EUROPEAN CONFERENCE 2023
PLANT & PROCESS SAFETY

REFINERY PLANT CONSERVATION PROJECT

Deni Džafo, Project manager

MOL GROUP, INA, Sisak refinery

Maastricht, December 13th, 2023

CONTENT

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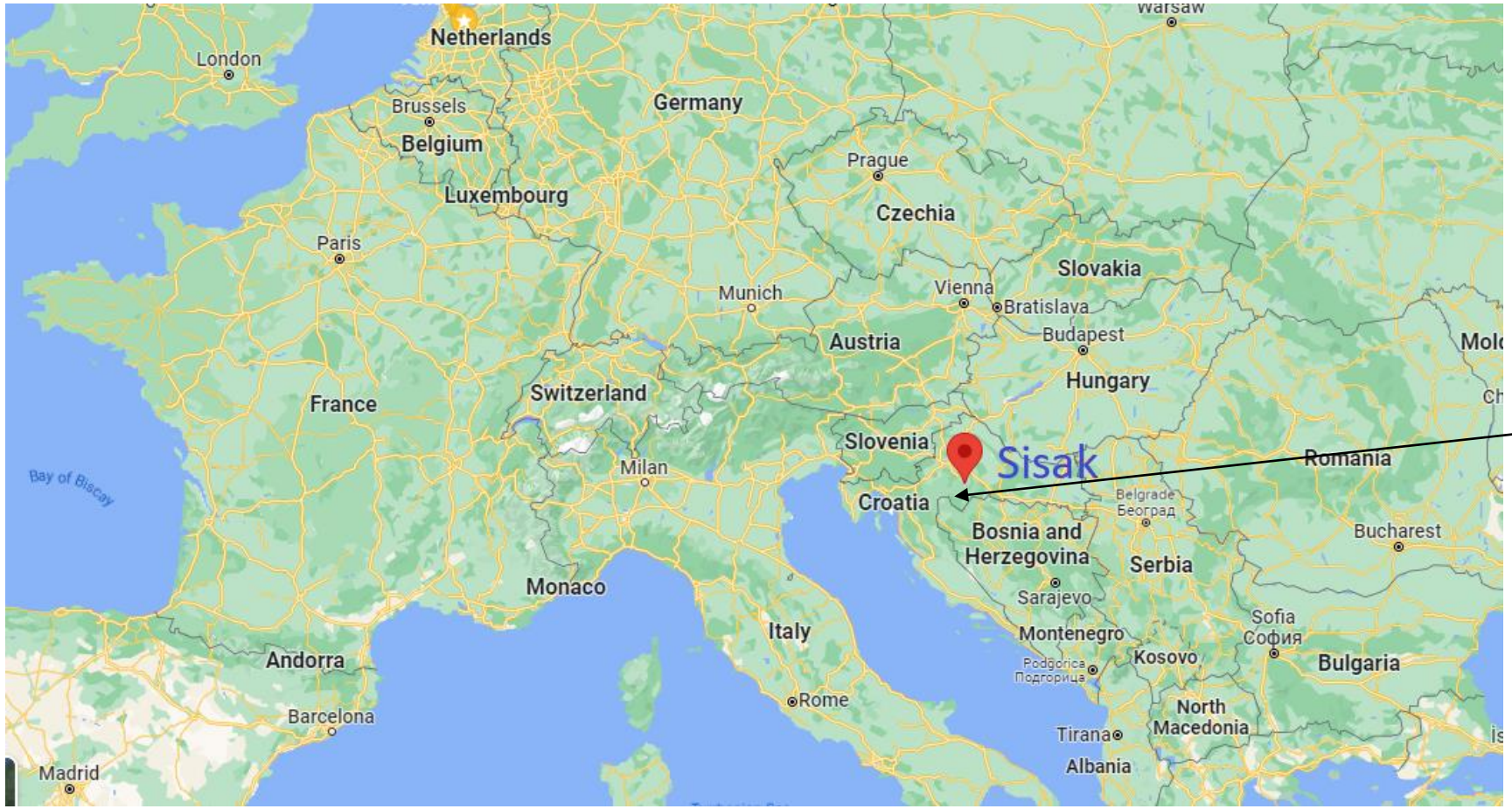
ABOUT

