شركة البترول الوطنية الكويتية

إحدى شركات مؤسسة البترول الكويتية
A Subsidiary of Kuwait Petroleum Corporation
KNPC

Sustainable Environmental Development through Wastewater Management at KNPC

Health, Safety & Environment Department

Environment Division

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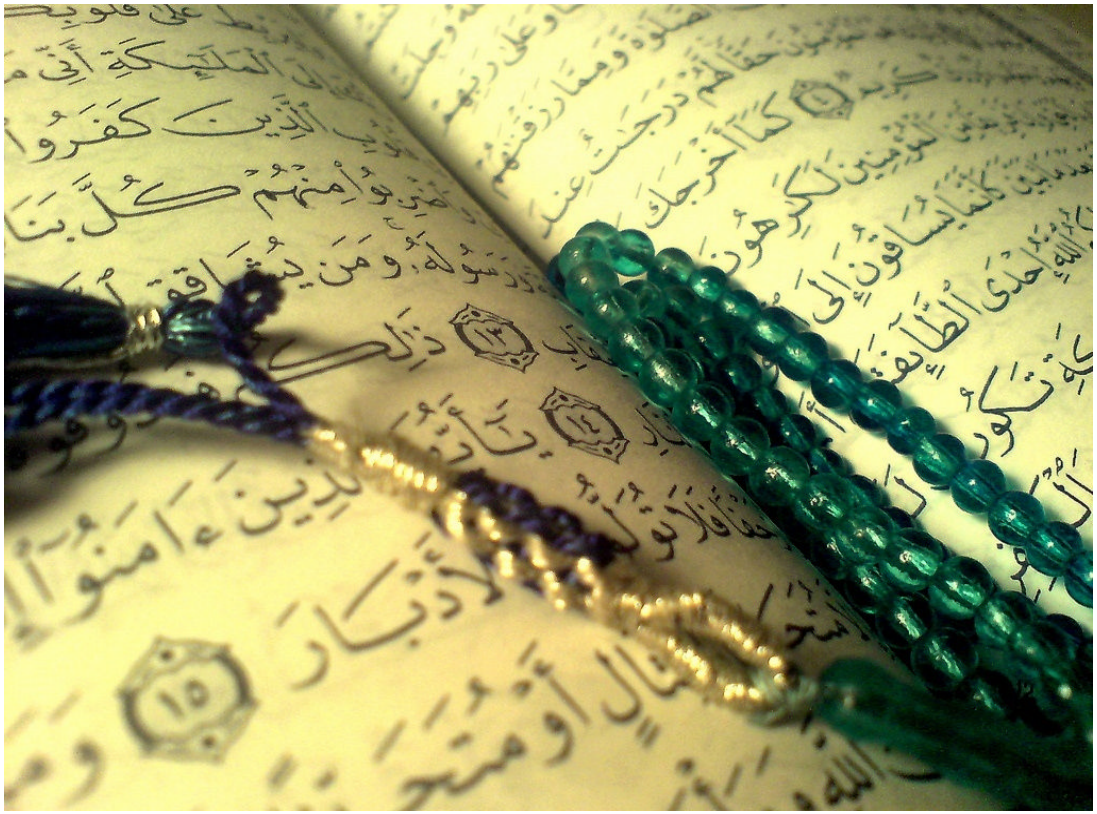
بسم الله الرحمن الرحيم

قال تعالى: {وَنَبِّئْهُمْ أَنَّ الْمَاء قِسْمَةٌ بَيْنَهُمْ كُلُّ شِرْبٍ مُّحْتَضَرٌ} (القمر/28).



