

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

JEDDAH INDUSTRIAL CITY

WASTEWATER TREATMENT PLANT

A Presentation by :

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SAWEA 2007 WORKSHOP, AL-KHOBER
4 December 2007

Built & Being Operated by :



icdoc

شركة تطوير وتشغيل المدن الصناعية

Industrial Cities Development and Operating Co.

**on Build-Operate-Transfer (BOT) Basis as the
First Project in the Kingdom of Saudi Arabia**

The Presentation will highlight:

- 1. History of the ICDOC & the Development of the Plant**
- 2. Aims & Objectives of the Project**
- 3. Factories – Existing in the Area & Served by Connections**
- 4. Layout & Process Flow Diagram of the New Plant**
- 5. Details of the Unit Processes / Advance Treatment Stages**
- 6. Average Flow, Influent & Secondary Effluent Characteristics**
- 7. Amount of Water Treated by Advance Treatment & its Reuse**
- 8. Violations & Operational Problem**
- 9. Conclusion**

Prior to April 2003, the WWTP conditions were poor
There was a Wastewater Treatment Plants
but:-



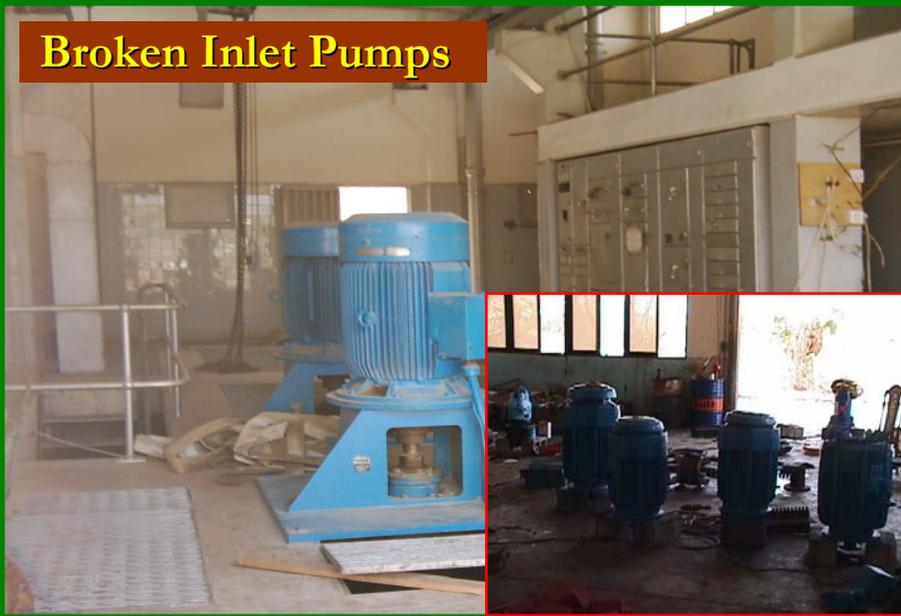
**The aging old Lagoons were with
Broken Side Walls**



**& Non-Operating
Surface Aerators**

Continue : Condition of the Old Plant

Broken Inlet Pumps



Damaged Inlet Works



Broken Grit Chamber



Non-Working Grit Classifiers



The surrounding areas used to suffer from:

- **Water Logging accompanied with Septic Black Sewage, having odor & environmental nuisance**
- **Untreated Effluents - used to be pumped into Red Sea causing negative impacts on the marine environment.**

Jeddah Industrial City Management was aware & concerned about the Problem and need to resolve it.

Consequently, They were seeking a Professional Company that could Provide Total Solution to the Existing Problem

**“Request for Proposal” was announced on International Level through
WORLD BANK**

On 1 April 2003,

Jeddah Industrial City Management

Awarded the BOT Contract to ICDOC

- **To Manage the Existing Old WWTP**
- **To develop New Wastewater Treatment Facilities in order to Serve the Jeddah Industrial City.**

ICDOC Rehabilitated some of the damaged Unit Processes



In order to start its Operation to the best of its abilities

Extensive Planning was done

&

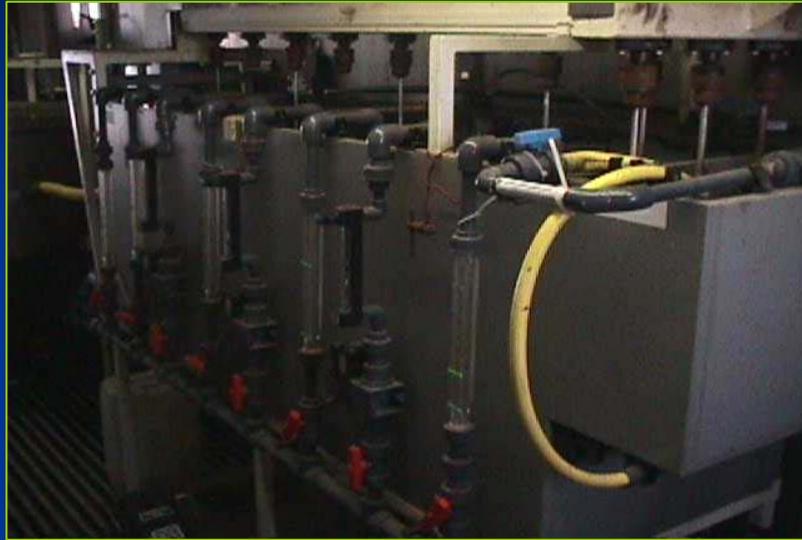
Within a quite Short time, the old facilities were rehabilitated for Emergency Operation

by :

- *Repairing the Pumps, Valves, Gates & Distribution Chambers etc.*
- *Repairing of Surface Aerators etc.*
- *Addition of Various Chemicals*
- *Applying Various Operational Techniques*



Pilot Plant Studies were conducted to select the Feasible Process & Design



During Operation of Old facilities, Simultaneously

- Design of The New Wastewater Treatment Plant**
- * Feasibility Studies by Operating Pilot Plant**
- * Construction of Civil Work**
- * Execution of Electro-Mechanical work**

was also in progress

Efficient Project Management Techniques were used during the Construction of the New Plant



The Project Completed on Scheduled Time

**Apart from ICDOC Managers,
Consultants & Engineers ...**

International Company - DHV

***& Local Companies like Muhaidib Contracting Co.,
Saudi Berkfeld (Wetico) & Saudi Tumpane***

**were the main Consultants & Contractors during
the whole Project Execution**

Now... There Exists a Most Modern Jeddah Industrial City Wastewater Treatment Plant

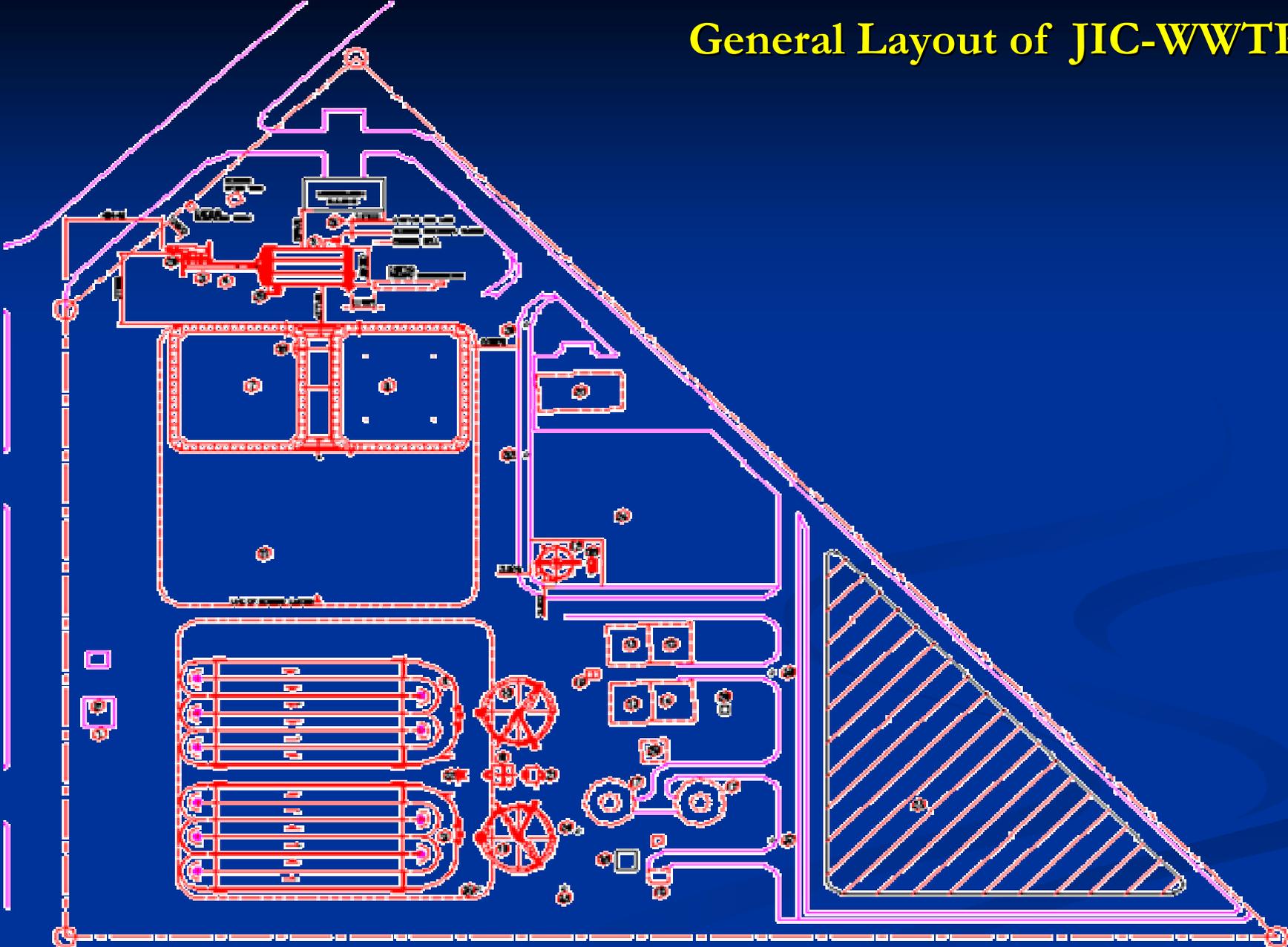


- Located in the South of Jeddah (21° 23' 59" N, 39° 13' 40" E) to Serve more than 550 factories in various phases of Jeddah Industrial City

