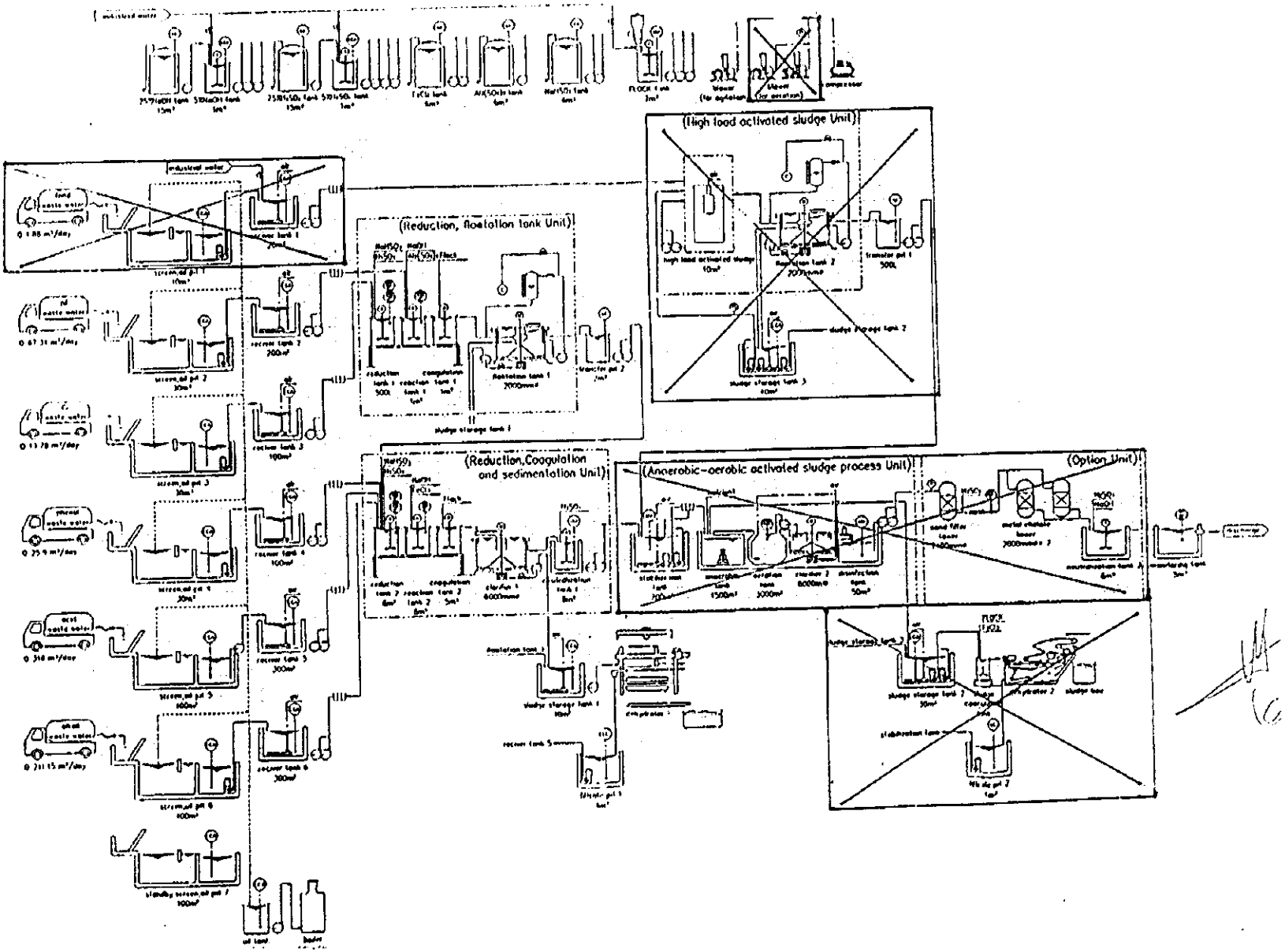
- Detailed wastewater analysis should be made for the factories listed in the short list next.

- As mentioned, principal concept for the design of industrial wastewater treatment facility is to know the characteristics of the wastewater as accurate as possible and classify these wastewater according to their contaminants before treatment. This means that each factory which produces wastewater is required to classify their wastewater by their components. Therefore, it is necessary to confirm the possibility of the classification of wastewater at their factories in the early stage.

9. Data and Information Collected

Data and information collected during the study period in Sao Paulo are shown in attached sheet.




(High load activated sludge Unit)
(Reduction, floatation tank Unit)
(Reduction,Coagulation and sedimentation Unit)
(Anaerobic-aerobic activated sludge process Unit)
(Option Unit)

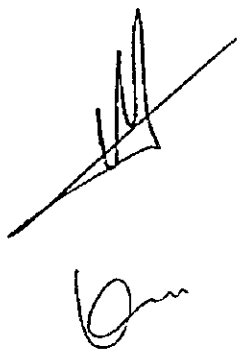
EQUIPMENT SPECIFICATION

No.	Item	Q'ty	Material	Specification	Remark
1	Screen, oil pit 2	1	RC	Capacity 30 m^3	LCA
	Transfer pump	1	SCS	300 l/min × 10 m × 1.5kw	
2	Screen, oil pit 3	1	RC	Capacity 30 m^3	LCA
	Transfer pump	1	SCS	300 l/min × 10 m × 1.5kw	
3	Screen, oil pit 4	1	RC	Capacity 30 m^3	LCA
	Transfer pump	1	SCS	300 l/min × 10 m × 1.5kw	
4	Screen, oil pit 5	1	RC	Capacity 100 m^3	LCA
	Transfer pump	1	PVC	300 l/min × 9 m × 2.2kw	
5	Screen, oil pit 6	1	RC	Capacity 100 m^3	LCA
	Transfer pump	1	SCS	300 l/min × 10 m × 1.5kw	
6	Standby screen oil pit 7	1	RC	Capacity 100 m^3	LCA
7	Receiver tank 2	1	RC	Capacity 200 m^3, aerator	LCA
	Transfer pump	2	SCS	60 l/min × 10 m × 0.75kw	
8	Receiver tank 3	1	RC	Capacity 100 m^3, aerator	LCA
	Transfer pump	2	SCS	30 l/min × 10 m × 0.4kw	
9	Receiver tank 4	1	RC	Capacity 100 m^3, aerator	LCA
	Transfer pump	2	SCS	30 l/min × 10 m × 0.4kw	
10	Receiver tank 5	1	RC	Capacity 300 m^3, aerator	LCA
	Transfer pump	2	PVC	300 l/min × 9 m × 2.2kw	
11	Receiver tank 6	1	RC	Capacity 300 m^3, aerator	LCA
	Transfer pump	2	SCS	180 l/min × 10 m × 1.5kw	
《Reduction, floatation tank Unit》					
12	Reduction tank 1	1	FRP	Capacity 500 l	
	pH meter	1		Panel indication and control	
	ORP meter	1		Panel indication and control	
	Agitator	1	SS+R/L	Portable type 0.2kw	

No.	Item	Q'ty	Material	Specification	Remark
13	Reaction tank 1	1	FRP	Capacity 1m³	
	pH meter	1		Panel indication and control	
	Agitator	1	SS+R/L	Portable type 0.4kw	
14	Coagulation tank 1	1	FRP	Capacity 1m³	
	Agitator	1	SUS304	Portable type 0.2kw	
15	Floatation tank 1	1	SS	2,000 mm dia., 0.2kw	
	Sludge discharge pump	1	FC+HiCr	50 l/min × 10 m × 0.75kw	
	Circulating pump	1	FC+HiCr	80 l/min × 10 m × 0.75kw	
16	Transfer pit	1	FRP	Capacity 2m³	LC
	Transfer pump	2	FC	80 l/min × 10 m × 0.75kw	
《Reduction, Coagulation and sedimentation Unit》					
17	Reduction tank 2	1	FRP	Capacity 8m³	
	pH meter	1		Panel indication and control	
	ORP meter	1		Panel indication and control	
	Agitator	1	SS+R/L	Vertical type 2.2kw	
18	Reaction tank 2	1	FRP	Capacity 8m³	
	pH meter	1		Panel indication and control	
	Agitator	1	SS+R/L	Vertical type 2.2kw	
19	Coagulation tank 2	1	FRP	Capacity 5m³	
	Agitator	1	SUS304	Vertical type 1.5kw	
20	Clarifier 1	1	SS	6,000 mm dia., 0.4kw	
	Sludge discharge pump	1	FC+HiCr	50 l/min × 10 m × 0.75kw	
21	Neutralization tank 1	RC		Capacity 8m³	LCA
	Agitator	1	SS+R/L	Vertical type 2.2kw	
	Transfer pump	2	FC	550 l/min × 10 m × 2.2kw	
《Dehydrator》					
22	Sludge storage tank 1	1	RC	Capacity 10 m³, aerator	LCA
	Transfer pump	2	FC	100 l/min × 35 m × 3.7kw	