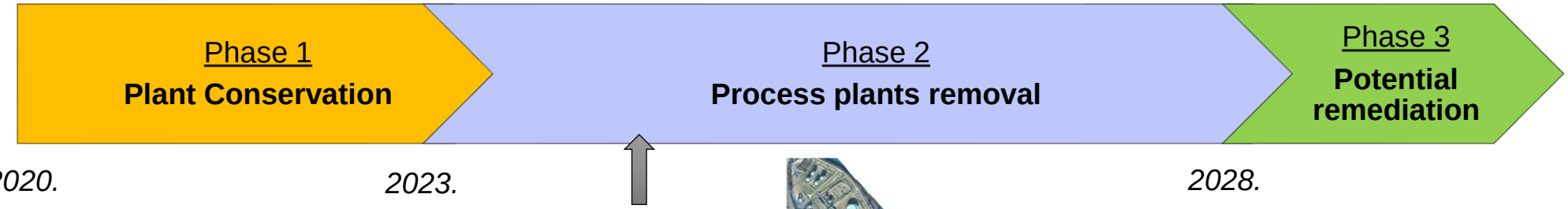
- INA was founded in 1964.
- INA is a medium-sized European company
- Part of MOL Group

- Sisak refinery was established in 1954.
- Area: 170 hectare



Earthquake Dec 29th 2020.

CONSERVATION PROJECT PROGRAM

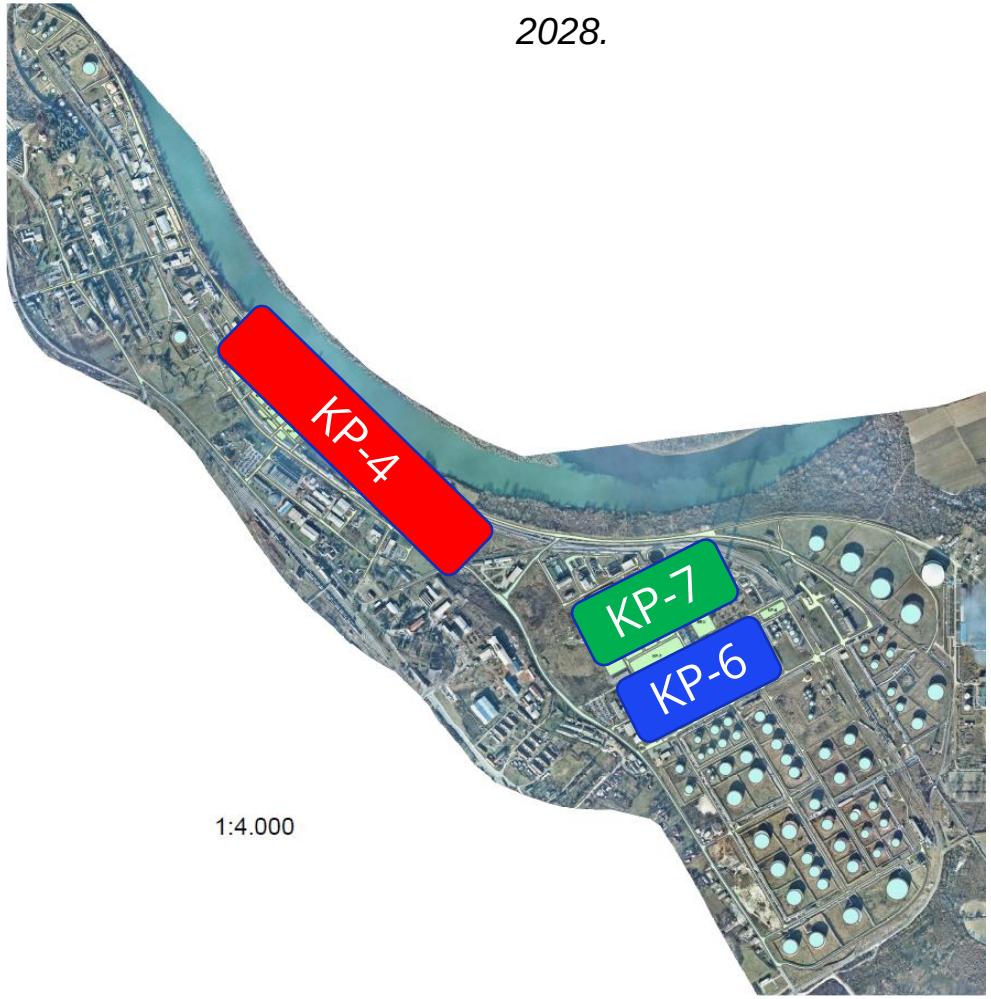


UNDER CONSERVATION

- 3 combined plants / 29 units
- Area of more than 70.000 m2
- More than 2.500 pcs of major equipment