The Set Objectives of the JIC-WWTP are to :-

- 1. Contribute in Serving the Jeddah Industrial City for treating its Wastewater.**
- 2. Provide High Quality Water to some Industries to cut down the Water demand.**
- 3. Satisfy the Client (JIC-Management) & Meteorology & Environmental Protection Agency (MEPA) by maximizing wastewater collection & Treatment in order to Contribute in Protection of the Environmental Pollution.**

General Layout of JIC-WWTP

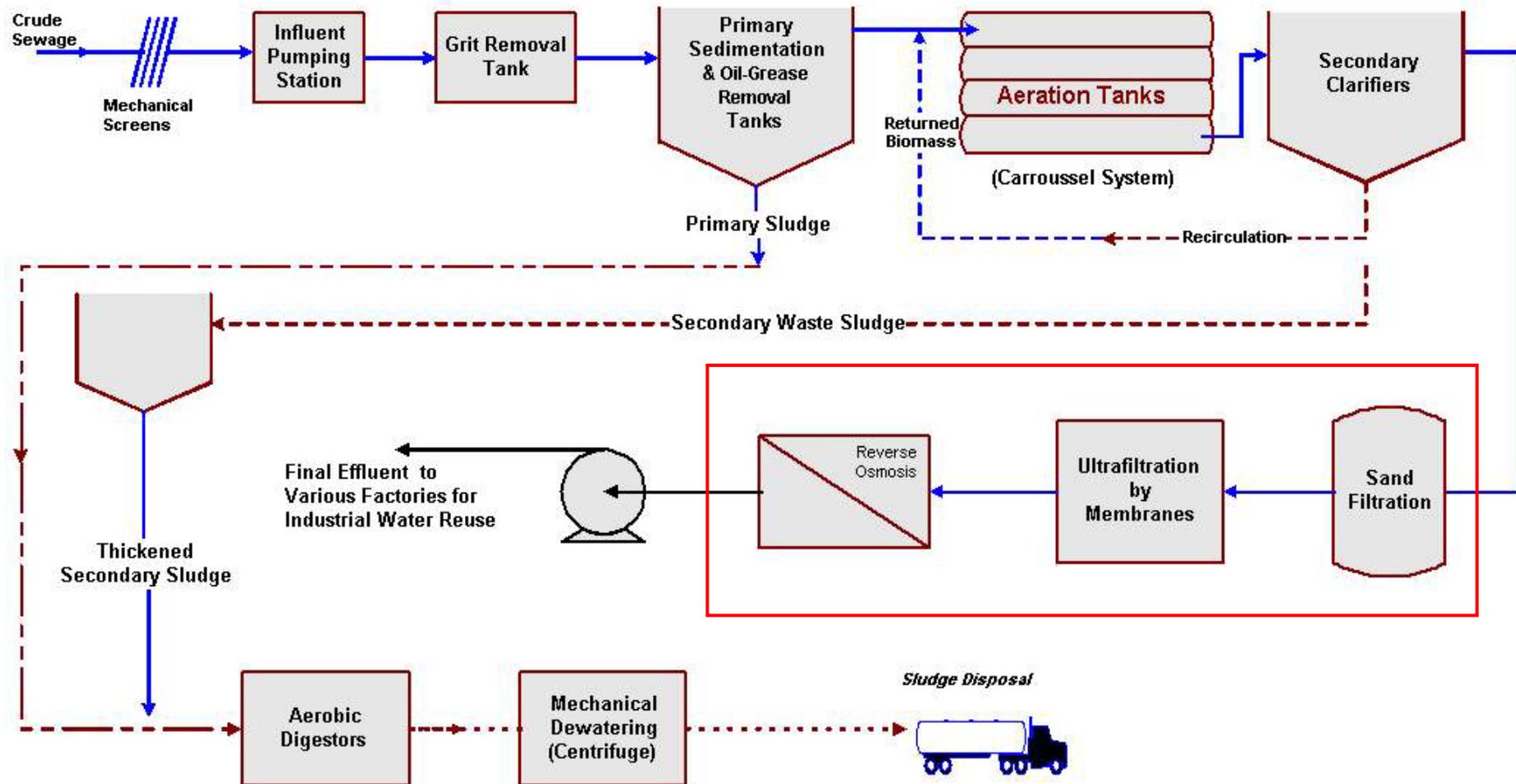


LAYOUT PLAN

Process Flow Diagram of the JIC - WWTP



Fig-2: Schematic Flow Diagram of Jeddah Industrial Wastewater Treatment Plant
Capacity = 25,000 m³/d



JIC-Wastewater Treatment Plant Design Details:

Process Name	Activated Sludge (Carrousel System)
Average Daily Flow	25,000 m ³ /day
Peak Flow	40,000 m ³ /day

Designed Influent & Effluent Characteristics:

Parameter	Influent	Secondary Effluent
pH	5 – 11	6 - 9
COD	3000 mg/l (75,000 Kg/d)	150 mg/l
BOD	1500 mg/l (37,500 Kg/d)	25 mg/l
Suspended Solids	2000 mg/l (50,000 Kg/d)	15 mg/l
Total Kj. Nitrogen	60 mg/l (1,500 Kg/d)	10 mg/l

MEPA Standards

Table 1-1 : Appendix of the Contract

Meteorology & Environmental Protection Administration (MEPA). Environment Protection Measures, Document No. 1409-01, Year 1402. Wastewater Treatment Plant Direct Discharge Standards

Primary Standard (Physiochemical)

Parameters	Acceptable Level
Floating Material	None Visible
Total Suspended Solids	15 mg/Liter
Temperature	To be Determined

Secondary Standard (Inorganic Chemical) :

Parameters	Acceptable Level
Ammonia	1
Arsenic	0.1
Cadmium	0.02
Selenium	0.1
Total Phosphate	1.0
Zinc	1.0

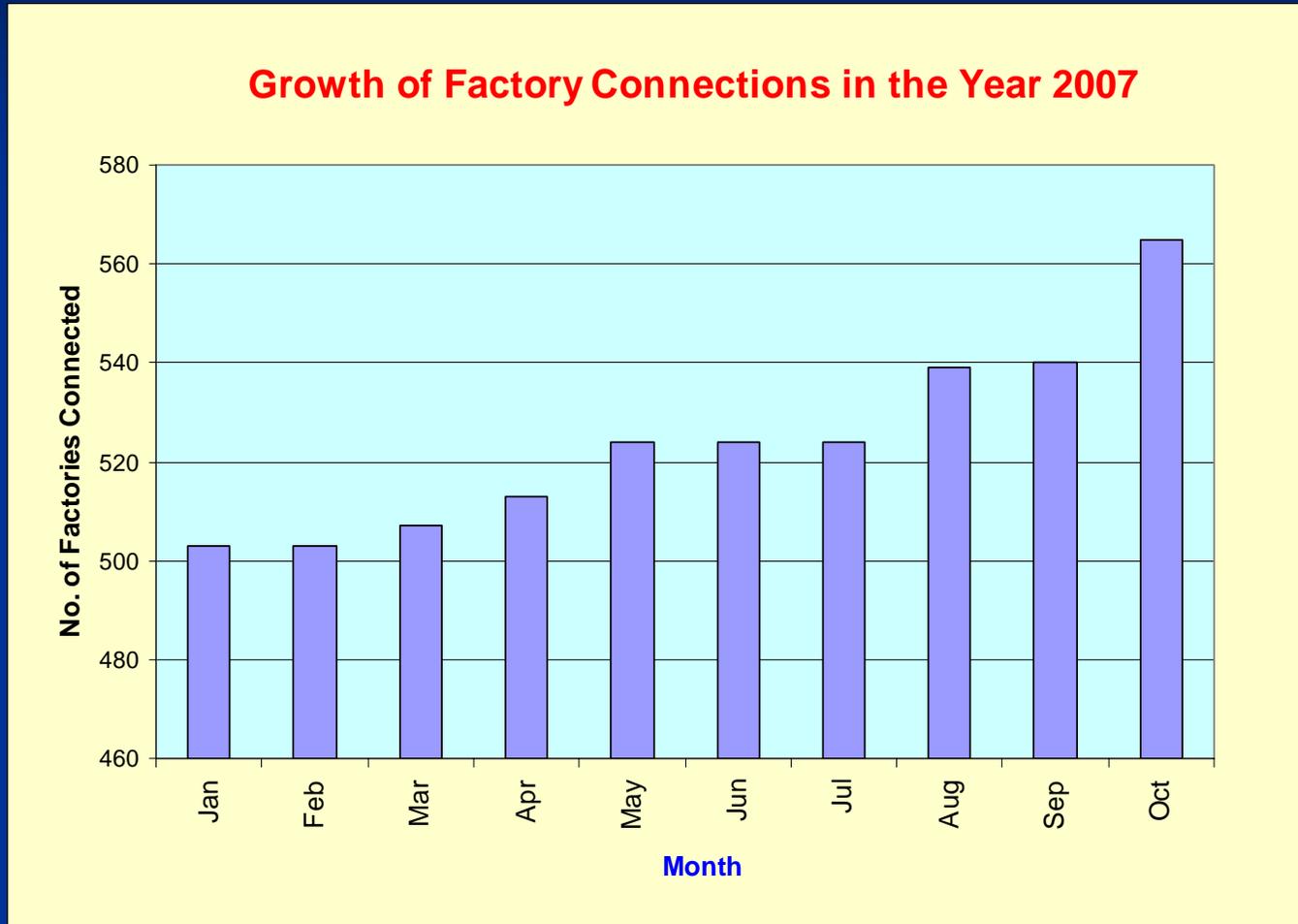
Secondary Standard (Organic Chemical) :

Parameters	Acceptable Level
Total Organic Carbon	50 mg/Liter
Total Kjehldahl Nitrogen	10 mg/Liter
Total Chlorinated Hydrocarbons	0.1 mg/Liter

At Present ...