No.	Item	Q'ty	Material	Specification	Remark
23	Dehydrator	1		Automatic filter press	
24	Filtrate pit 1	1	RC	Capacity 1m³	LC
	Transfer pump	1	FC	100 l/min × 10 m × 0.75kw	
25	Filtrate pit 3	1	RC	Capacity 1m³	LC
	Transfer pump	1	FC	100 l/min × 10 m × 0.75kw	
《Chemicals》					
26	25% NaOH tank	1	FRP	Capacity 15m³	LA
	Transfer pump	1	PP	50 l/min × 10 m × 0.4kw	
27	5% NaOH tank	1	FRP	Capacity 1m³	LCA
	Agitator	1	SUS304	Portable type 0.2kw	
	Feed pump	3	PVC	0.2kw	
28	75% H_2SO_4 tank	1	FRP	Capacity 15m³	LA
	Transfer pump	1	PP	50 l/min × 10 m × 0.4kw	
29	5% H_2SO_4 tank	1	FRP	Capacity 1m³	LCA
	Agitator	1	SS+R/L	Portable type 0.2kw	
	Feed pump	4	PVC	0.2kw	
30	$FECl_3$ tank	1	FRP	Capacity 6m³	LA
	Feed pump	2	PVC	0.2kw	
31	$Al_2(SO_4)_3$ tank	1	FRP	Capacity 6m³	LA
	Feed pump	1	PVC	0.2kw	
32	$NaHSO_3$ tank	1	FRP	Capacity 6m³	LA
	Feed pump	2	PVC	0.2kw	
33	Flock tank	1	FRP	Capacity 2m³	LCA
	Agitator	1	SUS304	Vertical type 0.75kw	
	Feed pump	1	PVC	0.2kw	
34	Aeration blower	2		12 m³/min × 4,000mmAq × 18.5kw	
35	Agitation blower	4		50 m³/min × 4,000mmAq × 48kw	

No.	Item	Q'ty	Material	Specification	Remark
36	Compressor	1		3.7kw	
37	Control panel	1		Indoor self-standing enclosed type	



廃水をトラックでSABESP処理施設へ輸送している工場。分野別及び特徴リスト

Ind	分野		流量(m3/日)	DBO	DQO	Cd	Cr	Cu	Fenol	Pb	Zn	Tolueno	Benzeno	OG
				... 濃度 (mg/l)										
1	Alimentícia		0,00	111.000	190.000		3,5			7,5	130			27.000
2	Alimentícia	食	0,17	3.370	4.230		0,0025	0,1						354
3	Alimentícia		0,00	9.030	22.004	0,1	0,3	0,00	0,05	0,5				
4	Alimentícia	品	0,00	23.000	05.000									102.120
5	Alimentícia		0,2	2.070	0,400	0,1	3,3	25,0	0,05	0,000				547
6	Alimentícia		0,17	25.400	42.000									0,070
7	Alimentícia		1,36	62.900	05.700	0,004	0,0025	0,0	0,15	0,000	2,1			11.000
8	Metalurgia/Mecânica		1,27	9.040	14.200	0,03	0,0025	8	2055	0,000	5,5			7.330
9	Metalurgia/Mecânica		2,14	347		0,004			0,061	0,000	0,09			
10	Metalurgia/Mecânica		1,17		1.100									
11	Metalurgia/Mecânica		3,37	2	0					0,50				
12	Metalurgia/Mecânica	鉄	0,10	157		0,7	0,3	0,2			0,5			37
13	Metalurgia/Mecânica	鋼	0,05	400	1.210	0,004	0,27	0,10	0,05		300			60
14	Metalurgia/Mecânica	鋳	0,27	0	95	0,02	0,02				540			20
15	Metalurgia/Mecânica		5,32	90	391	0,030		0,19			0,05			8
16	Metalurgia/Mecânica	と	0,19	430	070		0,05			0,1	0,09			
17	Metalurgia/Mecânica		0,44	2.220	4.570									640
18	Metalurgia/Mecânica	機	0,11	7.520	10.970				0,25					
19	Metalurgia/Mecânica		1,0	2.270	2.700				333		0			398
20	Metalurgia/Mecânica	械	0,24	14.100	25.000							0,011		
21	Metalurgia/Mecânica		8,77	1.650	4.010				0,05					282
22	Metalurgia/Mecânica		0,00	1.900	032				0,01		24			140
23	Metalurgia/Mecânica		0,05	1.210	7.330	0,004	0,0025	12,0	200					2.790
24	Metalurgia/Mecânica		0,09	7.300	10.700	0,004	0,0025	2,35	1,62	0,000	0,05			60.200
25	Metalurgia/Mecânica		0,76	0.400	34.200									0.020
26	Metalurgia/Mecânica		0,04		440									
27	Química/Farmacêutica	化	15,37		113.000	0,0015	0,0025	2,5	0,27		30,0	0,300		00
28	Química/Farmacêutica		0,00		41.000	0,004	2,43	1	4,58	0,000	2,2			774
29	Química/Farmacêutica	学	0,00	20.000	00.000	0,004	100	10,1	0,54	12,0	211			13.000
30	Química/Farmacêutica		0,09		3.400		0,11	18,0		0,54	90			
31	Química/Farmacêutica	薬	2,08	22.600	35.900		0,0025		0,05	0,000	1,3			1.020
32	Química/Farmacêutica		0,20	350	10.197	0,004		0,0025	0,132	0,000	0,0004			
		品												

Ind	(N	流量(M³/D)	DBO	DQO	Cd	Cr	Cu	ol	Pb	Zn	Tolueno	Benzeno	OG
33	Química/Farmacêutica	0,74	2.591	6.002		0,0025	0,005	5,3					870
34	Química/Farmacêutica	0,12	250	970	0,01								313
35	Química/Farmacêutica	0,74	25.000	55.400				1,00		0,39			
36	Química/Farmacêutica	0,32	600	250				0,68					1.530
37	Química/Farmacêutica	2,90	34.000	52.000	0,004	0,031	0,2	2,46	0,14	0,55			104
38	Química/Farmacêutica	23,82	16.700	20.300				75,1					207
39	Química/Farmacêutica	0,00	30.900	42.100				9000					39
40	Química/Farmacêutica	22,34	20.000	35.200				7750		0,100			129
41	Química/Farmacêutica	1,1	373	725	0,004	0,01	0,01	0,070	0,000	0,0004			20
42	Química/Farmacêutica	1,10	188	220	0,004	115	0,0025	0,05	0,000				4
43	Química/Farmacêutica	35,8	39.000	52.700		0,0025		0,99	0,000				113
44	Química/Farmacêutica	1,71	3.740	12.300	0,004	0,0025	0,0025	2,07	0,000	2,7			1.140
45	Química/Farmacêutica	0,05	310	437		0,10		0,05					4
46	Química/Farmacêutica	0,56	28.300	67.000	0,004	0,0025	0,07	8000	0,000	3,0			100
47	Química/Farmacêutica	16,70	8.200	10.500	0,170	0,25	0,000	0,005	1,34	0,0			
48	Química/Farmacêutica	1,24	4.944	8.568		0,008		0,172					1.043
49	Química/Farmacêutica	12,10	2.130	3.520	0,0045	0,2	0		0,000	0,3			218
50	Química/Farmacêutica	11,23	21.000	25.600	0,55	0,0025	0,0025	0,005	2,95	0,0			2
51	Química/Farmacêutica	2,75	43.311	125.700	0,04	0,72	0,12			1,10			00
52	Química/Farmacêutica	0,70	4.102	21.705	0,25		0,10		2,74				140
53	Química/Farmacêutica	0,92		5.400	0,0045	0,09	0,140		0,37	0,30			406
54	Química/Farmacêutica	2,24	070	5.240			7,0						73
55	Química/Farmacêutica	1,31	220	1.300		20,1							272
56	Química/Farmacêutica	3,2	3.300	3.450	0,0045	0,0025	7,05	0,15	1,05	27,0			100
57	Química/Farmacêutica	1,11	10.400	10.700						7,5			8.050
58	Química/Farmacêutica	0,12		110			0,2		0,000	0,4			
59	Química/Farmacêutica	1,00	14.150	20.470		0,43							374
60	Química/Farmacêutica	30,70	1.600	4.510			0,05			0,707			204
61	Química/Farmacêutica	0,10					0,06	0,22					
62	Química/Farmacêutica	8,8	2.510	7.420	0,05	0,0025	12,1	17,7	0,000	2,4			405
63	Química/Farmacêutica	2,24	15.600	30.500	0,4	1,5	0,55	44,0	2,0	0,0			251
64	Química/Farmacêutica	3,54	4.200	10.400									312
65	Química/Farmacêutica	0,29	7.664	13.737				0,05					70
66	Química/Farmacêutica	0,59		1.706	0,004	0,0025	0,0025		0,000	0,19			