OBJECTIVES AND GOALS

- Ensure safe condition
- Valuable material management and waste disposal
- Mitigate threats to human health and environment
- Prepare location for new investment projects



KP – Combined Plant

PLANT CONSERVATION

PLANNING PROCESS – MAIN ACTIVITIES

- Planning and documentation preparation
- HAZID
- Unit separation from auxiliary media and energy sources
- Equipment removal from service
- Emptying and cleaning of units and equipment
- Conservation and inertization
- Waste disposal
- Valuable material management
- Legal obligation compliance and revision
- Asbestos removal

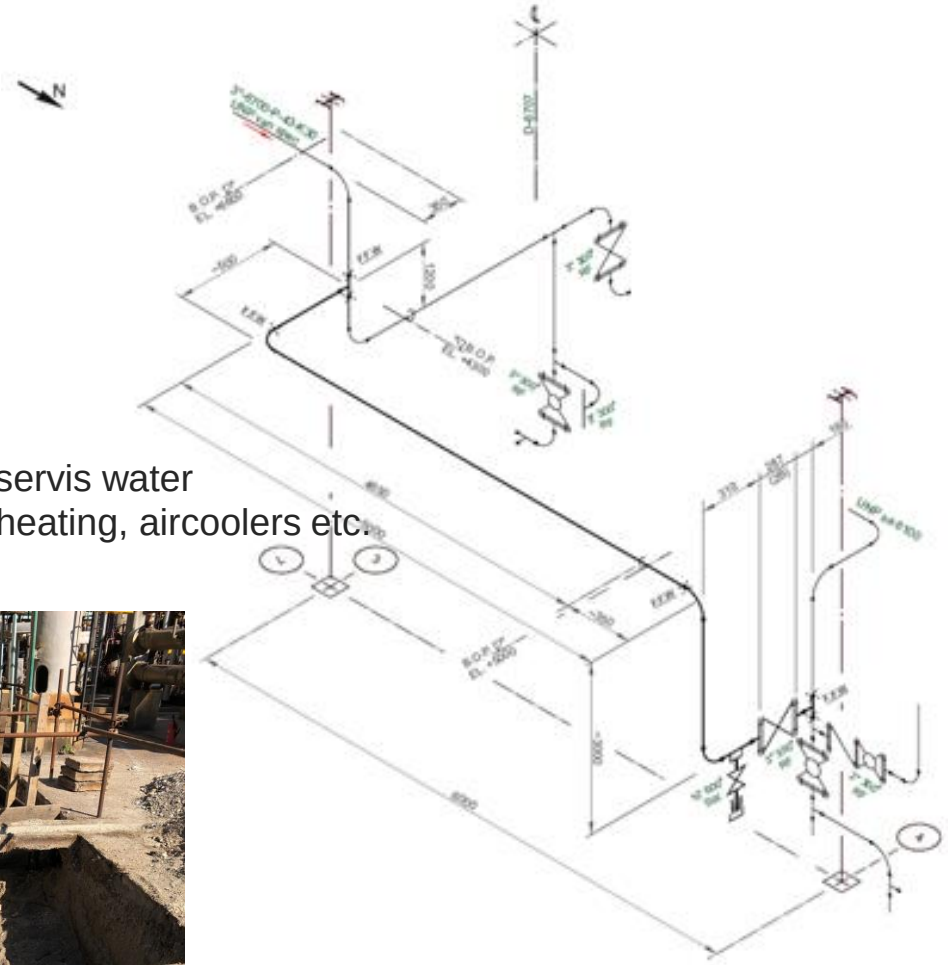
RISK	MITIGATION MEASURES
Catalyst degradation and toxic media leakage from reactor systems	• Reactors separation and nitrogen supply installation • Nitrogen pressure monitoring plan preparation • Catalyst discharge and disposal
Environmental pollution and ignition of tank media	• Frequent inspection and monitoring of tanks • Emptying, discharge and cleaning of tanks
Radioactive sources hazard to health	• Radioactive sources proper disposal
Covid-19 health risk	• Goverment and INA recommendations compliance
Additional budget due to eartquake damage	• Detailed assessment and analyzis
Potential earthquake	• Health recommendations awareness and compliance • Ensure safe conditions on site