There are about 580 factories in the area

Out of which 565 are connected to our Sewerage Network

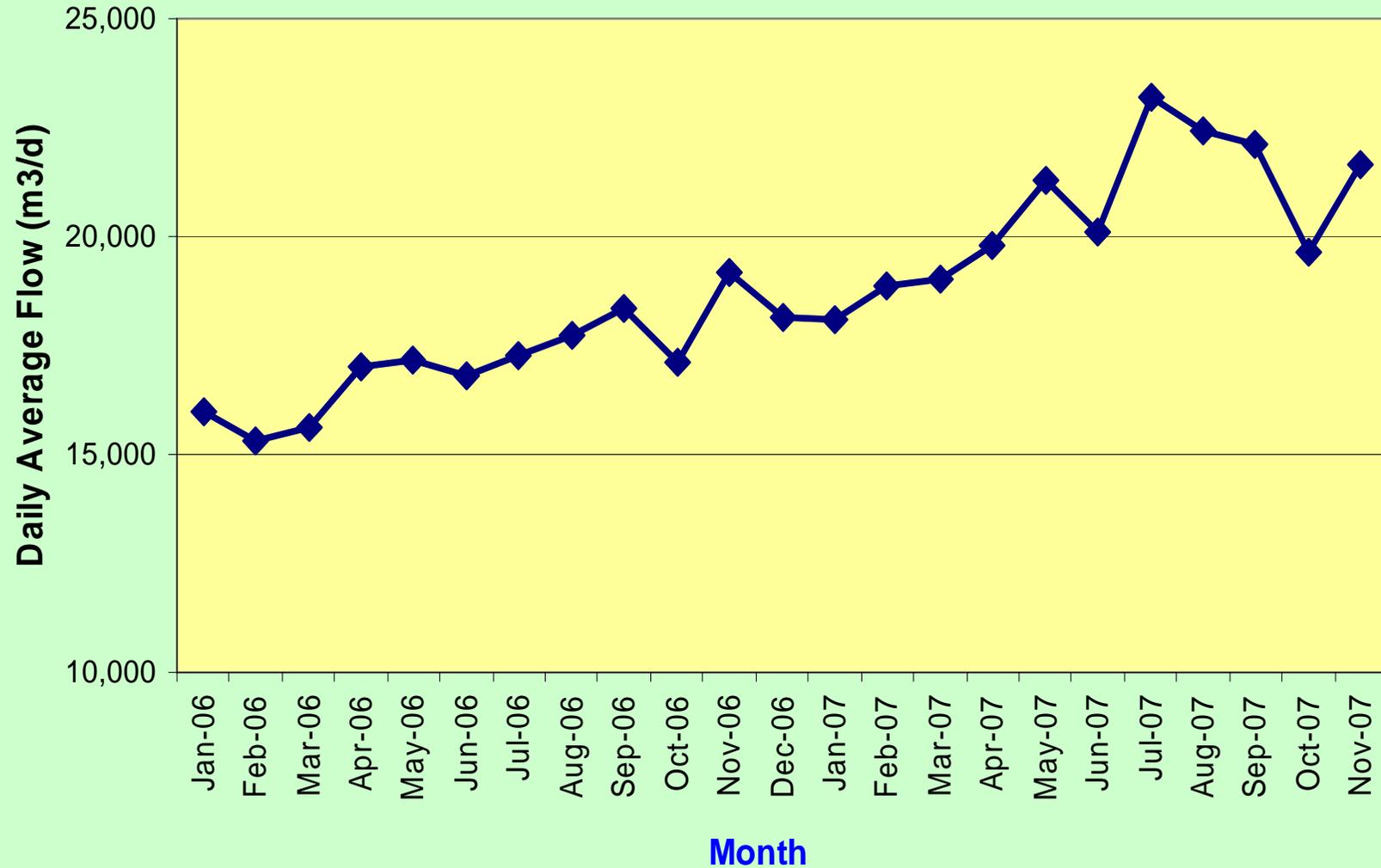


Only 2.5 % factories are still not connected.

Factories, which are the Major Contributors of Flow include the following types :-

- | |
|--|
| ■ Metal Industries |
| ■ Plastic Packing Industries |
| ■ Carpet Manufacturing Factories |
| ■ Soap & Detergents Factories |
| ■ Glass Manufacturing Factories |
| ■ Cooking Oil Producing Factories |
| ■ Food & Beverage Factories |
| ■ Water & other Food Items |
| ■ Housing Compounds / Labor Camps |

Average Daily Flow to the JIC-WWTP Since Jan 2006 - Till now



Influent to the Plant



Influent Pumps



Inlet Chamber



Flow Measurement

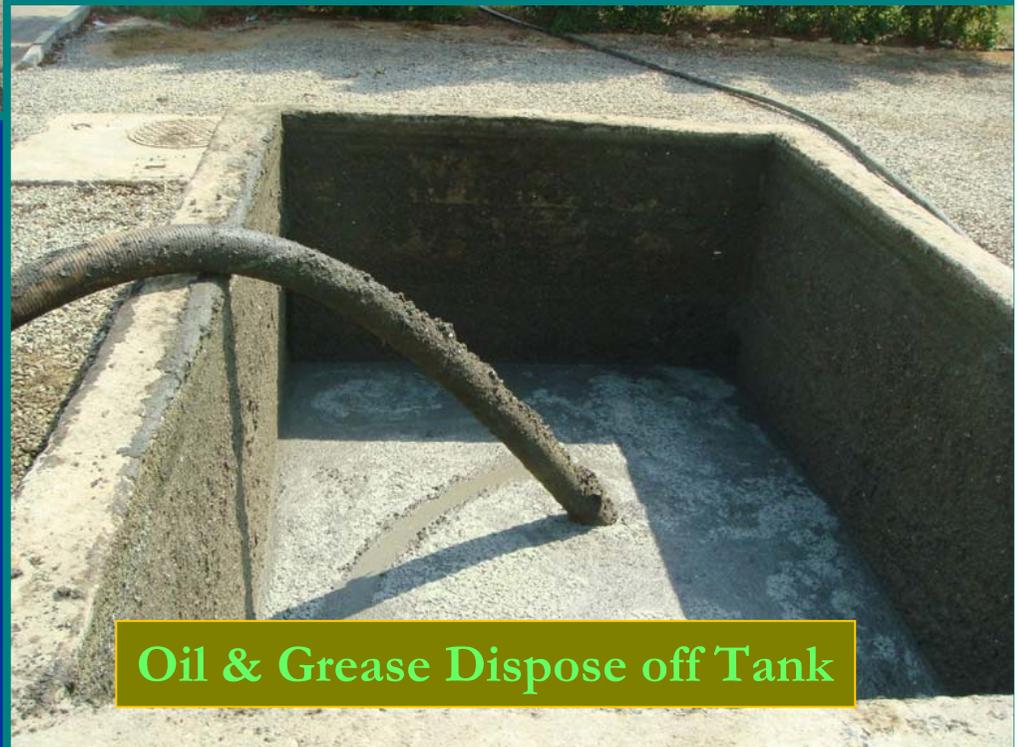
Grit Removal Chamber & Classifier



Primary Sedimentation Tank / Oil Removal



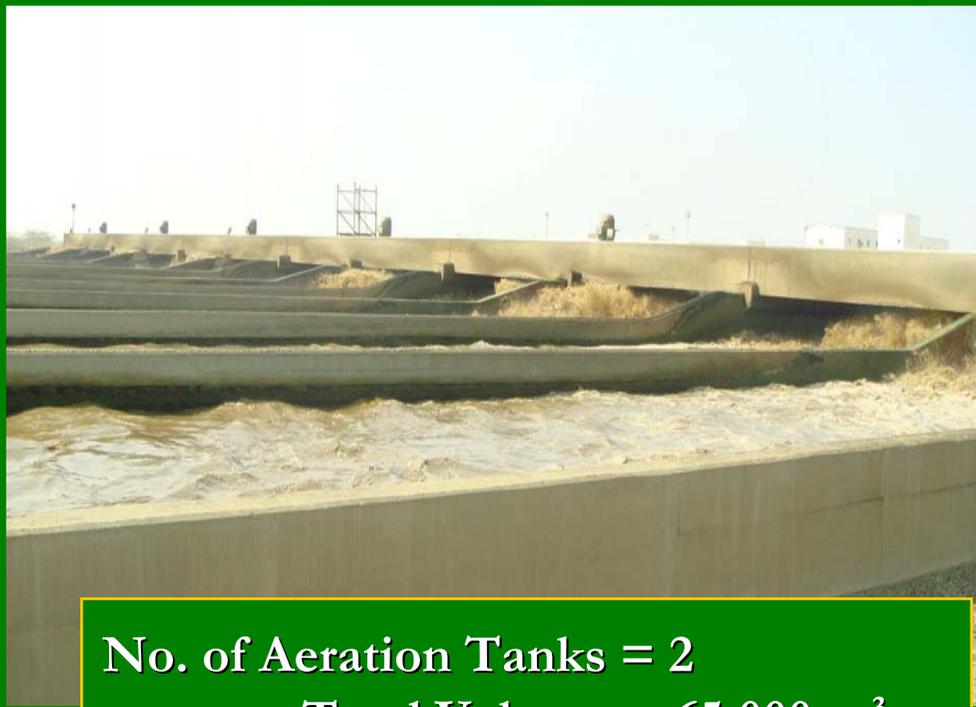
Primary Sedimentation Tank



Oil & Grease Dispose off Tank

Aeration Tanks (Carrousel System)