Ind	(X)	Vazão (m3/h)	DBO	DQO	Cd	Cr	Cu	Fenol	Pb	Zn	Tolueno	Benzeno	OG
07	Química/Farmacêutica	0,24	704	1.545			0,0025						231
08	Química/Farmacêutica	0,01	110.000	164.000	0,004	0,0025	1,5	53,9	10	2,05		2740	107
09	Química/Farmacêutica	100,02	459	1.359	0,004	0,02	0,001	0,05	0,008	0,15			97
70	Química/Farmacêutica	0,04	80	432	0,004	0,0025	0,0025	0,05	0,5	0,2			30
71	Química/Farmacêutica	10,4	172	322	0,004	0,0025	0,0025	0,005	0,008	1,01			27
72	Química/Farmacêutica	0,2	1.070	7.000				0,01					484
73	Química/Farmacêutica	1,07	7.040	11.020	0,004	0,04	1,5	53,9	10	2,05	0,01	0,01	1.050
74	Química/Farmacêutica	0,05	8.155	23.600						0,1			40.561
75	Química/Farmacêutica	130,1	202	653	0,004	0,002		0,05	0,08	3,05			11
76	Química/Farmacêutica	0,43	3.490	10.200	0,004	0,0025	0,3	0,005	0,008	0,159	1,14		439
77	Química/Farmacêutica	13,39	43.700	75.100	0,004		1,5	0,54	0,008	3,75			2.200
78	Química/Farmacêutica	0,31		2.890	0,004	0,0025	60,4	0,005	3,45	10			11
79	Química/Farmacêutica	5,50	2.305	10.700	0,004	0,0025		0,005	0,008	1,98			
80	Química/Farmacêutica	0,14	1.420	7.470	0,004	0,0025	2,35	8,0	3	82			542

Data & Information Collected

1. Brochure of SABESP (Portuguese, German, English)
2. Brochure of sewage treatment plant (E. T. E. ABC, E. T. E. PQ. Novo Mundo, E. T. E. Sao Miguel) (Portuguese)
3. Environmental Bylaw, Discharges from Sewage Treatment Plants, SABESP, June 1998, 2nd ed. (English)
4. Tariff on wastewater discharge (English)
5. Example of sewage water analysis (E.T.E. Suzano) (Portuguese)
6. Map of Project Tiete (Portuguese)
7. Example of sewage water analysis (E.T.E. Sao Miguel)
8. Organization chart of SVMA (English)
9. SANEAS, September '98. (Portuguese)
10. Reply to the questionnaire of JICA study team from SABESP (English)
11. Standards Adopted by SABESP for design of STP's (Portuguese)
12. NBR 10004 (Brazil Industrial standard) (Portuguese)
13. Organization chart of SABESP (English)
14. Layout plan of Piqueri pumping station (Portuguese)
15. Organization of Secretaria de Estado do Meio Ambiente (Portuguese)
16. Guia de Tecnologias Ambientais Brasil – Alemanha, 1999-2000 (Portuguese, German)
17. Brochure of Ambiental Laboratorio e Equipamentos Ltda.and CEIMIC (Portuguese)
18. Brochure of FILSAN WQUIPAMENTOS E SISTEMAS LTDA. (Portuguese, English)
19. Brochure of ENFIL (Portuguese, English)
20. Brochure of AQUAMEC (Portuguese)
21. Disposal of Solid Waste in Brazil, prepared by Ambiental Loaboratorio (Floppy disk) (Portuguese)
22. ENGENHARIA, No. 527/1998, Ano 55 (Portuguese)

Data & Information Collected

1. Brochure of SABESP (Portuguese, German, English)
2. Brochure of sewage treatment plant (E. T. E. ABC, E. T. E. PQ. Novo Mundo, E. T. E. Sao Miguel) (Portuguese)
3. Environmental Bylaw, Discharges from Sewage Treatment Plants, SABESP, June 1998, 2nd ed. (English)
4. Tariff on wastewater discharge (English)
5. Example of sewage water analysis (E.T.E. Suzano) (Portuguese)
6. Map of Project Tiete (Portuguese)
7. Example of sewage water analysis (E.T.E. Sao Miguel)
8. Organization chart of SVMA (English)
9. SANEAS, September '98. (Portuguese)
10. Reply to the questionnaire of JICA study team from SABESP (English)
11. Standards Adopted by SABESP for design of STP's (Portuguese)
12. NBR 10004 (Brazil Industrial standard) (Portuguese)
13. Organization chart of SABESP (English)
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19. Brochure of ENFIL (Portuguese, English)
20. Brochure of AQUAMEC (Portuguese)
21. Disposal of Solid Waste in Brazil, prepared by Ambiental Loaboratorio (Floppy disk) (Portuguese)
22. ENGENHARIA, No. 527/1998, Ano 55 (Portuguese)

Annex-II

List of Attendants

Brazilian Side

Companhia de Saneamento Basico do Estado de Sao Paulo (SABESP)

Ariovaldo Carmignani	Presidente
Paulo Ferreira	Diretor Tecnico e Meio Ambiente
Silvana de Almeida Nogueira Cotrim	Superintendente, Superintendencia de Pesquisa e Desenvolvimento Tecnologico-TD, Diretoria Tecnica e Meio Ambiente
Geraldo Juliao dos Santos	Superintendente, Unidade de Negocio de Tratamento de Esgotos Oeste-AEO
Alipio Teixeira dos Santos Neto	Gerente de Departamento, Departamento de Desenvolvimento Tecnologico-TDD
Rosane Ebert	Coodenador de Desenvolvimento Tecnologico RMSP/ Interior/Litoral - TDD/DT
Angelica Yumi Hirata	Coodenador de Planejamento e Desenvolvimento Tecnologico - TDD/PL

Japanese Side

JICA Study Team

MIHIRA, Keisuke	Leader
SARUHASHI, Atsuko	Technical Cooperation Administration
NAKAMURA, Yoshiaki	Industry Development
SUZUKI, Akihiko	Study Planning
SATO, Shinsuke	Industrial Waste WaterTreatment 1

SATO, Masayuki	Industrial Waste WaterTreatment 2
ICHINO, Hidetoshi	Waste Water Treatment Facility

JICA Sao Paulo Office

IKESHIRO, Tadashi	Director of Technical Cooperation
Vicente Murakami	Staff

資料4　SABESPからのレター（第2次プロ形調査）

companhia de saneamento básico do estado de são paulo – sabesp

São Paulo, December 17, 1998.

JICA – JAPAN INTERNATIONAL CO-OPERATION AGENCY
Mr. Tadashi Ikeshiro
Director of Technical Co-operation

LETTER OF INTENT

Dear Sir,

The JICA study team visited SABESP from November 19 to December 18, 1998 to assess the present situation of the industrial wastewater treatment in the Greater São Paulo. After a four-week survey, a summary of the findings was prepared and submitted to SABESP. This report also proposed the construction of a common wastewater treatment facility that will treat hazardous industrial effluents, which overload the existing sewage system, discharged by small and medium size enterprises.

SABESP considered that the proposal was effective enough to minimise the water pollution in the Greater São Paulo and accepted it. Thus, SABESP would like JICA to carry out a study project based on the plans presented in the report.

