Wastewater pretreatment of PETN-RDX and HMX plants

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XVII SAFEX Congress
Istanbul, May 23 - 28

Agenda

- Company Introduction
- PETN-RDX and HMX Effluent sources
- Previous situation
- Project scope and flow sheet
- Photo gallery
- Results and Conclusions
- Next steps

Introduction

Austin Powder Argentina S.A. (APA), is one of the leading explosives manufacturers for mining in Argentina and the region…

… annually produces a wide variety of explosives, including:

- ANFO
- Slurries
- Boosters
- Emulsions
- PETN-RDX
- HMX

… and we are starting up a new **Detcord** plant

Location

APA privileged location, in Rafaela, at the center of the mining activities.

Policy

Austin Powder Argentina S.A. as part of the Argentinean Chemical Chamber, adheres to the **Responsible Care® program**…

… and as part of our continuous improvement policy,…

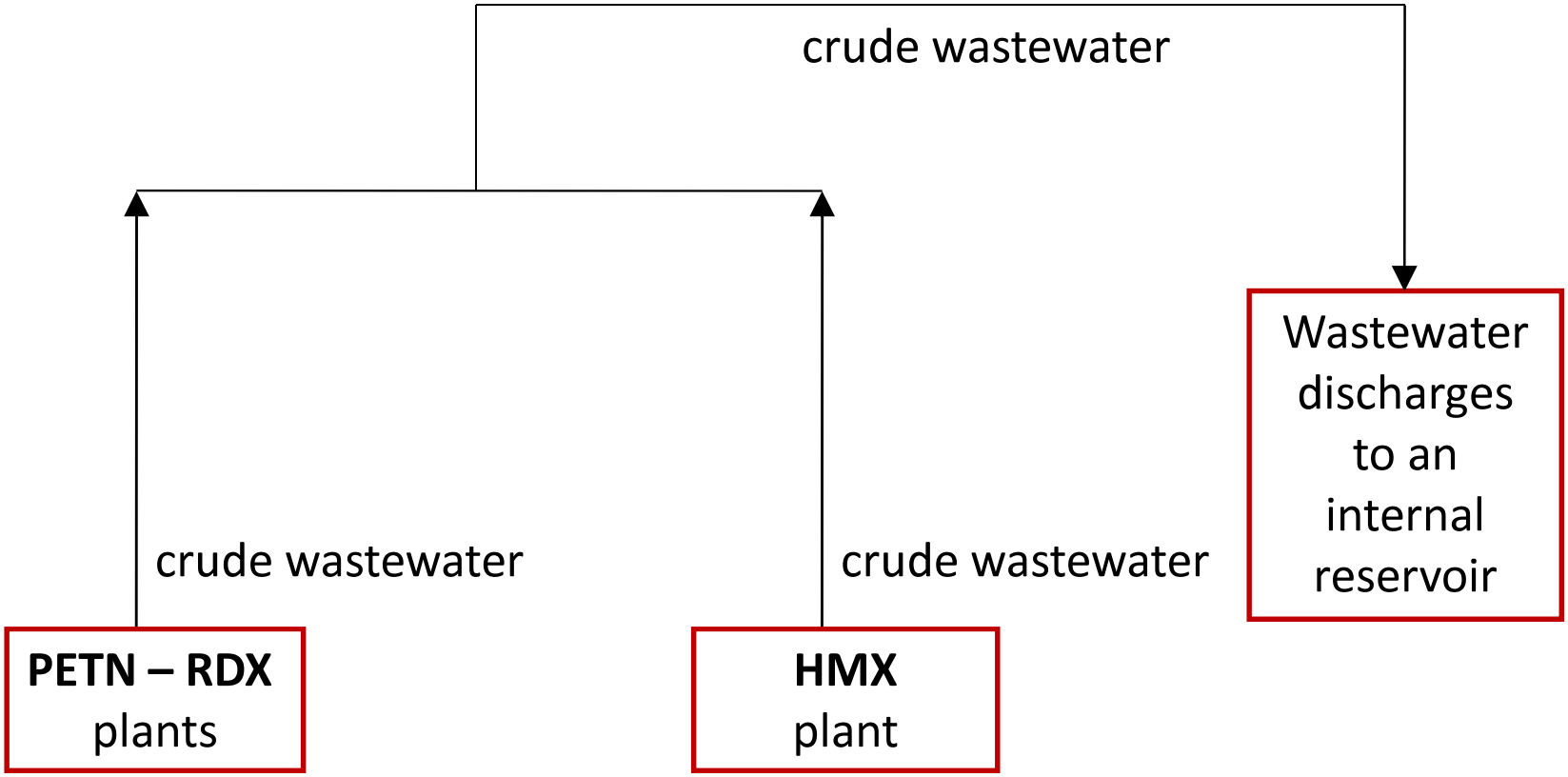
… minimize the environmental impact of **PETN-RDX** and **HMX** plants is a must.