Where the Organic Matter is converted to CO_2 , H_2O and New Cells



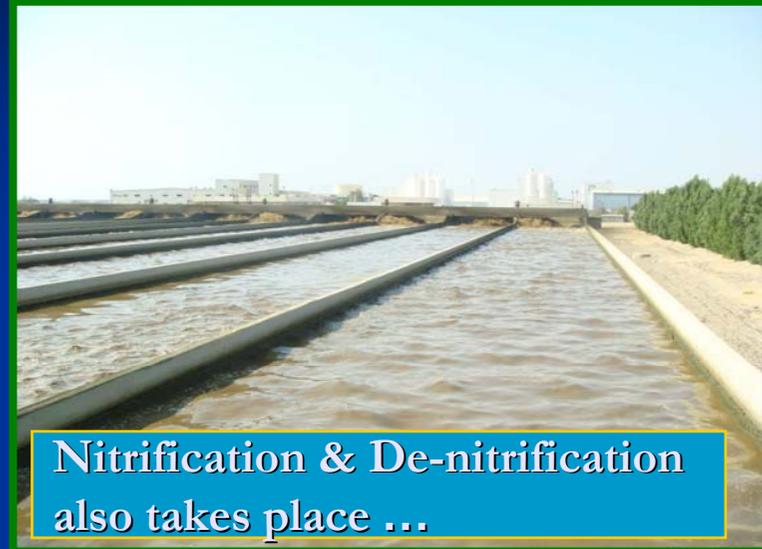
No. of Aeration Tanks = 2

Total Volume = 65,000 m³

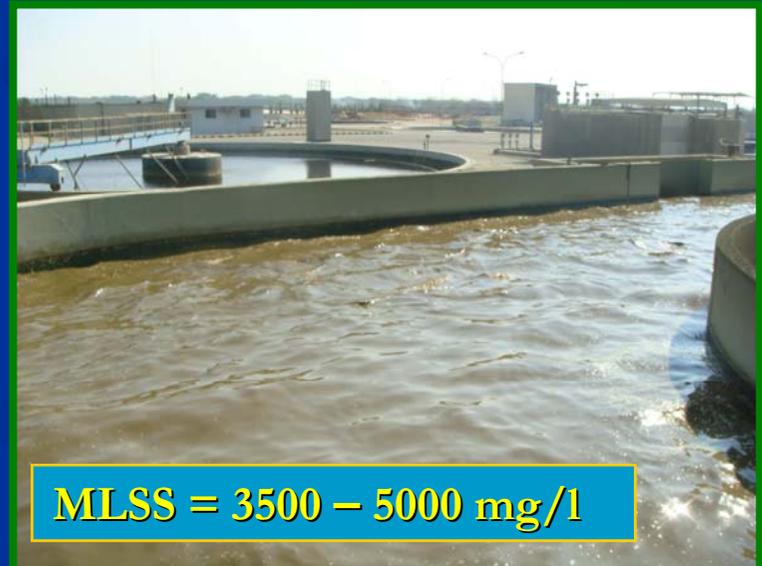
Total No. of Aerators = 10

Total Power = 1200 KW

Total O₂ Supplied = 30,000 Kg/d



Nitrification & De-nitrification
also takes place ...



MLSS = 3500 – 5000 mg/l

Secondary Clarifier :



Separates the Clean water.

Biomass is settled at the bottom which is returned to A/Tanks.

Some Sludge is wasted to keep the proper SRT in the System.

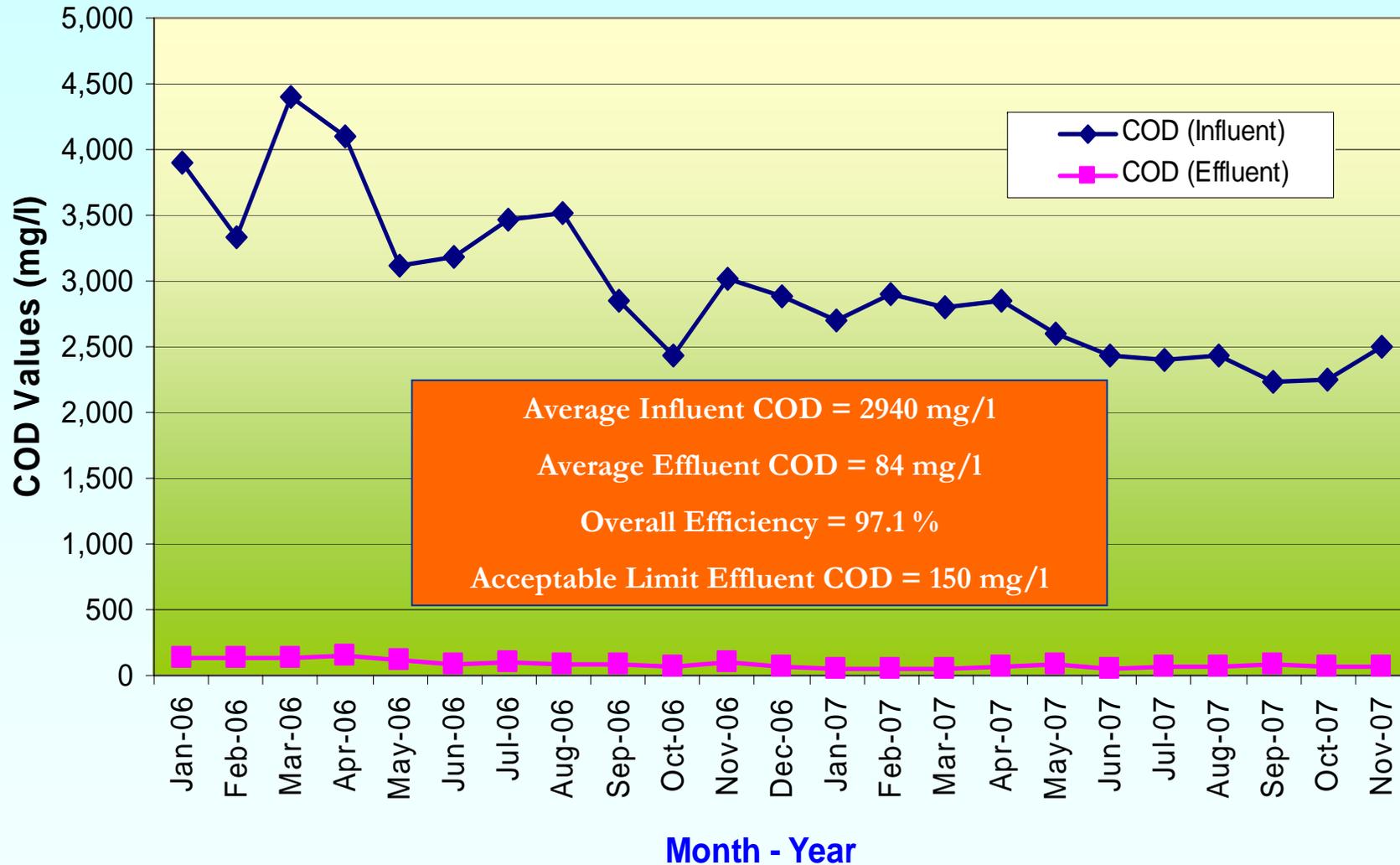
ICDOC has met The Contractual Requirement of the Effluent Quality