The following measures, essential to assess the feasibility of the project, will be taken in order to implement the co-operation agreement between JICA and SABESP.

1) Ask ABC –Agência Brasileira de Cooperação, the Brazilian authority in charge of all international co-operation agreements, to forward an official application concerning this issue to the Japanese Government. The basic concepts of the study are presented in a document attached to this letter.

2) Collect necessary information requested by JICA:
The characterisation of each industrial discharger (industrial processes, products manufactured, type of wastes generated) listed in a complete inventory that has been already organized by SABEP. We will ask CETESB's assistance to obtain these data.

3) Take further measures to ensure technical visits to the industries to allow the development of the studies. Those visits should be arranged with the assistance of other organisations such as FIESP.

SABESP will have informed JICA about the outcome of its actions by the end of March 1999. If we attain our aims, we will expect JICA to send a mission to Brazil to work on the proposed plan. We would like to emphasise that we intend to start the project next year.

Yours faithfully

Paulo Ferreira
Director –Technical and Environmental Directorate

Silvana N. de Almeida Cotrim
Manager – Research and Technological Development Superintendence

BASIC CONCEPT OF DEVELOPMENT STUDY PROJECT ON INDUSTRIAL POLLUTION CONTROL

1 PURPOSE

To contribute to abate the water pollution caused by industrial wastewater, especially those discharged by small &medium sized enterprises.

2 EXPECTED OUTPUT

The study expects to produce the following outputs:

a) Recommendations on suitable industrial wastewater treatment systems for each target industries and target sub-sector;

b) Know-how transfer on organisation, construction and management of the common wastewater treatment facility;

c) Elaboration of the common wastewater treatment facility design;

d) Installation of a common wastewater treatment facility that will operate as a demonstration plant;

e) Technology transfer to the personnel who will operate the common wastewater treatment facility;

f) Recommendation on policies for the abatement of wastewater pollution in the Greater São Paulo.

3 GEOGRAPHICAL AREAS AND INDUSTRIAL SUB-SECTORS

a) The study will focus on the area of the Greater São Paulo;

b) The study will focus on the major industrial sub-sectors installed in the Greater São Paulo.

4 ACTIVITIES

a) Visit target industries to assess their effluents, carry out sampling and analysis procedures and present recommendations for the improvement of their wastewater treatments.

b) Recommend measures for the improvement of wastewater treatment for each target sub-sector, based on the result obtained in the above mentioned item (a).

c) Elaborate the design of the common wastewater treatment facility that will treat hazardous effluents before they are discharged into Sabesp's sewage system;

d) Propose the managerial strategy for the common wastewater facility;

e) Install and operate the common wastewater treatment facility;

f) Monitor the operation of the common wastewater facility in order to gather information to spread the knowledge and experience obtained to other areas ;

g) Recommend policies.

5 **Other**

a) Select the site for the construction of the common wastewater facility. This issue is being analysed and a suitable site will be defined in due time.

b) Calculate the costs: transportation of equipment (inland) , construction (civil works, foundation for equipment), pipeline interconnections (common wastewater treatment facility to the Sabesp's sewage system), operational costs, taxes, etc.). These costs are being analysed and will be defined later.

Note: A reasonable part of the project costs will be paid by the Brazilian counterparts.

資料５　クエスチョンネアのSABESPからの回答（第２次プロ形調査）

JAPAN INTERNACIONAL COOPERATION AGENCY

QUESTIONNAIRE (2)

1. Data and Information Related to Organization and Industrial Systems

(1) Governmental organizations or non-governmental organizations related to environmental management/control

Name of organization : Sabesp – Basic Sanitation Company of the State of São Paulo
Responsability and role : Sabesp has more than 20 years of experience in construction and operation of water and sewerage systems, with na internationally acknowledged know-how. The population served in the State is 22 million persons.
Number of staff : 19.086 employees.
With 16 Business Units and three Services Units, Sabesp acts as na holding, granting more quickness to units. For more information see **Organizational Structure.**
Major activities : Sabesp produces 70 thousand liters of treated water per second, and has 166 treatment stations to supply 1332 water reservoirs with a 2.5 billion liters storage capacity. It is responsible for supplying water and collecting and treating sewerage in 343 municipalities in São Paulo State.

Cetesb: This organization is responsible to control the pollution fonts (industries, wastewater treatment plants etc) and to promove the pollution prevention program. This organization belongs to SMA (Secretaria do Meio Ambiente).

Secretaria do Meio Ambiente: This organization is responsible to analyze the EIA/Environmental Impact Assessment of projects, programs etc and to give the environmental licenses.

DAEE: This organization is responsible to manage the water resources.

(2) Organizations of central and local Government which have responsibility for Environmental management/control

Cetesb /Secretaria do Meio Ambiente

(3) Legislation or authorized standards related to environmental management/control (including Factory Act, Public Health Act, etc.)

(3.1) Federal Regulations

Environmental legislation is enacted by both the federal and state governments. Federal legislation addreesses environmental protection through a series of 40 laws, 75 decreees and numerous resolutions and other decrees. The most relevant resolution that applies to the discharge of treated effluent to receiving streams is Resolution CONAMA N. 20 (Resolução Conselho nacional do Meio Ambiente – CONAMA).

Under Article 1° of CONAMA, surface waters are classified according to their use and quality. There are nine classes (Special, Class 1 to Class 8) that describe respective uses

such as domestic water supply with only simple disinfection to navigation and recreation . There are five classes of freshwater (Special and Class 1 to 4), two classes of seewater (Class 5 nd 6) and two classes of saline water (Class 7 and 8).

The same resolution under article 21, specifies the requiremments for discharge of effluent to surface waters.

For more detailed information see the **copy in Portuguese** (page 24 to 34 from the Manual of Federal Regulations).

(3.2) State Regulations

The State of São Paulo has enacted in the order of 17 environmental laws, 30 decrees and nine resolutions to legislate environmental protection.

Article 19-A – The State of São Paulo, Legislation of the Control of Pollution of the Environment (Legislação Estadual – Controle de Poluição Ambiental do Estado de São Paulo) states that who develops natural resources is obligated to reinstate the impact on the environment trough the appropriate tecnical solution required by the appropriate competent puhblic organization. This Article provides the general legislative power to the Companhia de Tecnologia de Saneamento Ambiental (CETESB) in the regulation of environmental matters. The Sate Law no. 118 (Lei no. 118) of June 1973 enacts and empowers CETESB with its mandate.

The State Law no. 997 (Lei no. 997) of May 1976 outlines the objectives for the disposal and discharge of pollution to the pollution to the environment. The Decreee no. 8468 aproves the Law no. 997.

The same regulation under Law no. 997, article 18, specifies the requiremments for discharge of treated effluent to surface waters and the article 19-A, specifies the requirements for discharge to sewage colleting systems.

For more detailed information see the **Environmental Bylaw Discharges from Sewage Treatment Plants** (copy in English).

(4) Existing monitoring system for water quality in and around São Paulo

Title of document : **Relatório de Qualidade das Águas Interiores do Estado de São Paulo – 1996**

Organization which has responsability for Environmental management/control : **Cetesb** (Companhia de Tecnologia em Saneamento Ambiental).

Contents : Since 1974 Cetesb develop and publish a report with results from the monitoring system for water quality in São Paulo State. This monitoring system started with 47 sampling points distributed among the most important watercouses. The last Water Qaulity Report published in 1996 has 123 sampling points. For more detailed informations, see "**Relatório de Qualidade das Águas Interiores do Estado de São Paulo –1996 - Cetesb**".

The monitoring water quality dates are compared to the standards established by Federal Resolution (CONAMA 20/86) instead State Decree (Decree n. 8468). The Federal Resolution is more restricting than the State Decree.

2. Data and Information Related to Wastewater Treatment and Water Quality Analysis

(1) Essential data/information for detailed study (kinds and number of discharge sources)

(1.1) ETE BARUERI

ETE Barueri is a conventional activated sludge plant serving a population of about 2.5 million people. The design flow for the existing facility is 7.0 m3/s (605,800 m3/d). It is currently treating na average day flow of about 3.7 m3/s (320,000 m3/d), of which about 8,6 percent is from industrial sources. The plant receives a significant quantity of hauled industrial and domestic (septage) wastes, and landfill leachate.