Effluent sources

PETN	RDX	HMX
Raw materials • Nitric acid • Sodium bicarbonate • Pentaerythritol • Acetone	**Raw materials** • Nitric acid • Sodium bicarbonate • Hexamine • Formaldehyde • Acetone	**Raw materials** • Nitric acid • Ammonium nitrate • Hexamine • Acetic anhydride • Acetic acid • Acetone
Process Stages • Nitration • Washing • Recrystallization • Washing	**Process Stages** • Nitration • Filtering • Crystallization • Filtering	**Process Stages** • Nitration • Filtering • Washing • Crystallization • Filtering

All processes highlighted in red contribute to effluent generation

Previous situation



Previous situation

Wastewater parameters **before** project implementation

Average wastewater flow rate: 2.6 m^3/h

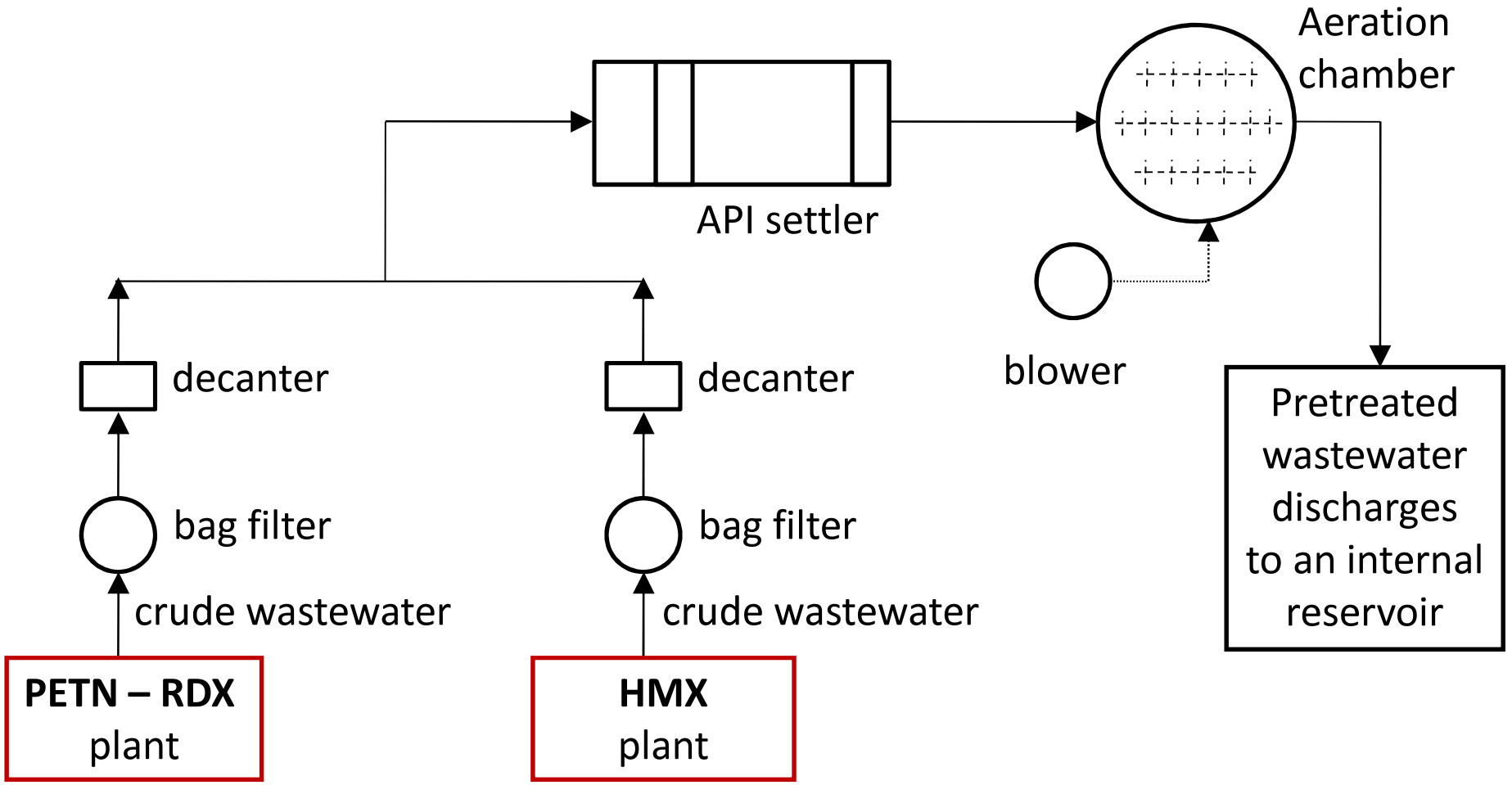
Crude Wastewater		
pH	acid	
Nitrates ($NO3^-$)	7,500	mg/l
Settleable solids (10 min)	0.3	ml/l
Settleable solids (2 hours)	0.3	ml/l
C.O.D.	9,000	mg/l