Influent

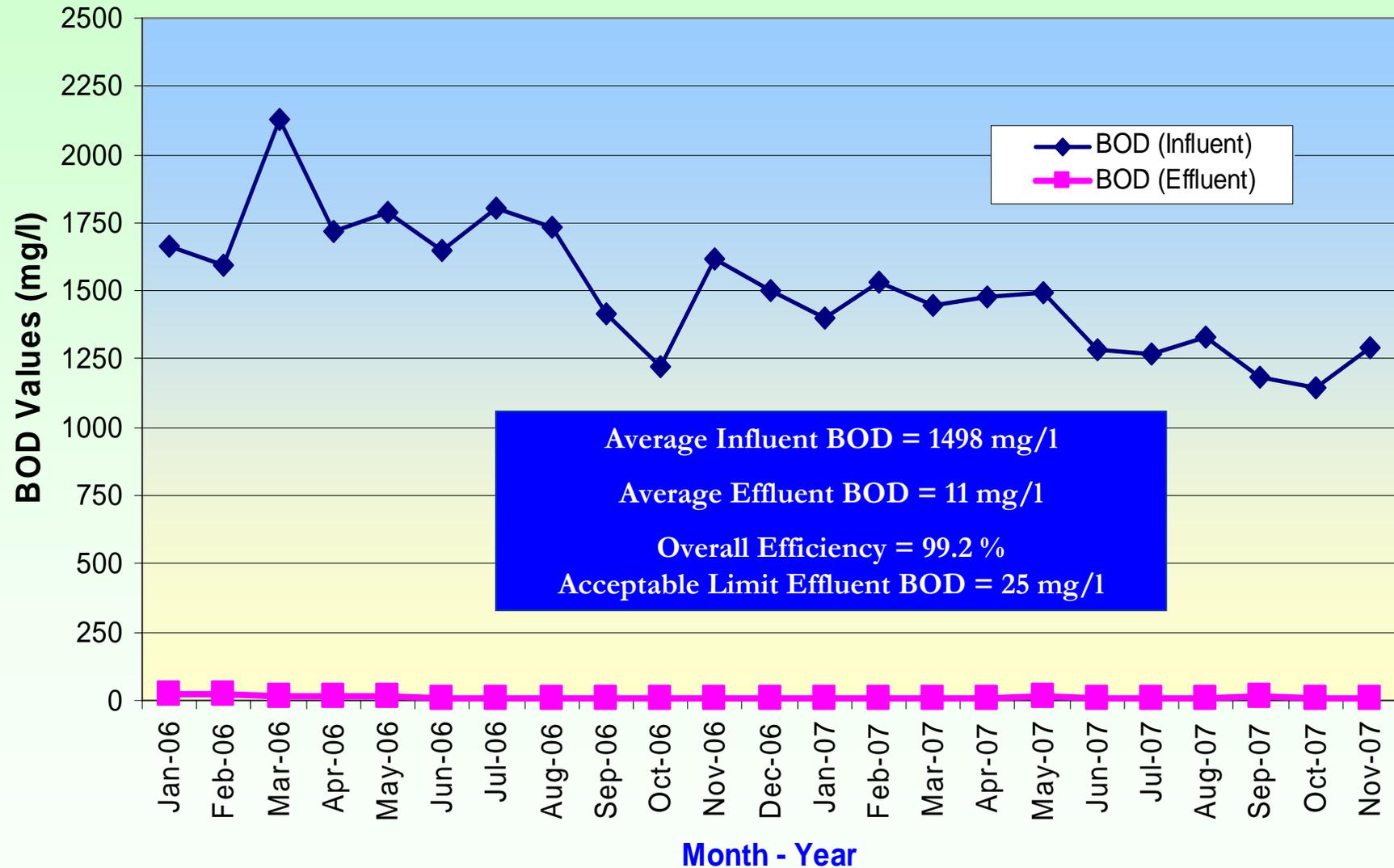


Secondary Clarifier
Effluent

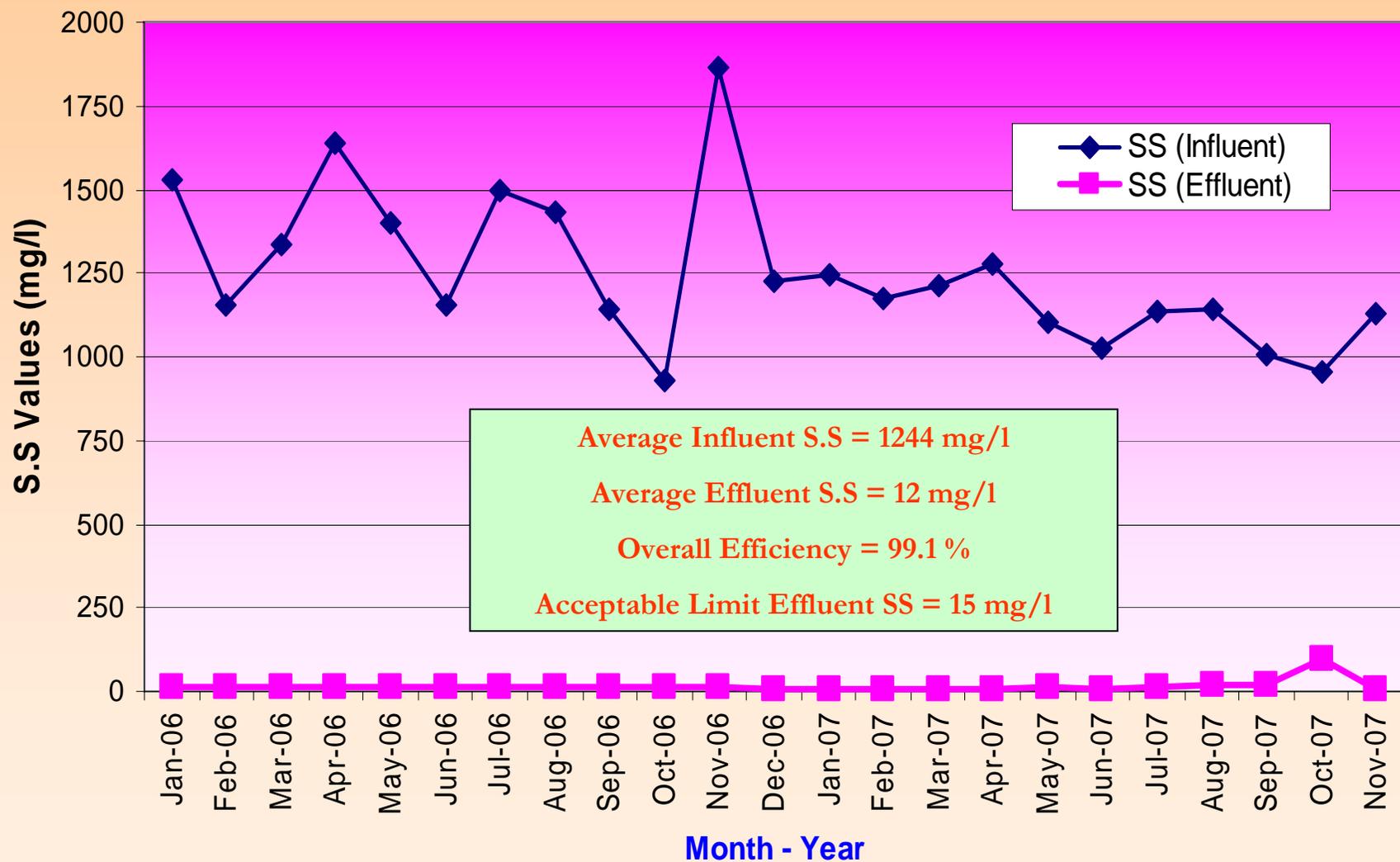
Influent & Secondary Clarifier Effluent COD for JIC-WWTP (Since Jan 2006 - Till now)



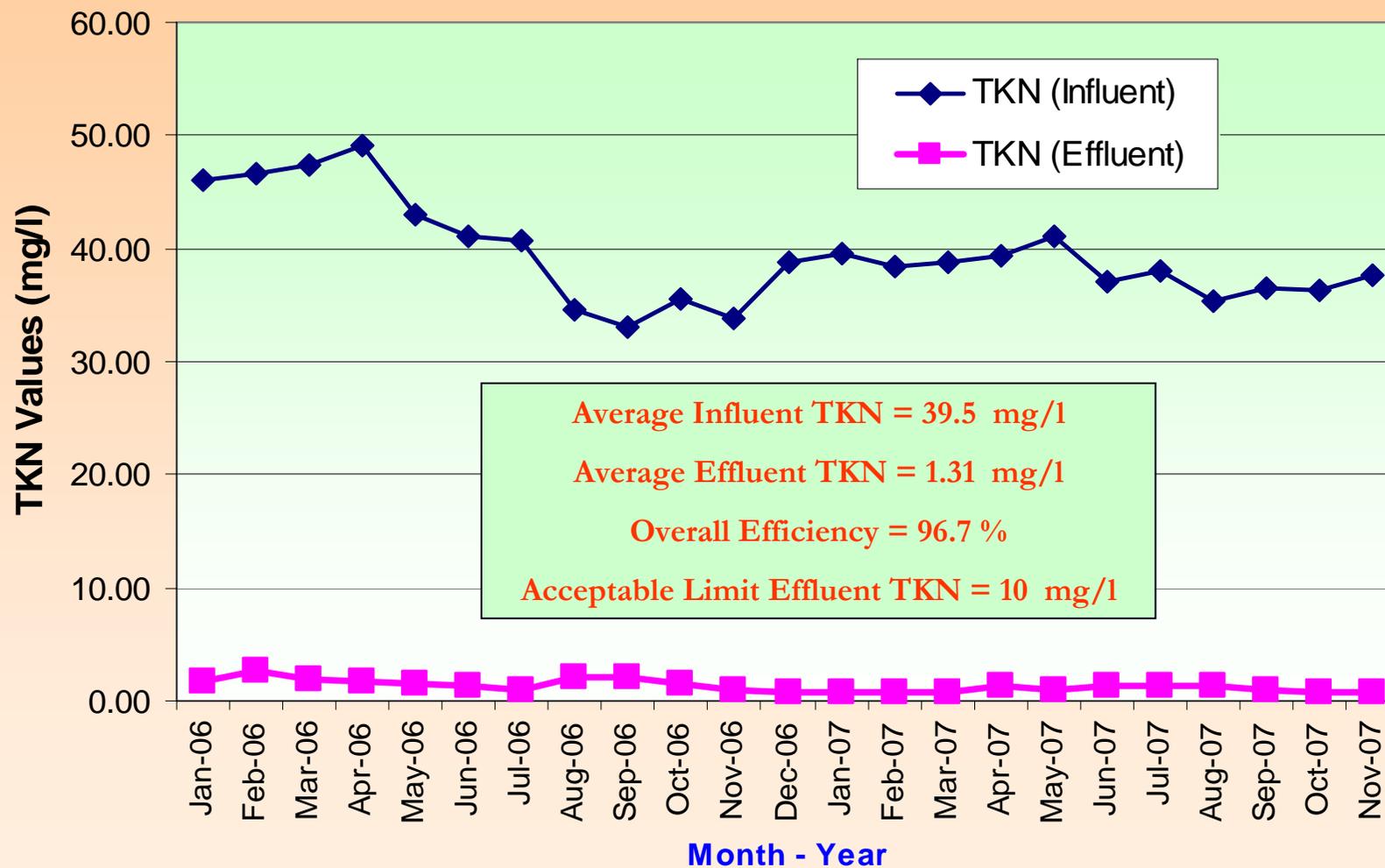
Influent & Secondary Clarifier Effluent BOD for JIC-WWTP (Since Jan 2006 - Till now)



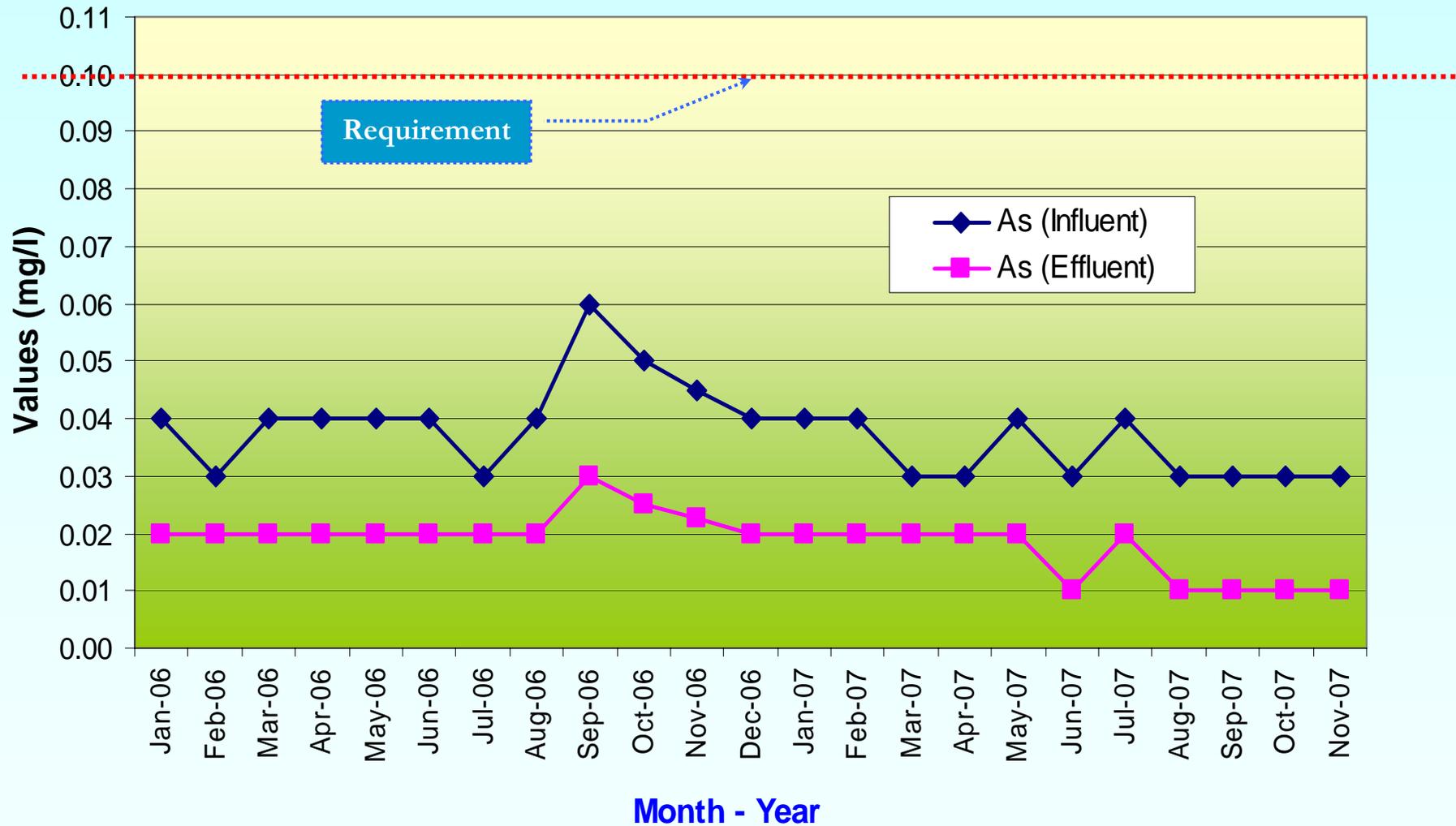
Influent & Secondary Clarifier Effluent SS for JIC-WWTP (Since Jan 2006 - Till now)