HAZID – Hazardus Identification

PLANT CONSERVATION

CONSERVATION SEQUENCE

1. Safe stop
2. Draining
3. Steam out
4. Process media pipelines separation and blinding
5. Equipment separation from sloap and sewer system
6. New connections installation (e.g. nitrogen)
7. Separation and blinding of auxiliary media: steam, cooling water, servis water
8. Out of function systems: fire steam, chemicals, electric power for heating, aircoolers etc.
9. In function systems: DCS, nitrogen, sewer, lighting, etc.
10. Equipment cleaning
11. Inertization



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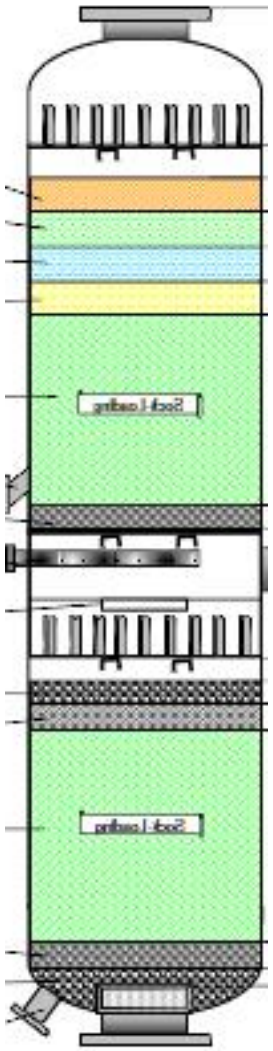
*every unit has it’s own challenges

DCS – Distributed Control System

PLANT CONSERVATION

VALUABLE MATERIAL SALE



- 18 reactors
- Safe and scheduled execution
- Specialized external company was contracted
- Start May 16th End June 13th 2022, with daily temperatures above 30°C
- Pt-containing catalysts and hazardous waste (NiMo, CoMo, TiO_2, Al_2O_3)
- Unloaded material was safely stored in metal bins and drums in warehouse until shipped to buyer

PLANT CONSERVATION

CHALLENGES

Adsorbens disposal

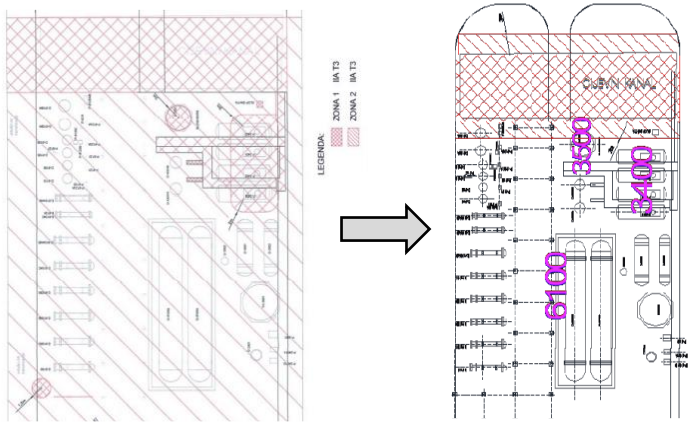
- 450t of adsorbens to dispose
- Also adsorbens containing mercury

Structural packings disposal

- Structural packing from columns disposal
- Difficulties with unloading

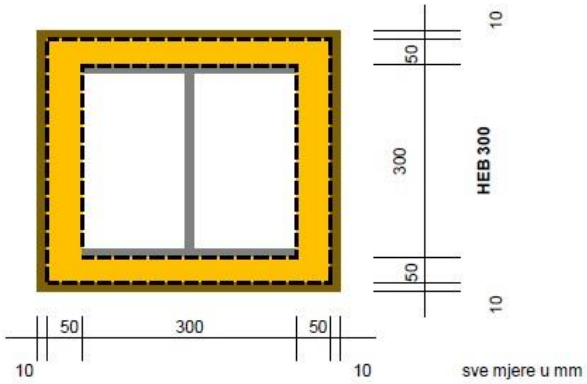
Anti-Explosive protection legal compliance