KUWAIT NATIONAL PETROLEUM COMPANY

MAIN BUSINESS UNITS

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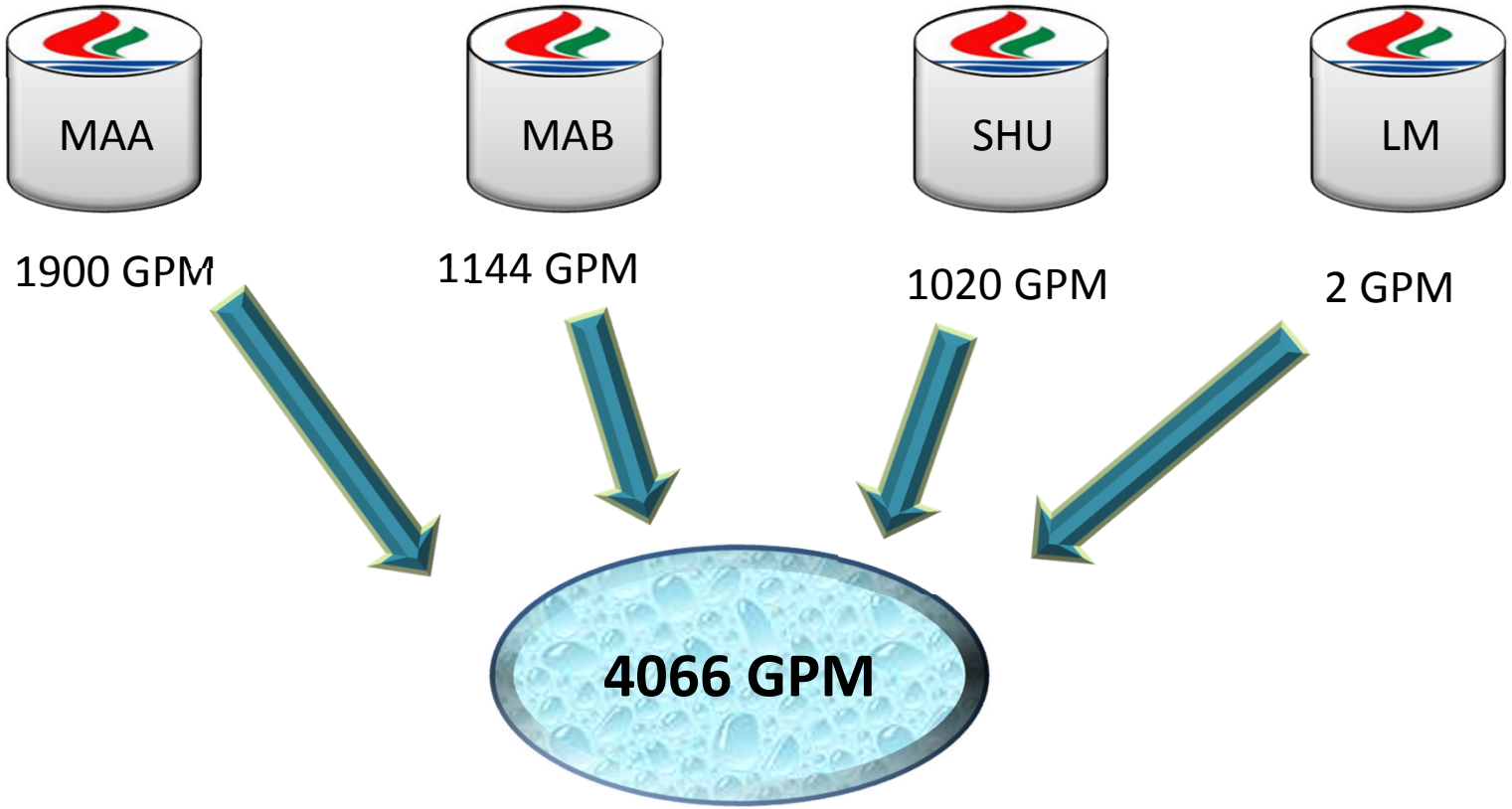
Wastewater:

Any water that has been *adversely* affected by organic or *inorganic* contaminant

Wastewater Generation From KNPC Facilities



Legal & other Requirements

- **Kuwait – EPA Articles:**
  - **Article 59**

  Liquid –Effluent discharge into the marine environment should not exceed levels listed *
  - **Article 60**

  Industrial liquid discharge into public drains should not exceed limits .
  - **Article 61**