Scope

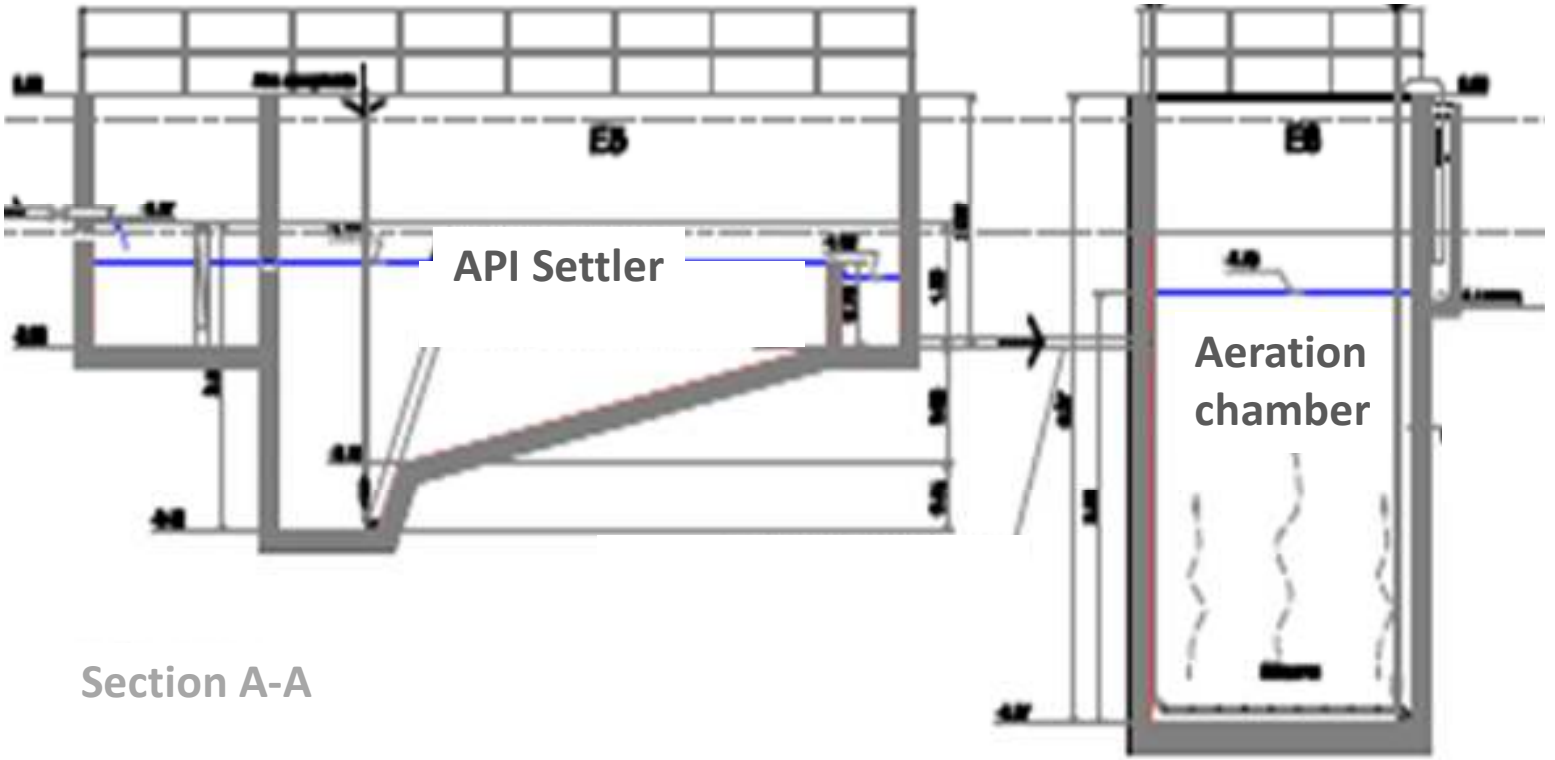
The project to treat **Wastewaters** of **PETN-RDX** and **HMX** plants is being implemented in 2 stages.