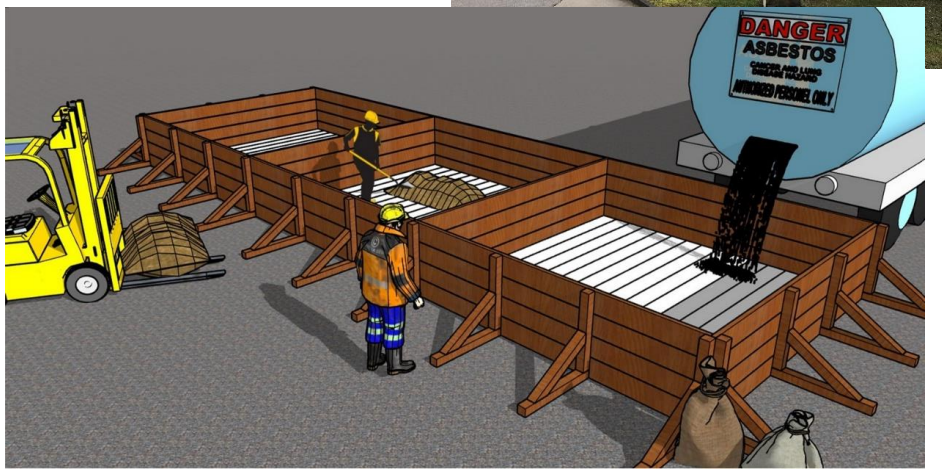
- Existing Ex-Zone classification no longer valid
- New approach: Combining multiple Ex facilities supervisions and reports
- New reclassification



Asbestos removal

- Majority of asbestos is located in old Aromatics unit
- Removal started in Q4 2022. and lasts till end 2023.
- cca 723,30 m3 of MSA material removed
- „wet" methode





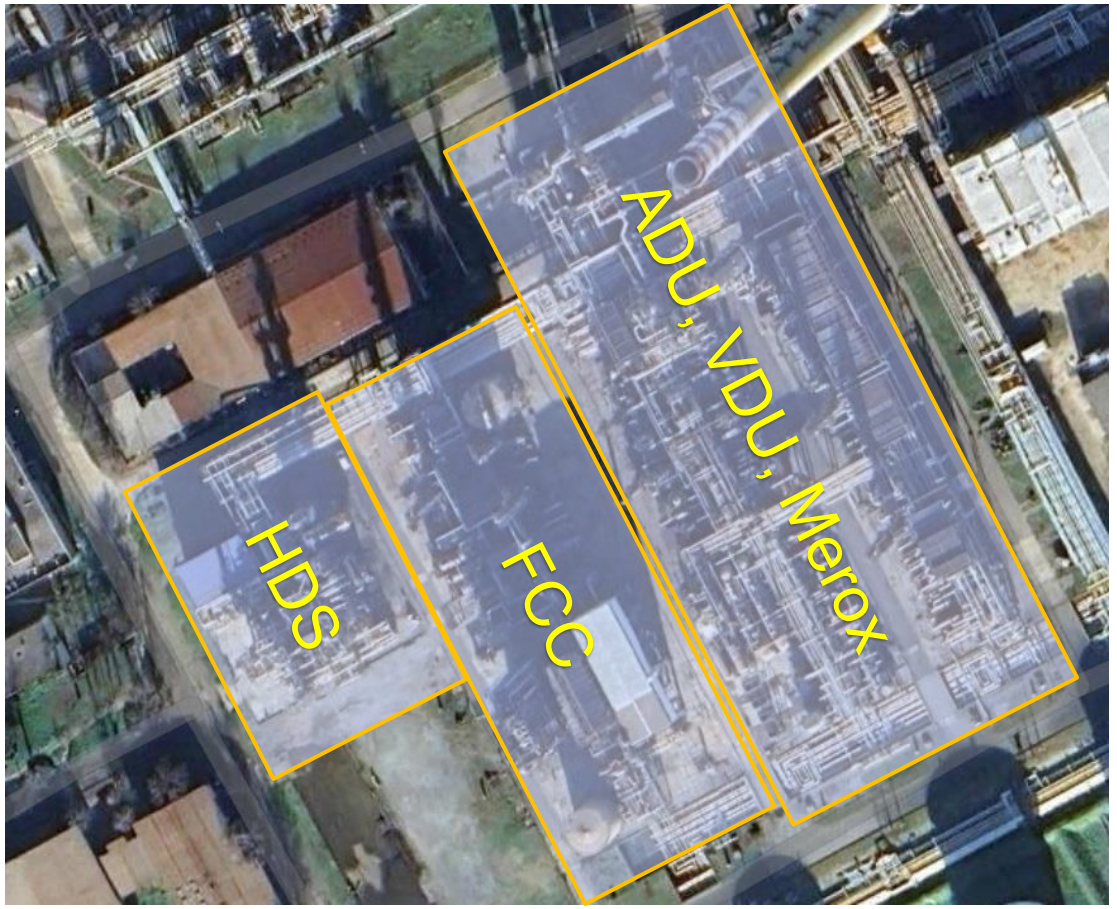
PROCESS PLANTS REMOVAL

3 combined plants – KP4, KP6, KP7

- KP-6 removal started in 2023., planned end is May 2024.