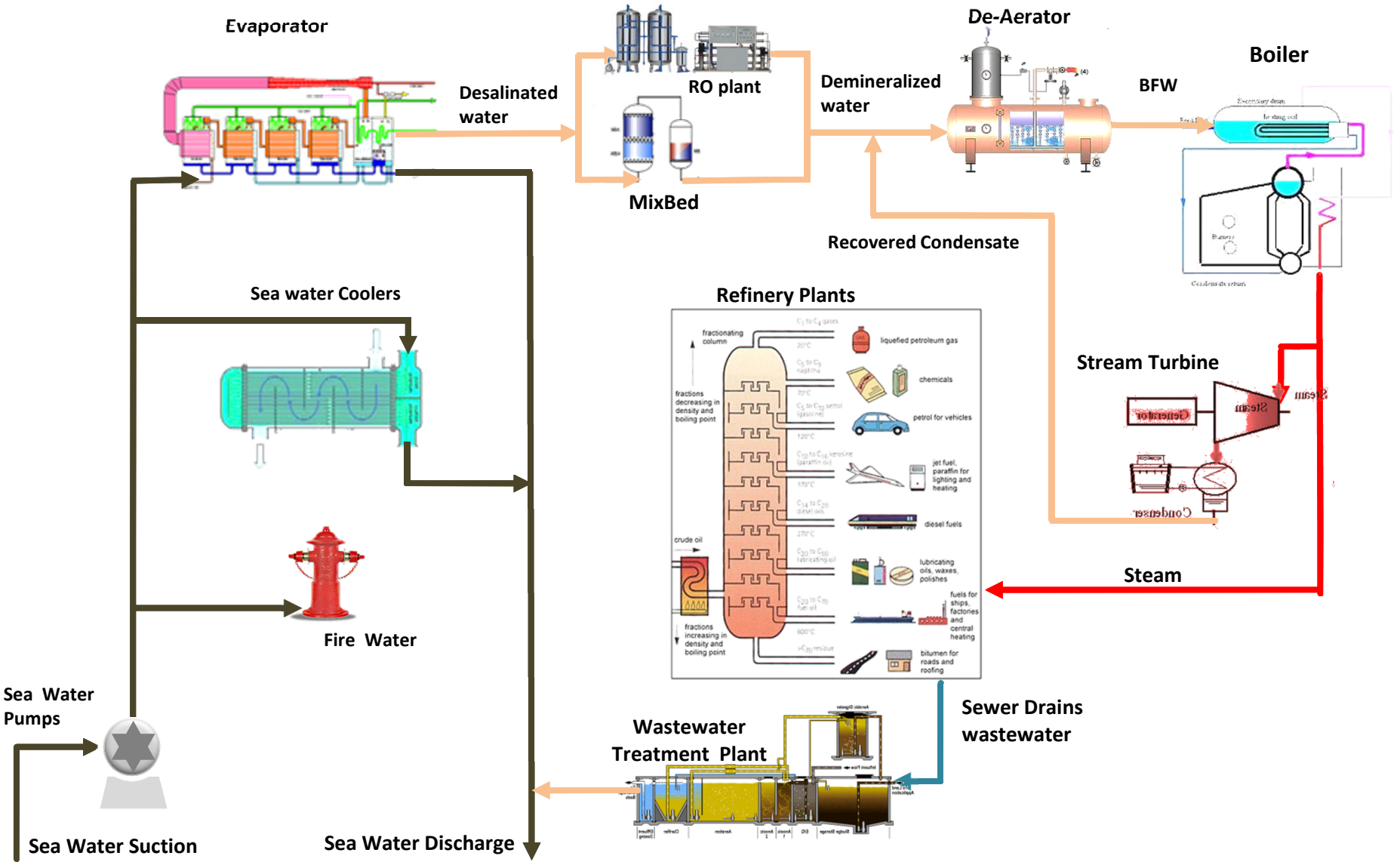
  Treated liquid wastewater must not exceed limits .