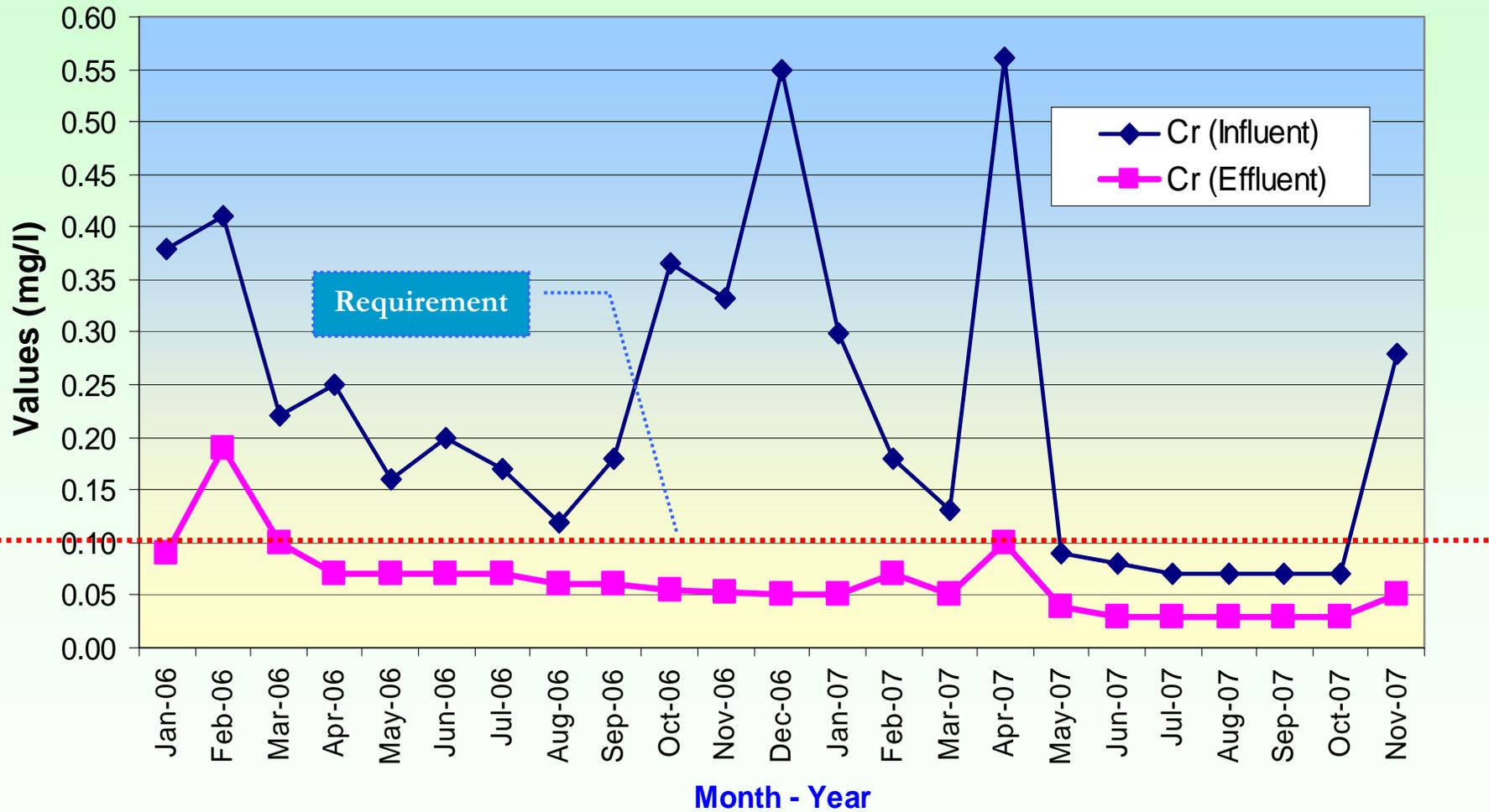
Influent & Secondary Clarifier Effluent Total Kjeldahl Nitrogen for JIC-WWTP (Since Jan 2006 - Till now)



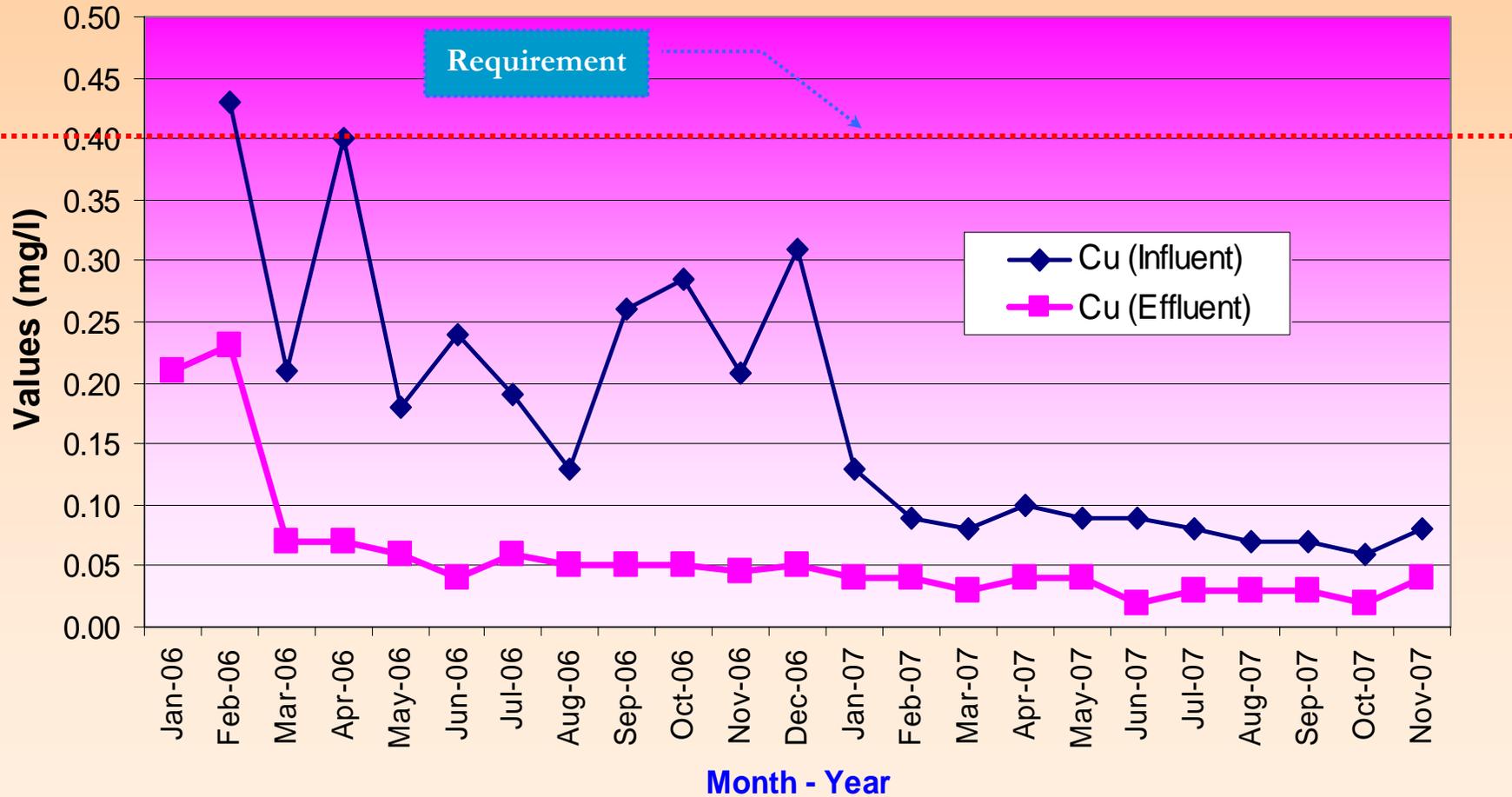
Influent & Secondary Clarifier Effluent Arsenic for JIC-WWTP (Since Jan 2006 - Till now)