(1.2) ETE SUZANO

ETE Suzano is a conventional activated sludge plant which serves a highly industrial catchment area upstream of São Paulo on the Tiete River. The design flow for the facility is 1.5 m3/s (130,000 m3/d). It is currently treating about 0,589 m3/s (50890 m3/d), of which about 11,4 percent is from industrial sources. The plant receives a significant quantity of hauled industrial and domestic (septage) wastes, and landfill leachate.

(2) wastewater effluent/discharge standards (including methods of determination or analysis) for :

- Water temperature: lower than 40° C;
- pH between 5.0 and 9.0 ***(electrometric method);***
- BOD 5 days, 20° C, maximum of 60 mg/l. This limit may only be exceeded if an effluent from a sewage treatment system has its pollutant discharge reduced in terms of BOD 5 days, 20° C of the discharge, in 80% minimum ***(5-Day BOD Test).***
- Oil & grease (substances soluble in hexane up to 100 mg/l, ***extraction method Soxhlet***);
- Heavy metals - Maximum concentration: : Cr: 5.0 mg/l, Cd: 0.2 mg/l, Cu: 1.0 mg/l Zn: 5.0 mg/l, Pb: 0.5 mg/l, Fe2+:15.0 mg/l, Sn: 4.0 mg/l, Ni: 2.0 mg/l ***(metals by atomic absorption spectometry);***
- Toxic substances (phenol: 0.5mg/l) – ***extraction gas chromatographic;***
  Other substances which indicate water quality : cyanide (0.2 mg/l) – ***extraction gas chromatographic.***
  Mn2+: 1.0 mg/l, Ag: 0.02 mg/l, As: 0.2 mg/l, Ba : 5.0 mg/l; B : 5.0 mg/l, Hg : 0..01 mg/l; Se : 0.02 mg/l - ***(atomic absorption spectometry);*** Cr(+6) : 0.1 mg/l; F(-) : 10.0 mg/l - ***(colorimetric method)***

Methods and Equipments

Determination of metals - Atomic Absortion Spectrometric Method : ABNT Standard – NBR 13.810
Determination of barium – Atomic Absorption Spectrometric Method : ABNT Standard – NBR 13.808

Detemination of Total Chromium – Atomic Absorption Spectrometric Method : ABNT Standard – NBR 13.814
Determination of tin – Atomic absorption Spectrometric Method : ABNT Standard – NBR 13.813
Determination of Iron – Atomic Absorption Spectrometric Method : ABNT Standard – NBR 13.815 and
Determination of Iron - Phenanthroline colorimetric method : ABNT Standard – NBR 13.934
Determination of Selenium – Atomic Absorption Spectrometric Method : ABNT Standard – NBR 13.802
(equipment : **Atomic Absorption Spectrometric Equipment)**

Determination of Hexavalent Chromium – Diphenylcarbazide colorimetric method : ABNT Standard – NBR 13.738
Determination of Fluoride – SPADNS colorimetric Method and Ion-selective Electrode Method : ABNT Standard – NBR 13.737
Determination total Manganese – Persulfate Colorimetric Method - ABNT Standard – NBR 13.739
Determination pH value – Electrometric Method : ABNT Standard - NBR 9251
Determination of Arsenic – Silver Diethyldithiocarbamate Method : ABNT Standard – NBR 13.801
Determination of phenols – Liquid-liquid Extraction Gas Chromatographic : ABNT Standard – NBR 10.740 (equipment : **Gas Chromatograph)** and
Determination of phenols – Direct Photometric Method – Sabesp Standard – PNTS 006 and ABNT Standard – NBR 10.740 (equipment : **Spectrophotometer)**
Determination of total Cyanide – Colorimetric and titrimetric Method : ABNT Standard – NBR 12.642
Determination Biochemical Oxygen Demand (BOD) – 5-Day BOD Test : Sabesp Standard - PNTS 003

For more detailed information see **"Catálogo 1997 – Normas Técnicas Usadas no Saneamento Básico/Ambiental"** (copy in Portuguese from Questionary 3).

ABNT - Brazilian Association of Technical Standards
NBR – Brazilian Standard
PNTS – Sabesp Standard

(3) Water quality standards for surface and underground water bodies including rivers.

Federal Law : Under Article 1° of CONAMA 20, surface waters are classified according to their use and quality. There are nine classes (Special, Class 1 to Class 8) that describe respective uses such as domestic water supply with only simple disinfection to navigation and recreation . There are five classes of freshwater (Special and Class 1 to 4), two classes of seewater (Class 5 nd 6) and two classes of saline water (Class 7 and 8). For more detailed information see the **copy in Portuguese** (page 24 to 34 from the Manual of Federal Regulations).

(2) Organization in charge of sewage /wastewater treatment

The Basic Sanitation Company of the State of São Paulo – SABESP according to the terms of Article 7th of its Tariff System Regulation, approved by the State Decree No. 21 123 of August 4, 1983, and altered by the State Decree No. 31 503 of May 2, 1990, informs that the charges for monitoring, collection and/or treatment of non-domestic effluents carried out from the date of publication of the communiqué No. 06, will be elaborated based on the following criteria:

1) For companies connected to the public network, the following formula will be applied:
$CM = P.V.K_1$, whereas
CM Monthly bill
P Prices determined by the current tariff structure, in R$/m³, according to the consumption rate for collection of industrial and commercial wastewater categories that belong to the tariff group where the company is located.
V Volume of effluent in m³, equal to the water volume supplied by Sabesp or the total volume of effluent discharged into Sabesp's network, whichever is higher.
K_1 Pollution Load Factor for discharge into the public network.

1.1) After 60 days from the date on which the customer receives Sabesp's formal communication, the K_1 factor will be applied according to the terms of this document.

1.2) The increase of bill values due to the application of the K_1 factor will be charged cumulatively at the rate of 1/12 (one-twelfth) per month.

2) The cost for hauled waste discharges at Sabesp's Receiving Stations located near interceptors or STPs, is calculated by the following formula:
$C = P.V.K_2$, whereas
C Charges for hauled wastes
P Highest price of the current tariff structure, in R$/m³, for the collection of industrial or commercial wastewater categories that belong to the tariff group where the Sabesp's Receiving Station is located.
V Volume discharged in m³
K_2 Pollution Load Factor for discharges at Sabesp's Receiving Stations.

2.1) Sabesp will only receive wastes hauled by companies already connected to the public network under exceptional circumstances and according to its own criteria.

3) The P values mentioned in items 1 and 2 are the same of those mentioned in the "Communiqués" published by Sabesp in the *Diário Oficial* – the State Official Newspaper, by the time the tariffs were readjusted.

4) The K_1 Pollution Load Factor values to be initially adopted are those mentioned in Table 1 enclosed.

4.1) The K_1 Pollution Load Factor values may be altered according to the concentration range, in mg/L of COD (Chemical Oxygen Demand) and TSS (Total Suspended Solids) in which the company falls into (see Table 2 enclosed). Therefore, Sabesp and the interested parties must provide the respective confirming analyses.

4.2) Table 1 and Table 2 values are also subjected to alterations derived from new analyses of the companies' effluent characteristics especially due to the results on the effluent toxicity and the need for periodic monitoring.

4.3) If the confirming analyses mentioned in item 4 present COD and TSS values higher than the limits established in Table 2, the K_1 value will be calculated by Sabesp.

4.4) Monitoring, collection and/or treatment of non-domestic effluents generated from companies whose activities are not mentioned in Table 1 will be charged after Sabesp has carried out the necessary analyses to determine the COD and TSS values with which the K_1 values will be calculated.

5) The K_2 Pollution Load Factor values will be calculated by the following formulas:

K2 = [0.26 + 0.38 (BOD/300) + 0.36 (TSS/300)] or
K2 = [0.26 + 0.38 (COD/450) + 0.36 (TSS/300)]

Whereas

BOD Biochemical Oxygen Demand obtained from the analysis of the discharged effluent, no less than 300 mg/L.

COD Chemical Oxygen Demand obtained from the analysis of the discharged effluent, no less than 450 mg/L.

TSS Total Suspended Solids obtained from the analysis of the discharged effluent, no less than 300 mg/L

5.1) Sabesp's technical operational area will choose the BOD or COD parameter and this choice will be based on the qualitative and quantitative predominance of raw material; that is, if organics are predominant the BOD parameter will be used, if not COD will be the choice.

6) The prices and conditions for monitoring, collection and/or treatment of non-domestic effluents will depend on their flow and on the operational capacity of the Treatment Station that will receive them and may be the object of a special contract.