FINAL TREATED WATER ALLOWABLE LIMIT BY K-EPA	
pH	6 - 8
Temperature	ΔT Water must not exceed 10 C°
Oil & Grease	10 mg/L
Ammonia, (NH3)	3.0 mg/L
Sulfide	0.5 mg/L
Phenol	1 mg/L
Total Suspended Solid (TSS)	10 mg/L
Chemical Oxygen Demand (COD)	200 mg/L
Biochemical Oxygen Demand (BOD5)	30 mg/L

- **KPC Corporate HSE Standard "Management of Wastewater Discharge (Document 14)" shall also be applicable and adhered to.**

KNPC Strategy For Water Conservation

WATER CYCLE IN REFINERIES



Various Conservation Schemes

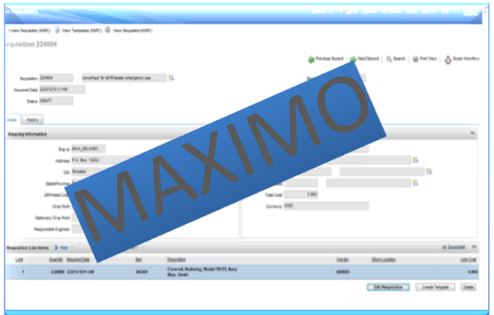
- Well laid draining procedures.
- Closed sampling loops.
- Maximum recovery of Slop.
- Spent caustic reuse for alkalinity makeup.
- Maximum reuse of Stripped Sour water.
- Reuse of treated effluent
  - Cooling tower makeup.
  - Irrigation.
  - Oil well pressure boosting.
- Maximum condensate recovery.
- Metering of Utility water consumption.

Conservation of Steam

Effective chemical Treatment program to Reduce Blow down.

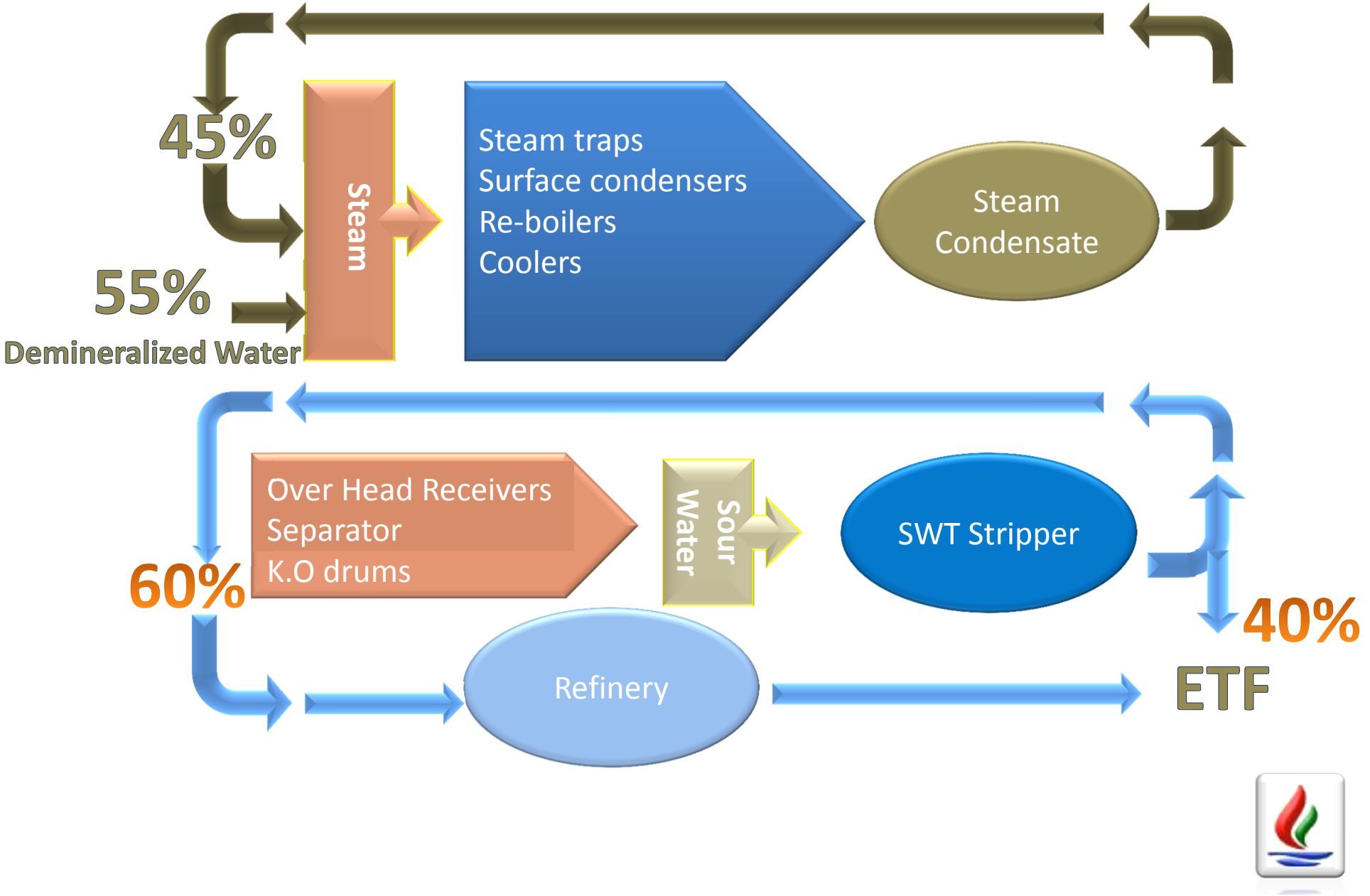
Effective Inspection.