PROCESS

- Preparation for removal
- Equipment takeover
- Valuable equipment sale
- Asset write-off
- Asbestos removal
- Demolition contracting
- Tax recognition
- Demolition
- Usefull waste disposal
- Useless waste disposal
- Area cleaning



PROCESS PLANTS REMOVAL

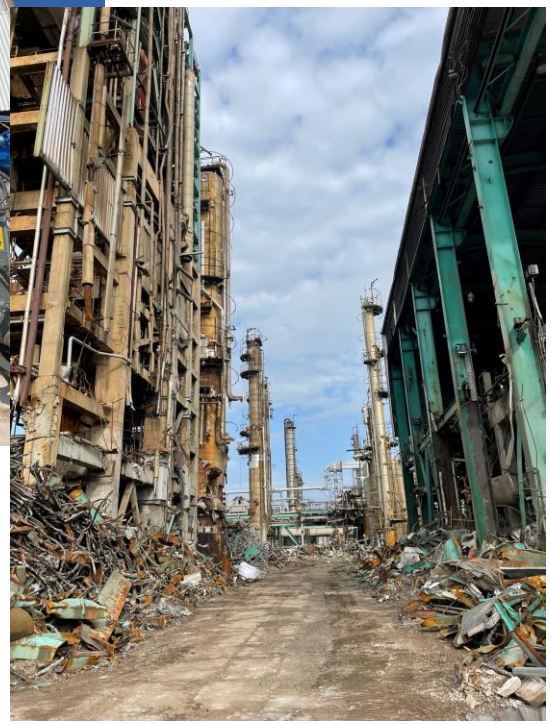
APPROACH

HDS FCC unit removal

- Estimated quantity of usefull material – 900t
- Removal start: March 2023.
- Removal completion: December 2023.
- Contractor: STSI (INA single service company)

FCC unit removal

- Estimated quantity of usefull material – 1800t
- Removal start: August 2023.
- Removal completion: December 2023.
- Contractor: Demiced (external company)



PROCESS PLANTS REMOVAL

Estimated quantity of useable waste (FCC)

TYPE OF EQUIPMENT	QUANTITY (kg)
PIPELINES	430.000
HEAT EXCHANGERS	155.000
AIR COOLERS	150.000
COLUMNS, REACTORS, VESSELS, TANKS	490.000
STEEL STRUCTURE	470.000
PUMPS, COMPRESSORS, TURBINES	58.000
FURNACES	35.000
ELECTRIC MOTORS	5.000
INSTRUMENTATION EQUIPMENT	20.000
ELECTRICAL AND INSTRUMENTATION CABLES	27.000
Total:	**1.840.000**

MATERIAL TYPE	QUANTITY (kg)
Carbon steel (CS)	1.740.000
Stainless steel (SS)	32.000
Copper	48.000
Aluminum	17.500
ASTM B338 Gr.2 Titanium	2.500
Total:	**1.840.000**

Estimated quantity of non-useable waste (FCC)

MATERIAL TYPE	QUANTITY (kg)
Fireproof insulation without asbestos	47.000
Thermal insulation - mineral wool	115.500
Concrete foundations	890.000
Fireclay (insulating lining)	135.000
Total:	**1.187.500**

Identified risks in technical specification for tender (FCC):

- Air cooler segments
- Process flare pipelines outside and inside the sections
- Process sloap piepelines in pipe channels
- Pipe elbows at the lowest parts of pipelines
- Fuel gas pipelines