- **Stage 1** (done)
  - » Primary solids (explosives) removal
  - » Reduce C.O.D levels (acetone)
- **Stage 2** (under development)
  - » pH adjustment (neutralization)
  - » Coagulation and flocculation (improving **Stage 1** solids removal)
  - » Water evaporation

Stage 1 – Pretreatment flow sheet



Stage 1 – Pretreatment main equipments



Section A-A

Stage 1 – Photo gallery

Stage 1 – Photo gallery

Stage 1 – Photo gallery

Stage 1 – Results

Controlled Parameters	Wastewater Quality **before** **Stage 1**	Wastewater Quality **after** **Stage 1**	Units
pH	acid	acid	
Nitrates ($NO3^-$)	7,500	7,500	mg/l
Settleable solids (10 min)	0.3	< 0.1	ml/l
Settleable solids (2 hours)	0.3	< 0.1	ml/l
C.O.D.	9,000	2,500	mg/l

Stage 1 – Conclusions

The objectives of Stage 1 were fulfilled

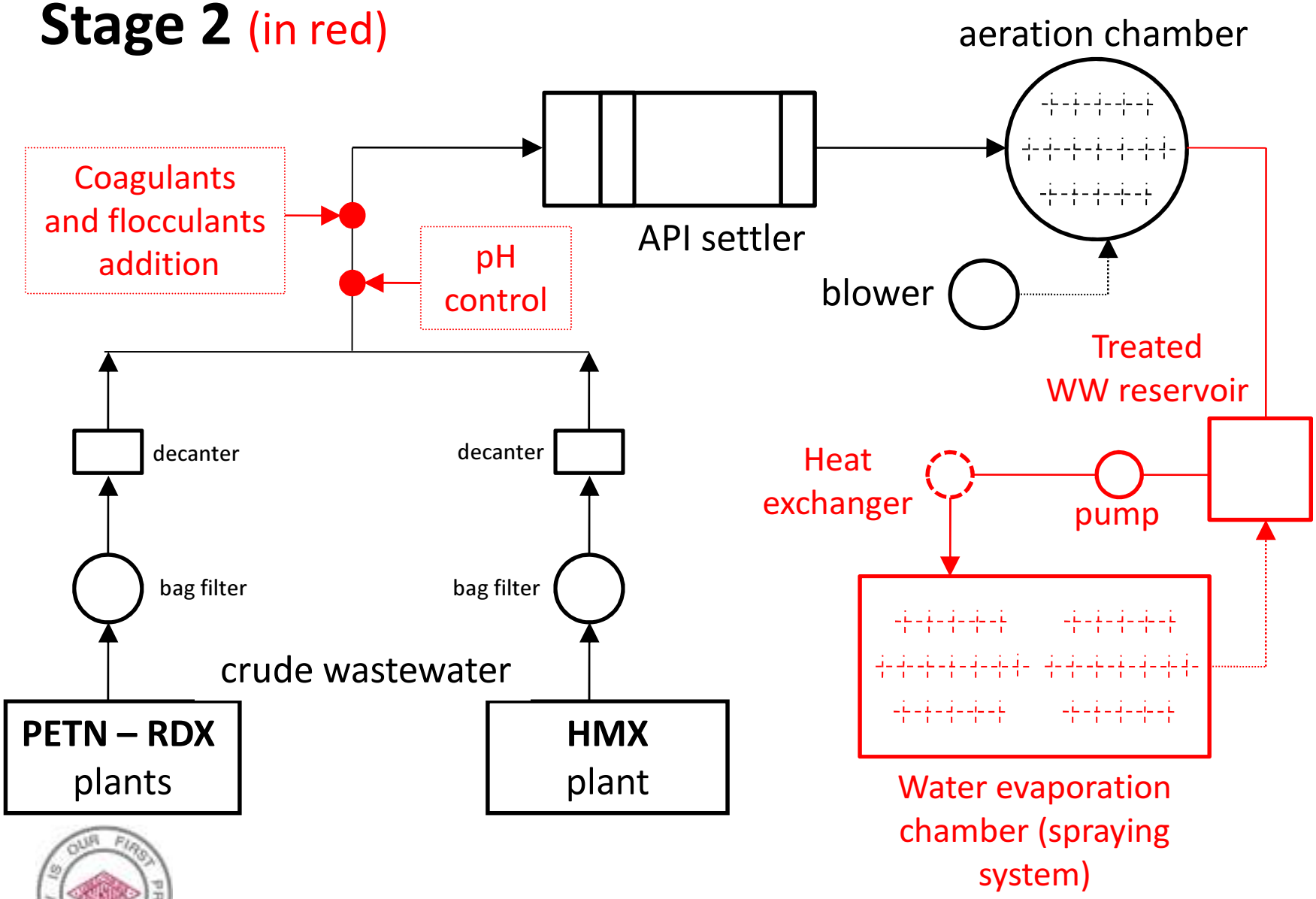
- Settleable solids shows >66% reduction; sludge collected in the precipitation chamber is finally disposed in burners for explosives
- Volatile organic compounds are significantly stripped in the aeration chamber
- Remaining settleable solids and organic compounds will be completely removed in Stage 2