7) Communiqué no. 14/92 of December 19, 1992 is hereby revoked.

TABLE 1

K_1 Load Factor Parameter

CODE	INDUSTRIAL CATEGORIES	ADOPTED K_1
10	Non-metallic minerals	1.15
11	Steel	1.03
12	Mechanical	1.10
13	Electric and communication equipment	1.14
14	Transportation material	1.21
15	Lumber and Wood products	1.02
16	Furniture	1.33
17	Pulp and Paper Mills	1.45
18	Rubber products	1.10
19	Leather, furs and leather products	2.06
20	Chemicals	1.35
21	Veterinary and pharmaceutical products	1.19
22	Perfume, soap and candles	1.53
23	Plastic products	1.25
24	Textile Mills	1.19
25	Clothing and footwear	1.19
26	Food processing	1.55
27	Beverage	1.53
28	Tobacco	2.29
29	Publishing and printing	1.31
30	Miscellaneous	1.02
34	Civil construction	1.68
35	Public Utility Industrial Services	1.68
41.5	Gas stations	1.53
41.8	Supermarkets	1.65
54	Services (e.g. Disinfecting & Exterminating, Septic tank cleaners, Building Maintenance, etc.)	1.74

TABLE 2

Average Concentration Ranges of COD and TSS, in mg/L, for determination of K_1 Pollution Loads

COD / TSS	< = 300	301-354	355-425	426-555	556-720	721-1032	1033-1700	1771-4000
< = 450	1.00	1.02	1.05	1.11	1.20	1.35	1.66	2.55
455-591	1.03	1.05	1.08	1.14	1.23	1.38	1.69	2.58
592-765	1.10	1.11	1.15	1.21	1.30	1.44	1.76	2.65
766-1040	1.19	1.21	1.25	1.31	1.39	1.54	1.85	2.74
1041-1430	1.33	1.35	1.39	1.45	1.53	1.68	1.99	2.88
1431-2000	1.53	1.55	1.59	1.65	1.74	1.88	2.19	3.09
2001-3360	1.94	1.96	2.00	2.06	2.14	2.29	2.60	3.49
3361-7000	3.00	3.01	3.05	3.11	3.20	3.34	3.66	4.55

TARIFFS/K_1

CONSUMPTION RANGES m³/month	TARIFFS RS
DOMESTIC	
0 to 10	5.50/month
11 to 20	0.85/m³
21 to 50	2.13 m³
over 50	2.36 m³
COMMERCIAL/ INDUSTRIAL/ PUBLIC	
0 to 10	11.00/month
11 to 20	2.13/m³
21 to 50	4.12/m³
over 50	4.40/m³

Presently, there is a special tariff for industries whose discharge flow is higher than or equal to 20 L/s, but there is a study group working on this problem to have these flows reduced.

(3) Legislation or authorized standards related to water quality manegement/control

(3.1)Watercouse Classification by State Law

The Decree n° 8468 of September 1976, Article 7, defines the watercouse classification according to the preponderant uses in four classes (Class 1 to 4) (see Table 3.1). For more detailed information see **Environmental Bylaw – Discharges from Wastewater Treatment Plants (copy in English)**

Quality Standards
Maximum limits for the following parameters : Ammonia, Arsenic, Barium, Cadmium, Chromium(total), Cyanide, Copper, Lead, Tin, Phenols, Fluoride, Mercury, Nitrate, Nitrite, Selenium , Zinc, Most Probable Number (MPN) of coliforms, DO (Dissolved Oxygen), BOD (Biochemical Oxygen Demand).
Virtually absent for : floating material, substances soluble in hexane, substances transmiting taste or odour

The Watercouse Classification of São Paulo State was stabilished by Decree n° 10.755 of November 1977. For more detailed information see the report named **"Relatório de Qualidade das Águas Interiores do Estado de São Paulo – 1996/ Cetesb" .**

(3.2) Watercouse Classification by Federal Law

The Resolution n° 20 of CONAMA (Conselho Nacional do Meio Ambiente) defines the watercouse classification according the preponderant uses in nine classes (Class Special, Class 1 to 8). Class Special and Class 1 to 4 are classificated as freshwater. For more detailed information see **copy in Portuguese.**

Table 3.1

Decreto 8468/76 State Law	CONAMA 20/86 Federal Law
Class 1	Especial and Class 1
Class 2	Class 2
Class 3	Class 3
Class 4	Class 4

(4) Analysers and measuring facilities/equipment for water pollutants

1) Possibility of equipments local procurement

1- Atomic Absorption Spectrometric Equipment

Perkin Helmer	- Fone : (5511) 578.9600 Fax : (5511) 276.1864 Contact : Paula Bueno
CG	- Fone : (5511) 241.0022 Fax : (5511) 240.6282 Contact : Andréia
CGA	- Fone : (5511) 574.8966 Fax : (5511) 571.4205 Contact : Alexandre
Variant	- Fone : (5511) 820.0444 Contact : Adriano

2- Dissolved Oxygen Meter

Procyon	- Fone : (5511) 820.3066 Fax : (5511) 820.1298 Contact : Antônio Marques
Jundilab	- Fone : (5511) 7397.2622
Analyser	- Fone : (5511) 267.3877 Fax : (5511) 299.1958 Contact : Romanato

3- pH Meter

Micronal	- Fone : (5511) 536.3100 Fax : (5511) 5561.6295 Contact : Rodrigo
Analyser	- Fone : (5511) 267.3877 Fax : (5511) 299.1958 Contact : Romanato
Merk	- Fone : (5511) 279.7422 Fax : (5511) 270.5040 Contact : Ismene

4- Gas Chomatograph

Perkin Helmer	- Fone : (5511) 578.9600 Fax : (5511) 276.1864 Contact : Paula Bueno
CG	- Fone : (5511) 241.0022 Fax : (5511) 240.6282 Contact : Andréia
Variant	- Fone : (5511) 820.0444 Contact : Adriano

5- Chemical Oxygen Demand

Analyser	- Fone : (5511) 267.3877
	Fax : (5511) 299.1958
	Contact : Romanato
Merk	- Fone : (5511) 279.7422
	Fax : (5511) 270.5040
	Contact : Ismene
Jundilab	- Fone : (5511) 7397.2622

6- Mass Spectrometer

Perkin Helmer	- Fone : (5511) 578.9600
	Fax : (5511) 276.1864
	Contact : Paula Bueno
Variant	- Fone : (5511) 820.0444
	Contact : Adriano

2) Local cost for analyser

Engineer Eliana Kitahara has already supplied this information at the meeting held in Suzano WWTP (Table with analysis costs for different standards). You have also received these data when we visited Ambiental and Labortenik labs .

(5) Local consultants

1) availability of local **R&D INSTITUTES**

1- CETESB- Companhia de Tecnologia de Saneamento Ambiental- Setor de Pesquisa Tecnológica de Sistemas de Tratamento, Efluentes Domésticos.

2- FCTH- Fundação Centro Tecnológico de Hidráulica.

3- IPEN- Instituto de Pesquisas Energéticas Nucleares.

4- IPT- Instituto de Pesquisas Tecnológicas do Estado de São Paulo.

5- IMT- Instituto Mauá de Tecnologia.

6- UNICAMP- Universidade Estadual de Campinas/Núcleo de Estudos e Pesquisas Ambientais- NEPAM.

7- Fundação para Incremento de Pesquisa e Aperfeiçoamento Industrial- FIPAI/Escola de Engenharia de São Carlos- Universidade de São Paulo.

資料６　サンパウロ州の排水規制

sabesp

Technical & Environmental Directorate - T
Research and Technological Development Superintendency - TD

ENVIRONMENTAL BYLAW DISCHARGES FROM SEWAGE TREATMENT PLANTS

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2nd ed.