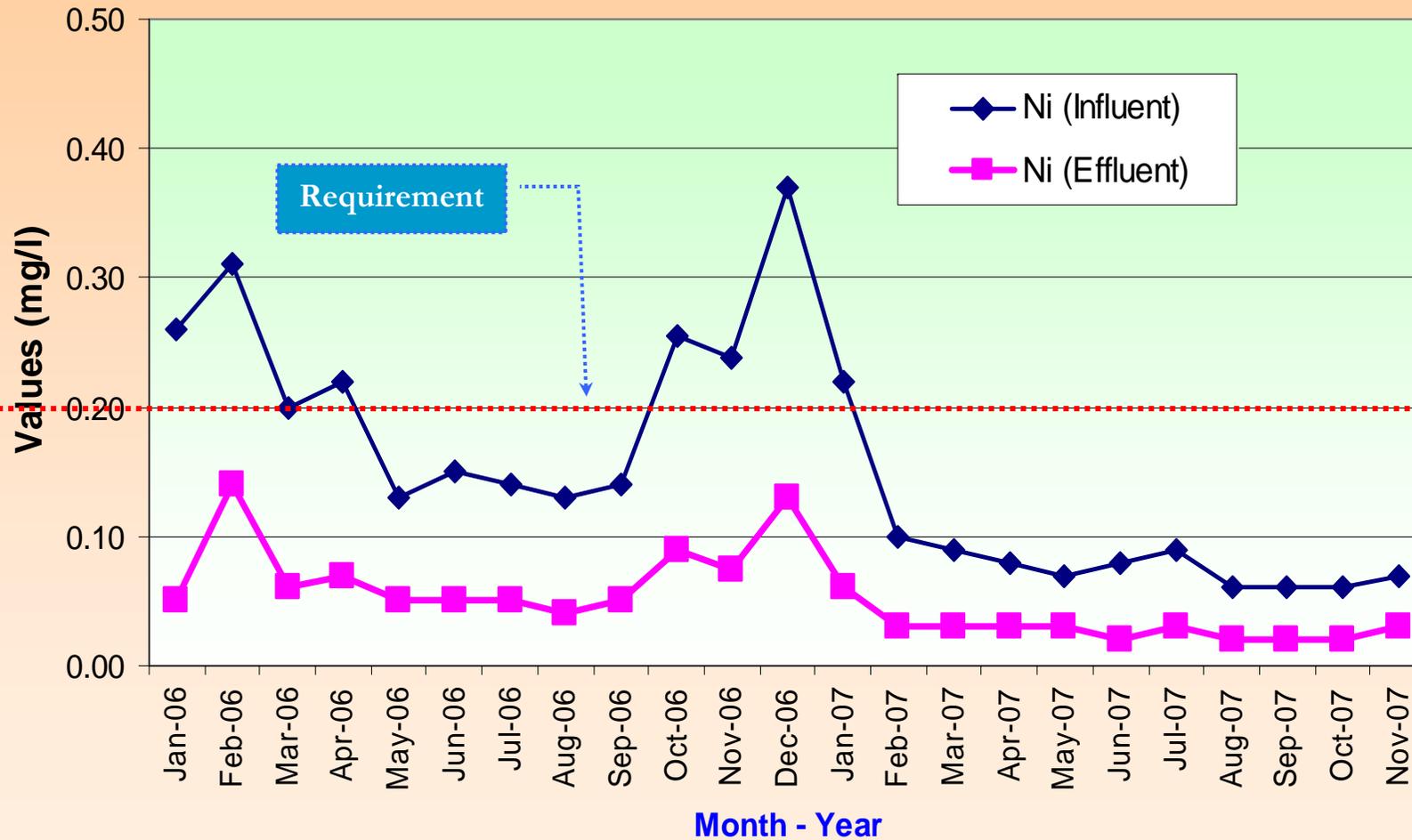
Influent & Secondary Clarifier Effluent Chromium for JIC-WWTP (Since Jan 2006 - Till now)



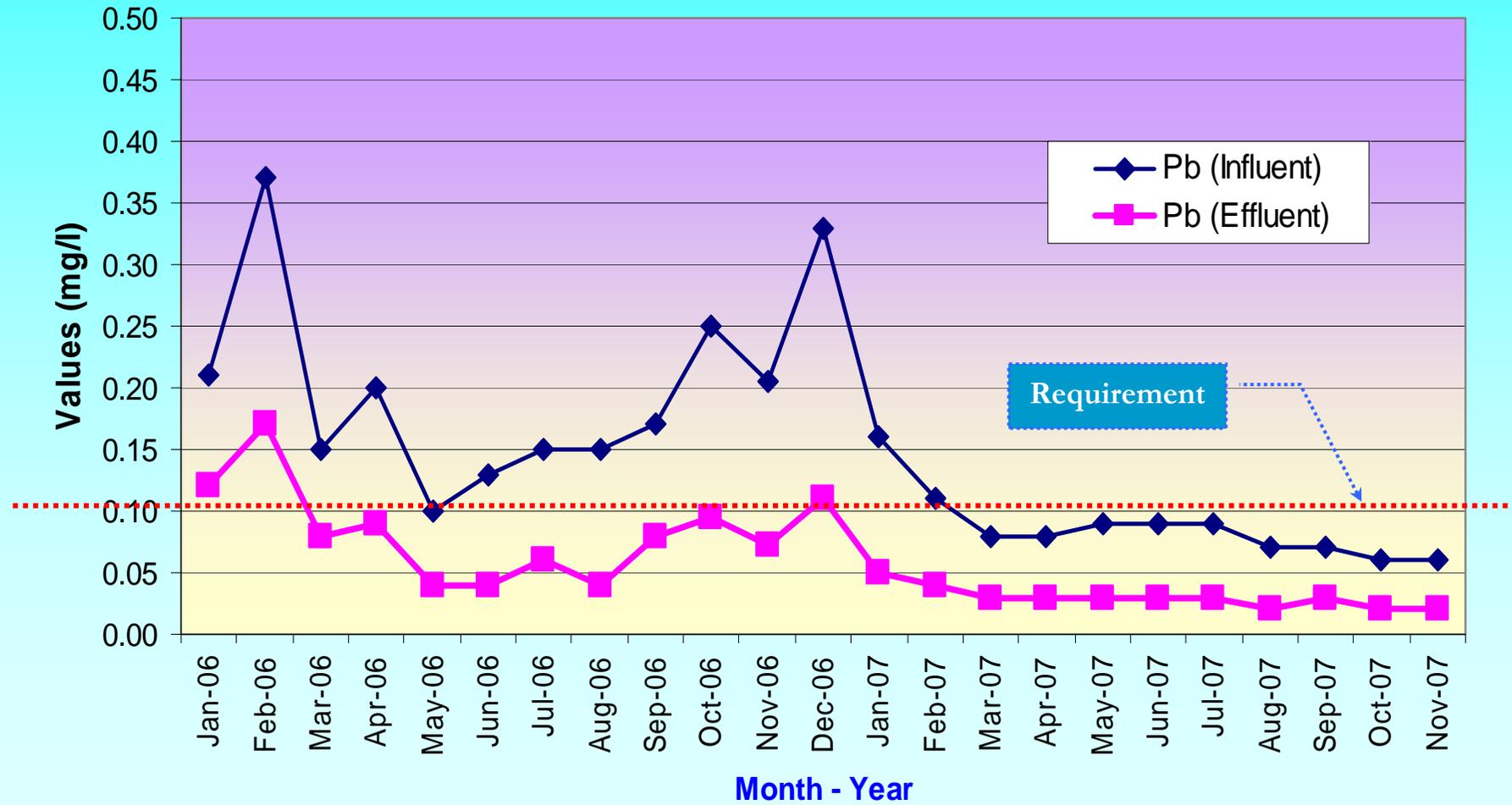
Influent & Secondary Clarifier Effluent Copper for JIC-WWTP (Since Jan 2006 - Till now)



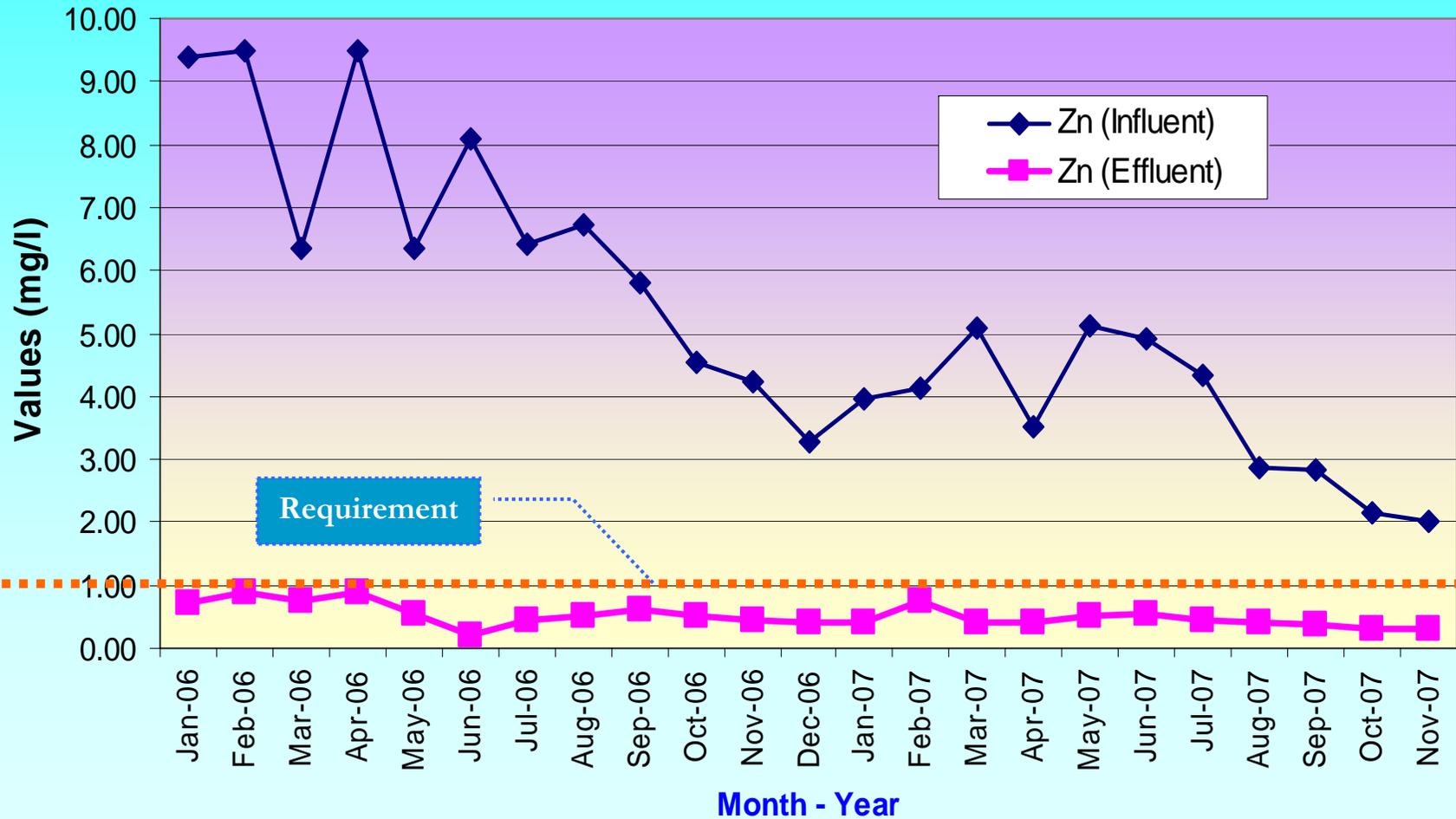
Influent & Secondary Clarifier Effluent Nickel for JIC-WWTP (Since Jan 2006 - Till now)



Influent & Secondary Clarifier Effluent Lead for JIC-WWTP (Since Jan 2006 - Till now)



Influent & Secondary Clarifier Effluent Zinc for JIC-WWTP (Since Jan 2006 - Till now)



ICDOC has continued further

Additional Pilot Plant Studies have been carried out to Enhance the Water Quality to Provide High Quality Water to the Factories for their use

Pilot Studies on the State of Art – Advanced Treatment Facilities



Then ICDOC Added ...