Next Steps

Stage 2 considers

- Wastewater neutralization (pH⟶ 7)
- Flocculants and coagulant addition
- **Wastewater thermal / mechanical evaporation** system to guarantee zero liquid discharge. (Pilot plant was already designed; field tests will be done in Q3, 2011)

Stage 2 (in red)



New technique of primary explosives decomposition in wastewater

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on behalf of
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XVII SAFEX Congress
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Agenda

- Company Introduction
- Primary explosives wastewater treatment - Old technology
- New technology
- Flow sheet
- Photo gallery

Introduction

Austin Detonator s.r.o., one of the leading European manufacturers of the initiation systems for industrial blasting:

- Produces annually **~ 5 tons** of primary explosives (PE) including Lead Azide (LA), Lead Picraminate (LP) and Lead Styphnate (LS)

- Is engaged in environmental protection. In 2006 implemented a new technique of primary explosives decomposition in wastewater

  Generates **1.7 m^3/day** of wastewater

Old technology

Disadvantages

- NO2 and HN3 (azoimide) generation due to LA decomposition
- Operators use breathing apparatus continuously during wastewater treatment
- PE decomposition process requires a wide variety of chemicals: HNO3, NaNO2, Na2S, Na2CO3, HCl, scrap iron, Ca(OH)2

Old technology

Disadvantages (cont.)

- PE decomposition process requires the operating crew presence in a dangerous environment
- LP and LS decomposition process precipitates toxic lead and reduce nitro groups to amino groups. Benzene ring remains intact
- LP and LS decomposition process is slow (~48 hours)

New technology

In 2006 Austin Detonator s.r.o. implemented a new technology for primary explosives decomposition in waste water.

Principles and benefits

- Primary explosives in waste water (LA, LP and LS) are oxidized by $KMnO_4$ – only one oxidant agent - in presence of HNO_3
- No NO_2 is released during the decomposition of LA

New technology

Principles and benefits (cont.)