Optimization of steam to reduce steam Venting .

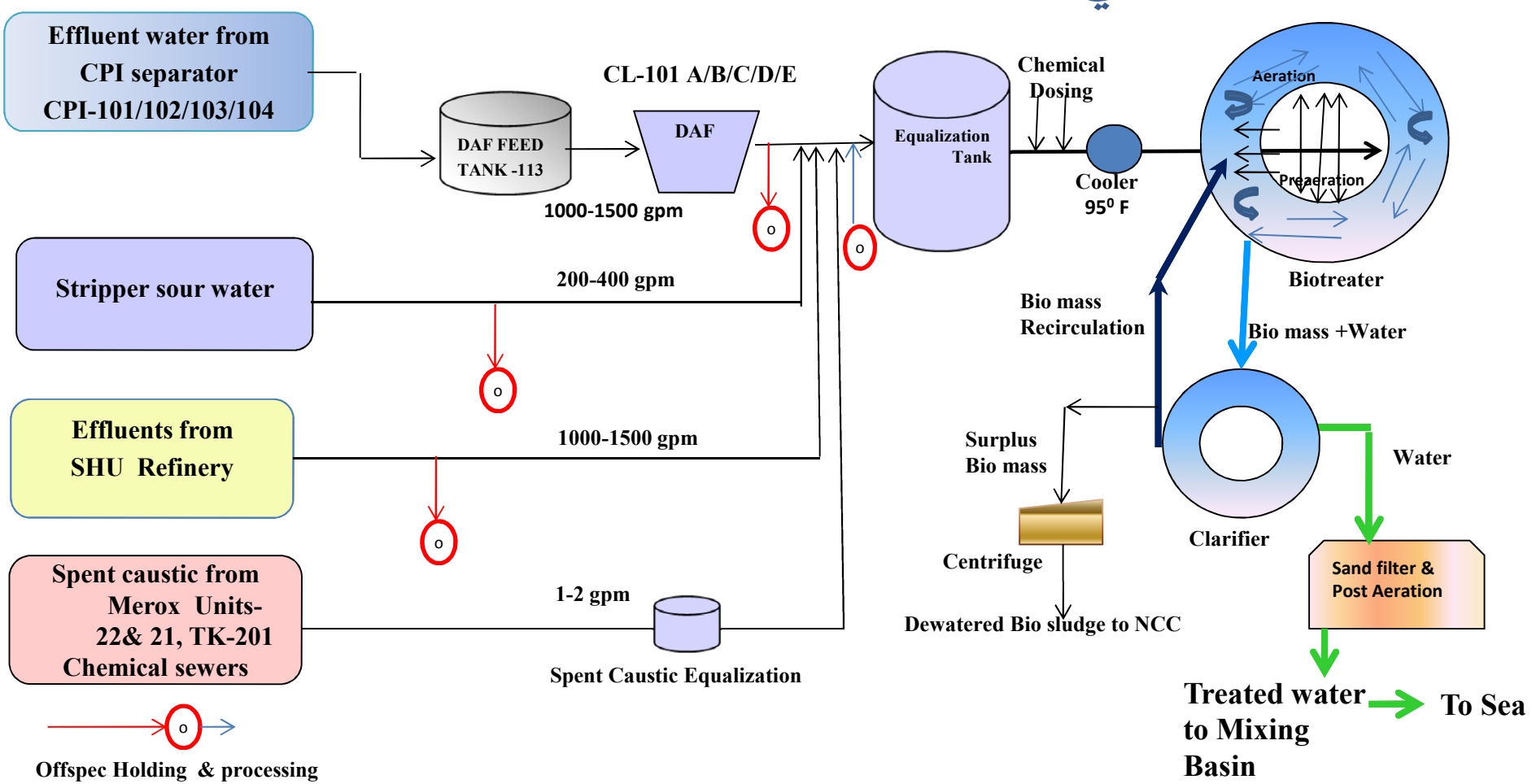


Effective preventive Maintenance .