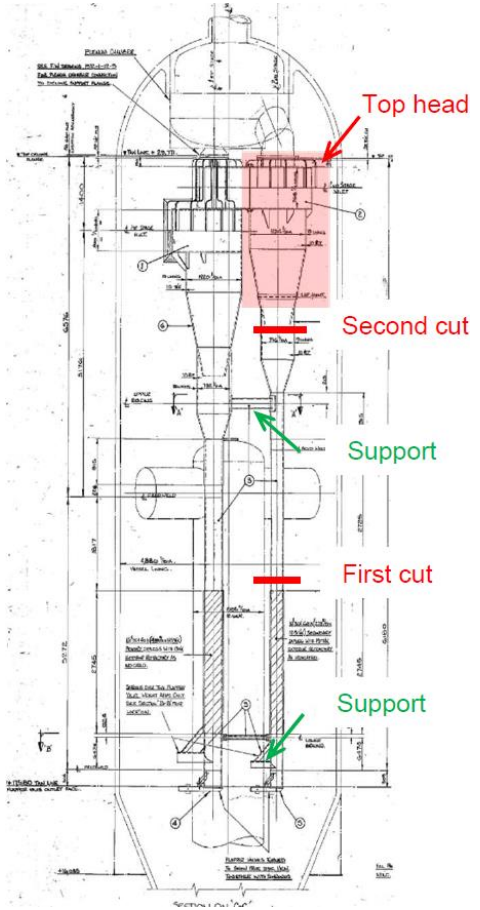
Bid evaluation cost sheet (FCC):

- A – Value of useful waste (€/kg)
- B – Cost of removal works (€/kg) - *based on A*
- C – Cost of disposal of useless waste (€/kg)

PROCESS PLANTS REMOVAL

Complex objects for removal (FCC)

Facility	Name	Dimensions - height / diameter (mm)	Elevation (mm	Mass (kg)
R-6401	FCC Reactor	30000 / 2590	32200	45100
R-6402	FCC Regenerator	34030 / 5080	36230	99800



PROCESS PLANTS REMOVAL

ADU, VDU, Merox unit removal

- Estimated quantity of usefull material – 5000t
- Planned removal start: December 2023.
- Planned removal completion: March 2024.
- Contractor: Demiced (external company)

Estimated quantity of non-useable waste

MATERIAL TYPE	QUANTITY (kg)
Fireproof insulation without asbestos	37.200
Thermal insulation - mineral wool	229.000
Concrete foundations	962.500
Fireclay (insulating lining)	1.140.000
Total:	**2.368.700**

Estimated quantity of useable waste

TYPE OF EQUIPMENT	QUANTITY (kg)
PIPELINES	1.050.000
EXCHANGERS	350.000
AIR COOLERS	270.000
COLUMNS, REACTORS, VESSELS, TANKS	1.200.000
STEEL STRUCTURE	1.400.000
PUMPS, COMPRESSORS, TURBINES	120.000
FURNACES	420.000
ELECTRIC MOTORS	22.000
INSTRUMENTATION EQUIPMENT	10.000
ELECTRICAL AND INSTRUMENTATION CABLES	63.000
Total:	**4.905.000**

Identified risks in technical specification for tender - additional:

- Process pipelines in furnaces H-6101 and H-6301

MATERIAL TYPE	QUANTITY (kg)
Carbon steel (CS)	4.655.000
Stainless steel (SS)	135.000
Copper	67.000
Aluminium	48.000
Total:	**4.905.000**