- HN3 generated by LA decomposition is neutralized with NaOH
- Modern and automated technology with flexibility to capture CO2 and NO2
- LS and LP lower decomposition time

Flow sheet

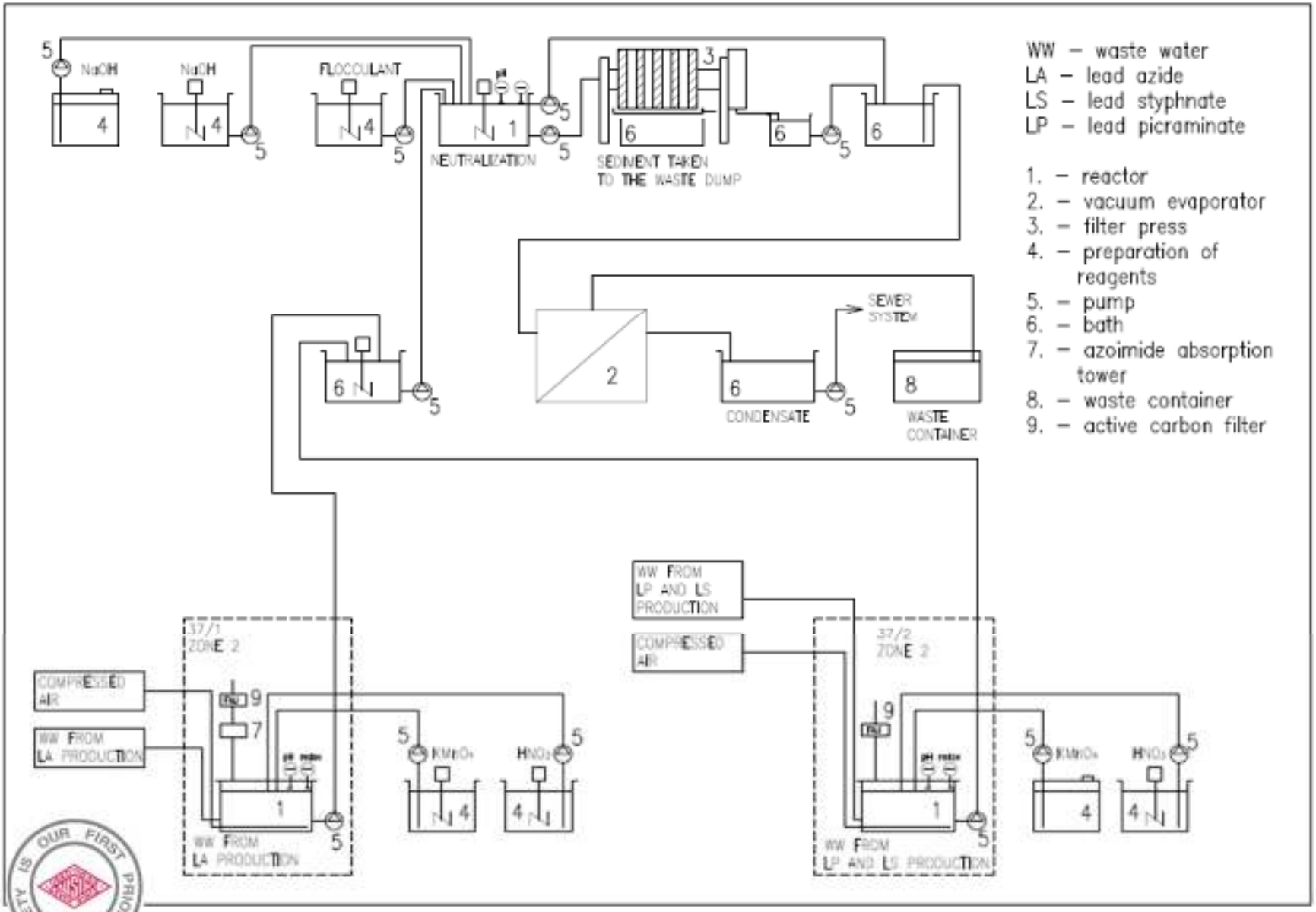
WW – waste water
LA – lead azide
LS – lead styphnate
LP – lead picraminate
1. – reactor
2. – vacuum evaporator
3. – filter press
4. – preparation of reagents
5. – pump
6. – bath
7. – azoimide absorption tower
8. – waste container
9. – active carbon filter
NaOH
NaOH
FLOCCULANT
NEUTRALIZATION
SEDIMENT TAKEN TO THE WASTE DUMP
SEWER SYSTEM
CONDENSATE
WASTE CONTAINER
WW FROM LP AND LS PRODUCTION
COMPRESSED AIR
37/1 ZONE 2
37/2 ZONE 2
WW FROM LA PRODUCTION
WW FROM LP AND LS PRODUCTION

Photo Gallery

Thank you