Water Recycle in Refineries



المرافق الجديدة لمعالجة النفايات السائلة
في مصفاة ميناء عبدالله U-56



Wastewater Biological Treatment

pH : 7.0

Oil : 34 ppm

TSS : 54 ppm

BOD : 750 ppm

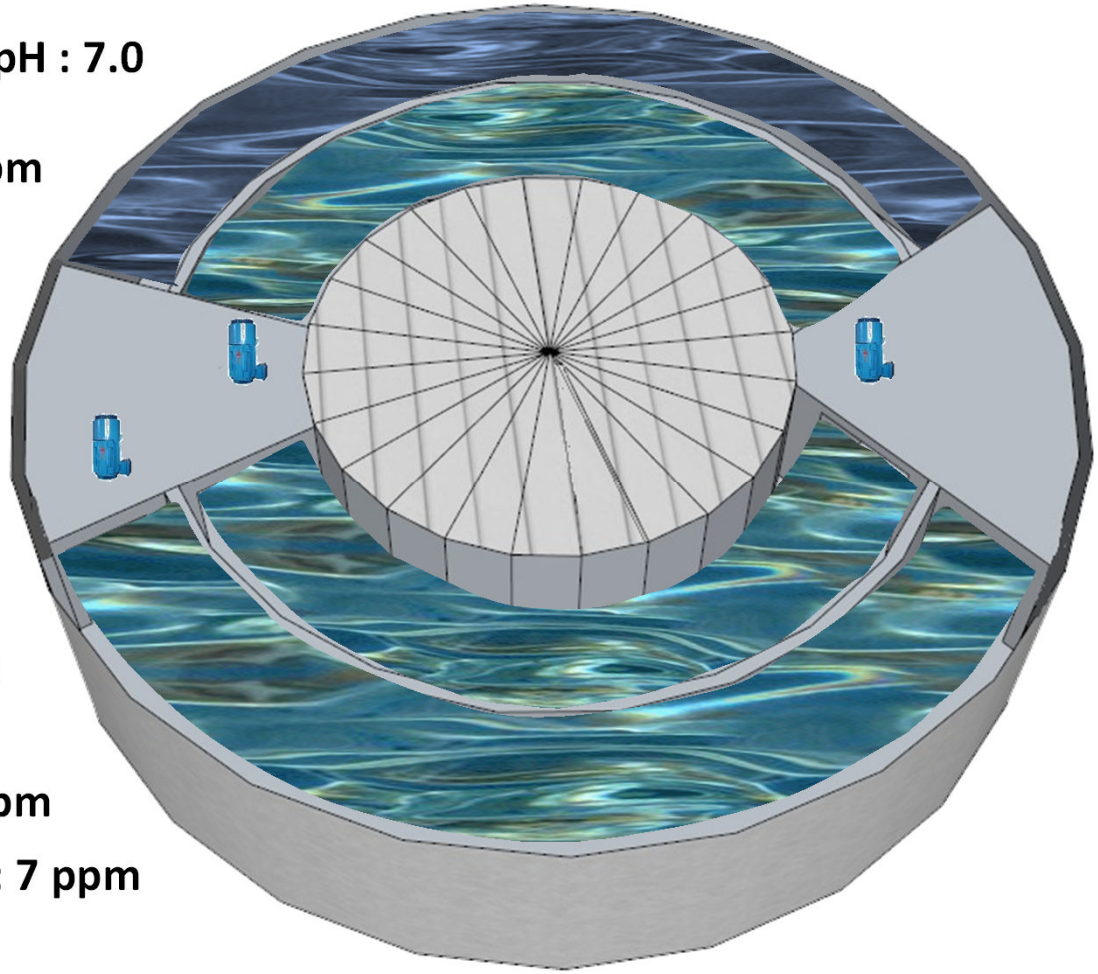
COD : 1316 ppm

Sulfide: 71 ppm

Phenol : 43 ppm

TKN : 63 ppm

MTBE : 7 ppm



RETF-MAB Biological Treatment

- **Preaeration:**
  - Purpose – Biological oxidation of Sulfides (up to <1 ppm) and Easily degradable COD (up to 50%). Resulting CO_2 formation leads to pH dip by 2.0-2.5 units.
  - Critical Parameters – pH (7.0-8.0 @ Outlet), DO (3-5 ppm), Nutrient (1.5-2.0 ppm of P, as per Feed COD).
- **Aeration:**
  - Purpose – Biological oxidation of remaining organic matter, Sulfides, Nitrification of TKN &Denitrification.
  - Critical Parameters – pH (6.5-7.5), DO (1-2 ppm), MLSS = 2500-3000 ppm, SSV (150-250 ml/1000ml), SVI (70-80 ml/gram).

RETF-Important Features

- Maximum possible level of Automation with Online analyzers, Local and remote DCS Control.
- Two train design for redundancy
- Adequate equalization with inline mixer
- Adequate off-spec holdup capacity
- All tank breathing vents fitted with Activated carbon filter. Biological process vent air treated by scrubber.
- Biological treatment process implementation in two steps-Preaeration and Aeration. This leads to very stable operation, very good microbiological health and settleability with plenty of rotifers. Also excess sludge production is minimum (about 100 gm /kg of COD input).