Sand Filtration

Ultra-Filtration by Membrane



Reverse Osmosis Plant :



Membranes to remove the
Total Dissolved Solids



SCADA System



Electrical Control Panel

NOW,

ICDOC

Produces ...



A
VERY
HIGH
QUALITY
WATER

Water Produced – After R.O. Process

**Average Daily Water Production after Reverse Osmosis
Since Jan 2007 - Till now**



Present Water Production & Reuse:

Average Daily Production :	4,274 m³/d
Maximum Daily Production :	7,331 m³/d
Total Water Produced in a Year (From Nov 2006 till November 2007) :	1,560,010 m³ (One Million Five Hundred Sixty Thousand and Ten m³)

Water Quality :

pH	7.3
Total Dissolved Solids	69 mg/l
Turbidity	NIL
Total Suspended Solids	NIL
Chloride	17 mg/l
Total Hardness	13 mg/l
COD, BOD	Not Detectable
T.K.N	Not Detectable



Our Water is Reused by:-

- Various Factories like :
 - Middle East Paper Company (MEPCO)
 - Carpet Factories
 - Glass Manufacturing Factories



- Tankers take away

An Average of 80 – 100 tankers (Capacity 20 m³) take away the high quality water to various locations in the Industrial City for Miscellaneous usages



JIC – WWTP has a well equipped Laboratory that is capable of doing all the required analysis

- pH
- Alkalinity
- Chloride
- Settleable Solids
- Chemical Oxygen Demand (COD)
- Biochemical Oxygen Demand (BOD)
- Total Suspended Solids (TSS)
- Oil & Grease
- Total Kjeldahl Nitrogen
- Ammonia Nitrogen
- Nitrite, Nitrate - Nitrogen

..... & so on



For Process Monitoring & Control

Atomic Absorption Unit for the Analysis of Heavy Metals



- Arsenic
- Lead
- Cadmium
- Nickel
- Copper
- Selenium
- Zinc
- Ag
- etc .. etc

To confirm the Final Effluent Standards as per the Requirement of MEPA

Microbiological Conditions are Monitored with the help of Microscope



**Every Plant has some exceptional
cases of Ups & Downs ...**

So, is our Plant

**But, WE always try hard to take
Maximum Care to Control the
Upsets by our Experts.**

Examples of Violations & Upsets:

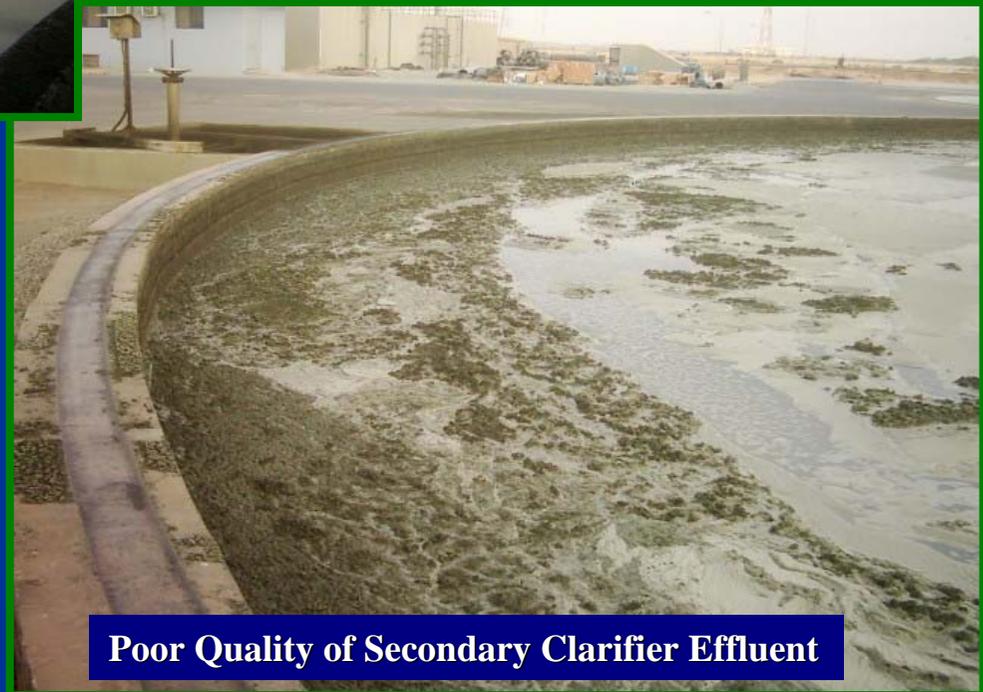
We do have Strict Regulations & Monitoring Program, But from time to time, some the factories dump unusual substance without our knowledge These substance include **Excessive Oil & Grease, Paint, Color, Some Toxic material etc ...**



Which leads to some Serious Problems to our Plant



Abnormal Scum Generation in A/Tanks



Poor Quality of Secondary Clarifier Effluent

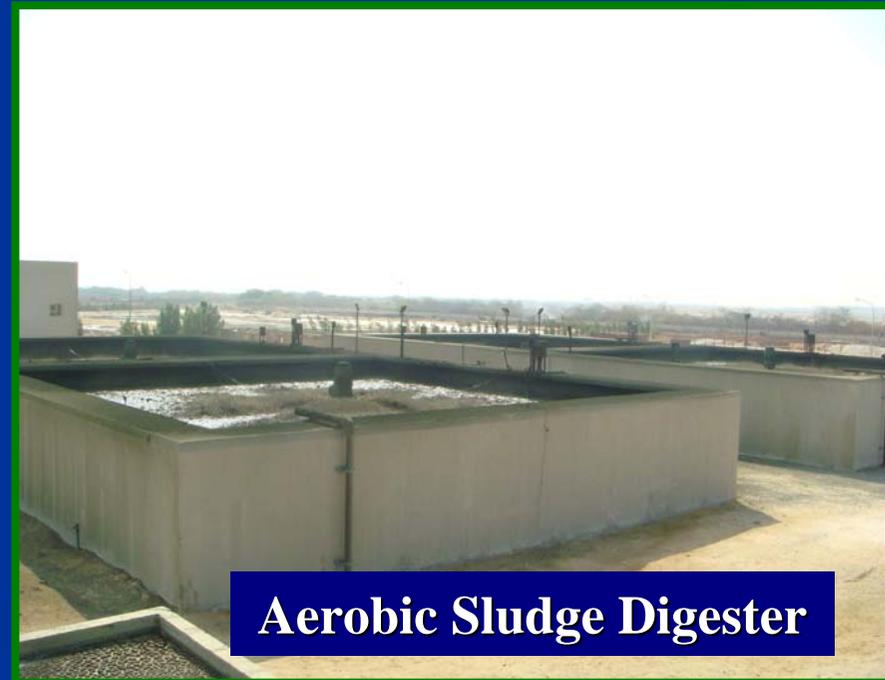
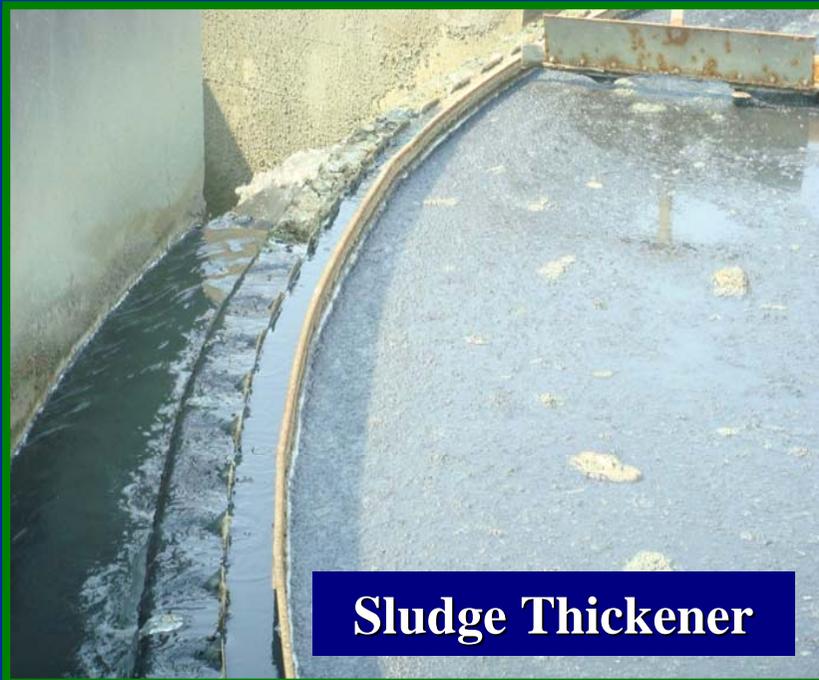
Problems to our Plant



Excessive Sludge Accumulation in Inlet Works

Sludge Handling Facilities

- Our Secondary Sludge is well digested as we keep the Sludge Retention Time in Carrousel System in the range of 12 to 20 days.
- **Primary Sludge is Thickened and digested in Aerobic digesters for more than 15 days**



All the Sludge is Dewatered by Centrifuge



**To Reduce the Volume for
Easy Disposal**



CONCLUSION:

JIC-WWTP is a True Model of what ICDOC can deliver for Effective Treatment and Re-use of the Industrial Wastewater in industrial cities in the Kingdom, and for Reshaping the Management of the Wastewater Treatment and reuse by integrated and advanced approaches.

Thus, We Meet Our Aims & Objectives



1. **Contribute in Serving the Jeddah Industrial City for treating its Wastewater.**
2. **Provide High Quality Water to some Industries to cut down the Water demand.**
3. **Satisfy the Client (JIC-Management) & Meteorology & Environmental Protection Agency (MEPA) by maximizing wastewater collection & Treatment in order to Contribute in Protection of the Environmental Pollution.**



**Thank You for
Your Kind Attention.**