ENVIRONMENTAL BYLAW – DISCHARGES FROM SEWAGE TREATMENT PLANTS

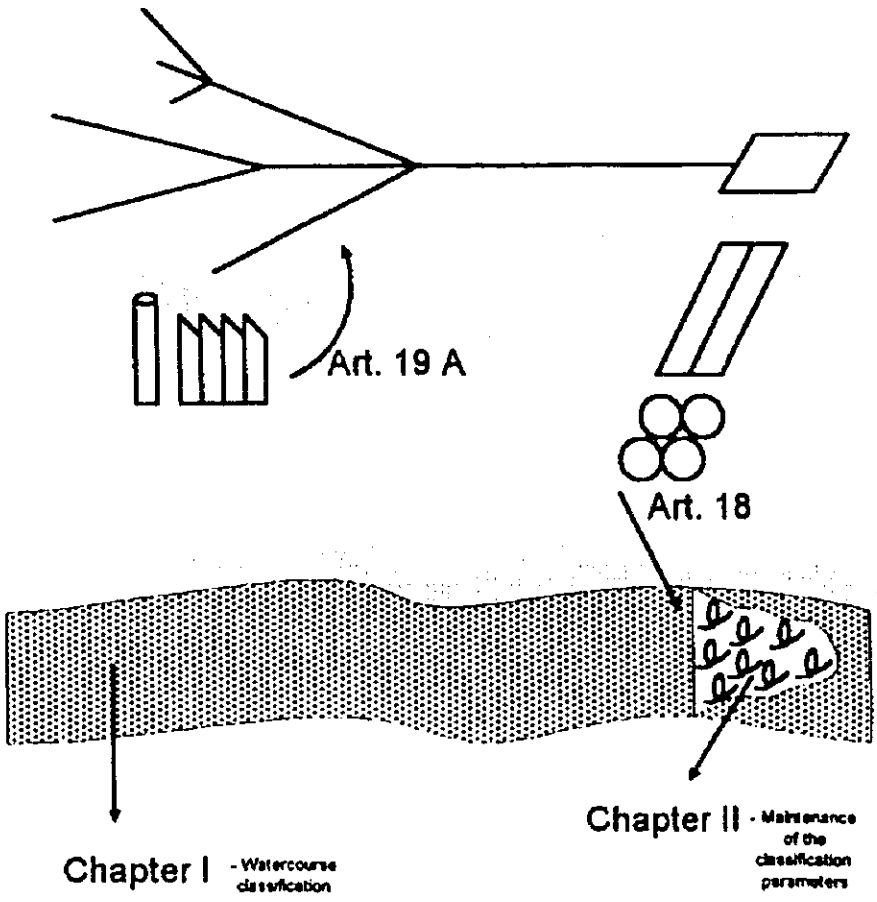
The Decree number 8468, of September 8, 1976, comprehends the present bylaw that specifies the liquid effluent discharge limits from Sewage Treatment Plants, in the State of São Paulo.

Basically the STP's effluents must comply with two criteria:

- maintenance of the classification parameters of the receiving bodies;
- compliance to STP's emission standards.

We set out below the guidelines to consult this bylaw;

- the watercourse classifications are defined in Chapter I;
- the maintenance of the classification parameters is defined in Chapter II;
- the emission standards for the receiving bodies are defined in Article 18th; whereas the Article 19th A specifies the emission standards for the sewage collecting systems.



TITLE II
Water Pollution
CHAPTER I
Water Classification

Article 7th All waters located at the State's territory, to the effects of this bylaw, will be classified according to the following preponderant uses:

I Class 1 Waters destined for domestic supply without previous treatment or with simple disinfection;

II Class 2 Waters destined for domestic supply, after conventional treatment, for vegetable and fruit tree irrigation and for primary contact recreation (swimming, water-skiing and diving);

III Class 3 Waters destined for domestic supply, after conventional treatment, for fish, fauna and flora general preservation and for animals;

IV Class 4 Waters destined for domestic supply, after advanced treatment, for navigation, landscape balance, industrial supply, irrigation and less demanding uses.

§ 1° Waters of better quality may be utilised for less demanding uses, providing these usages do not affect the quality established for these waters.

§ 2° The classification addressed by the present article may cover part or the whole of the water collection, making the decree that determines this

classification defines the limits.

CHAPTER II
Standards
SECTION I
Quality Standards

Article 10th No person shall discharge effluents into Class 1 waters, even if these effluents are treated.

Article 11th No person shall discharge effluents into Class 2 waters which may cause an adverse effect on its quality due to the alteration of the following parameters or values, even if these effluents are treated:

I Virtually absent:

a) floating material, including unnatural foams;

b) substances soluble in hexane;

c) substances transmitting taste or odour;

d) in the case of potential hazardous substances, up to their maximum limits mentioned below:

1 – Ammonia 0,5 mg/L of N (five-tenths milligram of Nitrogen per litre);

2 – Arsenic 0,1 mg/L (one-tenth milligram per litre);

3 – Barium 1,0 mg/L (one milligram per litre);

4 – Cadmium 0,01 mg/L (one-hundredth milligram per litre);
5 – Chromium (total) 0,05 mg/L (five-hundredths milligram per litre);
6 – Cyanide 0,2 mg/L (two-tenths milligram per litre);
7 – Copper 1,0 mg/L (one milligram per litre);
8 – Lead 0,1 mg/L (one-tenth milligram per litre);
9 – Tin 2,0 mg/L (two milligrams per litre);
10 - Phenols 0,001 mg/L (one millesimal milligram per litre);
11 – Fluorine 1,4 mg/L (one milligram and four-tenths per litre);
12 – Mercury 0,002 mg/L (two millesimals milligram per litre);
13 – Nitrate 10,0 mg/L of N (ten milligrams of Nitrogen per litre);
14 – Nitrite 1,0 mg/L of N (one milligram of Nitrogen per litre);
15 – Selenium 0,01 mg/L (one-hundredth milligram per litre);
16 – Zinc 5,0 mg/L (five milligrams per litre);

II Prohibition of artificial dyes that are not removed by the conventional processes of coagulation, sedimentation or filtration.

III Most Probable Number (MPN) of coliforms up to 5.000 (five thousand) with 1.000 (one thousand) being the limit of those of fecal origin in 100 mL (one-hundred millilitres), for 80% of, at least, 5 (five) samples, collected during a period of at least 5 (five) consecutive weeks;

IV Biochemical Oxygen Demand (BOD) during 5 (five) days, at 20°C (twenty degrees centigrade) for any sample, up to 5 mg/L (five milligrams per litre);

V Dissolved Oxygen (DO), for any sample, not below 5 mg/L (five milligrams per litre);

Article 12th No person shall discharge effluents into Class 3 waters which may cause an adverse effect to the quality of these waters, due to the alteration of the parameters and values mentioned below, even if these effluents are treated:

I Virtually absent:

a) floating material, including unnatural foams;

b) substances soluble in hexane;

c) substances transmitting taste or odour;

d) in the case of potential hazardous substances, up to their maximum limits mentioned below:

1 – Ammonia 0,5 mg/L of N (five-tenths milligram of Nitrogen per litre);

2 – Arsenic 0,1 mg/L (one-tenth milligram per litre);

3 – Barium 1,0 mg/L (one-milligram per litre);

4 – Cadmium 0,01 mg/L (one-hundredth milligram per litre);

5 – Chromium (total) 0,05 mg/L (five-hundredths milligram per litre);

6 – Cyanide 0,2 mg/L (two-tenths milligram per litre);

7 – Copper 1,0 mg/L (one milligram per litre);

8 – Lead 0,1 mg/L (one-tenth milligram per litre);

9 – Tin 2,0 mg/L (two milligrams per litre);

10 - Phenols 0,001 mg/L (one millesimal milligram per litre);

11 – Fluorine 1,4 mg/L (one milligram and four-tenths per litre);

12 – Mercury 0,002 mg/L (two millesimals milligram per litre);

13 – Nitrate 10,0 mg/L of N (ten milligrams of Nitrogen per litre);

14 – Nitrite 1,0 mg/L of N (one milligram of Nitrogen per litre);
15 – Selenium 0,01 mg/L (one-hundredth milligram per litre);
16 – Zinc 5,0 mg/L (five milligrams per litre);

II Prohibition of artificial dyes that are not removed by the conventional processes of coagulation, sedimentation or filtration.