FINAL EFFLUENT QUALITY

Parameters	MAB	
	Design	Actual
Flow	2976-4357 USGPM	2400 USGPM
pH	7-8	7.0-7.5
Oil & Gr (ppm)	<10	<5
TSS (ppm)	<10	5-10
BOD (ppm)	<30	15-30
COD (ppm)	<200	50-100
SULFIDE (ppm)	<0.5	<0.1
TKN (ppm)	<5	<5
PHENOL (ppm)	<1	<1
MTBE (ppm)	0.01	ND
NOTE :Online measurement for pH,Conductivity,Turbidity,S,TOC,NH4,O&Gr.& DO		

MAB&SHU-Positive Impact

Contaminant	Effluent quality before RETF Project	Effluent quality post RETF Project (Design)	Positive Impact as per design
	ppm	ppm	Reduction
Oil	50	<10	>80%
TSS	28	<10	>64.3%
COD	419	<200	>52.2%
Sulfide	13	<0.5	>96.2%
TKN	12	<5	>58.4%
Phenol	06	<1	>83.6%

WATER QUALITY MONITORING & CONTROL AT KNPC

Online Analyzers

CCTV monitoring

Sampling by External agency

Wastewater Management Team

Sampling by KNPC Lab

Further Challenges

- **Disposal of Biological Sludge :**
  - Exploring better options than landfill e.g. Incinerate /use for bioremediation of contaminated soil/ soil reclamation etc.
- **Off-spec waste management:**
  - Occasionally very strong COD/TKN/Sulfide bearing wastewater streams get generated (e.g. Chemical decontamination) or sometimes the abnormality (leak etc.) leading to off-spec wastewater production continues for more than expected /design time.
- **Online analyzers for Ammonia and Sulfide**
  - These analyzers based on Ion selective electrode method are not found reliable.

THANK YOU

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