III Most Probable Number (MPN) of coliforms up to 20.000 (twenty thousand) with 4.000 (four thousand) being the limit of those of fecal origin in 100 mL (one-hundred millilitres), for 80% of, at least, 5 (five) samples, selected during a period of at least 5 (five) consecutive weeks;

IV Biochemical Oxygen Demand (BOD) during 5 (five) days, at 20°C (twenty degrees centigrade), up to 10 mg/L (ten milligrams per litre) on any day;

V Dissolved Oxygen (DO), for any sample, not below 4 mg/L (four milligrams per litre);

Article 13th No person shall discharge effluents into Class 4 waters which may cause an adverse effect to the quality of these waters, due to the alteration of the values and conditions mentioned below, even if these effluents are treated:

I Floating material, including unnatural foams virtually absent;
II Odour and aspect not objectionable;
III Phenols up to 1,0 mg/L (one milligram per litre);
IV Dissolved Oxygen (DO), for any sample, higher than 0,5 mg/L (five-tenths milligram per litre);

§ 1st If Class 4 waters present levels of coliforms higher than the established maximum values to Class 3 waters, they shall only be destined for public supply providing special treatment methods are used, in order to guarantee their potability.

§ 2nd If Class 4 waters are destined for public supply, the same concentration limits of potentially hazardous substances established to Class 2 and 3 waters, mentioned in item "d", section I, articles 11 and 12 of this bylaw, will be applied.

§ 3rd In order to meet the needs of the municipalities located downstream, CETESB may establish for Class 4 waters, for each case, limits to be observed for pollutant discharges.

Article 14th The Biochemical Oxygen Demand (BOD) limits, established for Class 2 and 3 waters may be elevated if the autodepuration study of the receiving body at any point shows that the foreseen minimum rate of Dissolved Oxygen (DO) will not be exceeded, during critical flow conditions.

SECTION II
Emission Standards

Article 18th The effluents from any pollutant source shall only be discharged, directly or indirectly, into the sewage collection system, if they comply with the following:

I pH between 5,0 (five integers) and 9,0 (nine integers);
II Temperature lower than 40°C (forty degrees centigrade);
III Settleable materials up to 1,0 ml/L (one millimetre per litre) in a one-hour test in "Imhoff cone";
IV Substances soluble in hexane up to 100 mg/L (one-hundred milligrams per litre);
V BOD 5 days, 20°C, maximum of 60 mg/L (sixty milligrams per litre). This limit may only be exceeded if an effluent from a sewage treatment system has its pollutant discharge reduced in terms of BOD 5 days, 20°C of the discharge, in 80% minimum (eighty per cent);
VI Maximum concentrations of the parameters mentioned below:

a) Arsenic 0,2 mg/L (two-tenths milligram per litre);
b) Barium 5,0 mg/L (five milligrams per litre);

c)	Boron	5,0	mg/L
(five milligrams per litre);			
d)	Cadmium	0,2	mg/L
(two-tenths milligram per litre);			
e)	Lead	0,5	mg/L
(five-tenths milligram per litre);			
f)	Cyanide	0,2	mg/L
(two-tenths milligram per litre);			
g)	Copper	1,0	mg/L
(one milligram per litre);			
h)	Hexavalent Chromium	0,1	mg/L
(one-tenth milligram per litre);			
i)	Total Chromium	5,0	mg/L
(five milligrams per litre);			
j)	Tin	4,0	mg/L
(four milligrams per litre);			
k)	Phenol	0,5	mg/L
(five-tenths milligram per litre);			
l)	Soluble Iron (Fe^{2} +)	15,0	mg/L
(fifteen milligrams per litre);			
m)	Fluorides	10,0	mg/L
(ten milligrams per litre);			
n)	Soluble Manganese (Mn^{2} +)	1,0	mg/L
(one milligram per litre);			
o)	Mercury	0,01	mg/L
(one-hundredth milligram per litre);			
p)	Nickel	2,0	mg/L
(two milligrams per litre);			
q)	Silver	0,02	mg/L
(two-hundredths milligram per litre);			

r) Selenium 0,02 mg/L (two-hundredths milligram per litre);
s) Zinc 5,0 mg/L (five milligrams per litre);

VII Other potentially hazardous substances, in maximum concentrations, to be determined by CETESB, for each case;
VIII Discharge rate with maximum flow up to 1,5 (one point five) times the average daily flow;

§ 1° Besides meeting the established limits set out by this article, the effluents shall not transmit to the receiving body characteristics that do not comply with the aforementioned determinations of the Water Classification.

§ 2° If a pollutant source generates different discharges or individualised emissions, the limits determined by this bylaw will be applied to each one of them, or to the group, after the mixture, according to CETESB's criteria.

§ 3° If the effluent has more than one potentially hazardous substance, CETESB may reduce the respective individual limits, proportionally to the number of existing substances.

§ 4° Providing the quality standards of the receiving body are protected, CETESB may authorise the discharge

based on the environmental impact studies carried out by the organisation responsible for the emission, establishing the kind of treatment and the conditions of this discharge.

Article 19th A The effluents from any pollutant source shall only be discharged into a sewage system, if they comply with the following conditions, providing the system is designed to receive them and has a suitable treatment system, according to § 4° of this Article.

I pH between 6,0 (six integers) and 10,0 (ten integers);
II Temperature lower than 40°C (forty degrees centigrade);
III Settleable materials up to 20ml/L (twenty millilitres per litre) in a 1 (one) hour test, in "Imhoff cone";
IV Absence of visible oils and greases and maximum concentration of 150 mg/L (one-hundred and fifty milligrams per litre) of substances soluble in hexane;
V Absence of solvents, gasoline, light oils and explosive or flammable substances in general;
VI Absence of discharges that cause or may cause obstruction of pipelines or any interference in the operation of the sewage system;
VII Absence of any substance in potentially toxic concentrations to biologic processes of sewage treatment;

VIII Maximum concentration of the following elements, groups of elements or substances:

a) arsenic, cadmium, lead, copper, hexavalent chromium, mercury, silver and selenium – 1,5 mg/L (one and a half milligram per litre) of each element subject to restriction of this sub-item and this section:

b) total chromium and zinc – 5,0 mg/L (five milligrams per litre) of each element, also subject to restriction of this sub-item and this section;

c) tin – 4,0 mg/L (four milligrams per litre) also subject to restriction of this sub-item and this section;

d) nickel – 2,0 mg/L (two milligrams per litre), also subject to restriction of this sub-item and this section;

e) all elements listed from sub-item "a" to "d" of this section, but hexavalent chromium – total of 5,0 mg/L (five milligrams per litre);

f) cyanide – 0,2 mg/L (two milligrams per litre);

g) phenol – 5,0 mg/L (five milligrams per litre);

h) soluble iron – (Fe^{2} +) – 15,0 mg/L (fifteen milligrams per litre);

i) fluoride – 10,0 mg/L (ten milligrams per litre);

j) sulphide – 1,0 mg/L (one milligram per litre);

k) sulphate – 1,000 mg/L (one thousand milligrams per litre).

IX Regimen of a continuous 24 (twenty-four) hour discharge, with maximum flow up to 1,5 (one and a half) times the daily flow;

X Absence of any amount of storm water;

§ 1° Providing the good operation of the sewage system will not be affected, the organisation responsible for that operation may, in specific cases, admit the alteration of the values determined in sections IV and VIII of this article, and should communicate the decision to CETESB.

§ 2° If the concentration of any element or substance reaches values which can affect the good operation of the system, the organisation responsible for that operation may, in specific cases, reduce the limits determined in sections IV and VIII of this article, as well as establish maximum concentrations of other potentially hazardous substances, and should communicate this decision to CETESB.

§ 3° If effluents are discharged into a public sewage system that is not able to receive them or does not have a suitable treatment system, it will be applied the emission standards mentioned in article 18, sections V, VI, VIII, sub-items "j" and "k", and section X, and also in the regulations originated from this bylaw.

§ 4º For the application of what is disposed in this article, public sewage system with capacity and suitable treatment system is the one which, according to CETESB, the treatment meets the intended objectives, or where there is a plan and work schedule already approved by the State or Federal Government.

資料７　その他収集資料一覧

1) Tiete プロジェクトに関する下水処理場のパンフレット（Sao Miguel, Novo Mundo 及び ABC 処理場）

2) 廃棄物に関するブラジル工業規格（NBR 10004）

3) Sao Paulo 市下水及び下水処理場計画図

4) SABESP 設計基準

5) 排水分析結果（Ambiental Labotatorios 社及び Labotechnic Tecnologia 社）

6) 水質分析 Tariff（Ambiental Labotatorios 社）

7) 廃棄物(スラッジ)に関する資料（Ambiental Labotatorios 社作成の資料）
〔カラーコピー及び Floppy Disk〕

8) ENGENHARIA, No, 527/1998 – ANO 55　（Tiete プロジェクト特集号）