PROCESS PLANTS REMOVAL

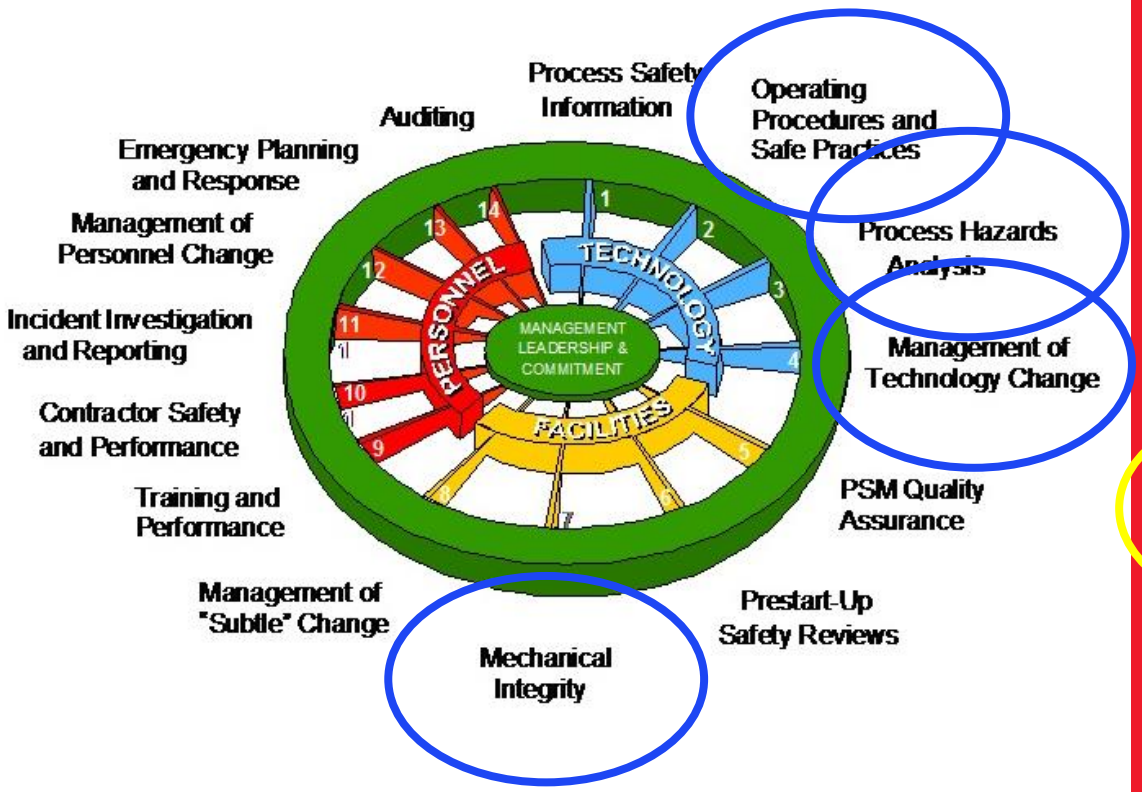
Complex objects for removal (ADU, VDU, Merox)

Object	Name	Dimensions – length / width (mm)	Elevation (mm)	Mass (kg)
H-6101	Crude distillation furnace	20840/10008	22430	460000
H-6301	Vacuum distillation furnace	18840/7800	16700	278000

Object	Name	Dimensions – height / diameter (mm)	Elevation (mm)	Mass (kg)
T-6101	Crude distillation column	45130/5600	50320	167840
T-6301	Vacuum distillation column	31078/5056	35126	97250

PSM & HSE

PSM – Process Safety Management



- 6 recorded incidents related to conservation process, 3 LOPC (Loss Of Primary Containment) with Very Low severity

PSM & HSE

PSM Wheel

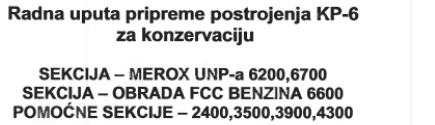
- Operating procedures and safe practices
  - Safe unit SD, draining plan and blinding plan documentation preparation
  - Unit conservation and inertization plan preparation

- Process Hazard Analyzis
- Management of Change process
- Mechanical Integrity
  - Nitrogen pressurization


INA INDUSTRIJA NAFTE, d.d. Rafinerija nafte Sisak

Radna uputa pripreme postrojenja KP-6 za konzervaciju
SEKCIJA Merox UNP-a 6200,6700
SEKCIJA obrade FCC benzina 6600
Pomoćne sekcije 2400,3500,4300

Oznaka: 50001178/KP-6/5
Izdanje: 01 | Stranica 1/153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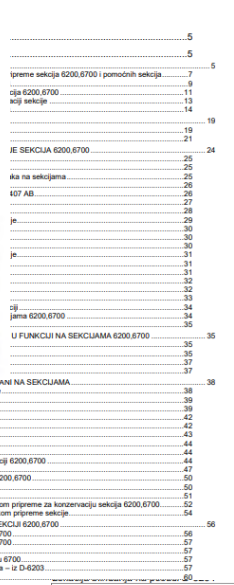
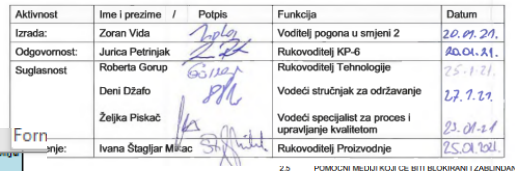
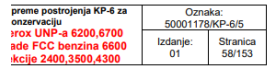
POMOĆNE SEKCIJE – 2400,3500,3900,4300

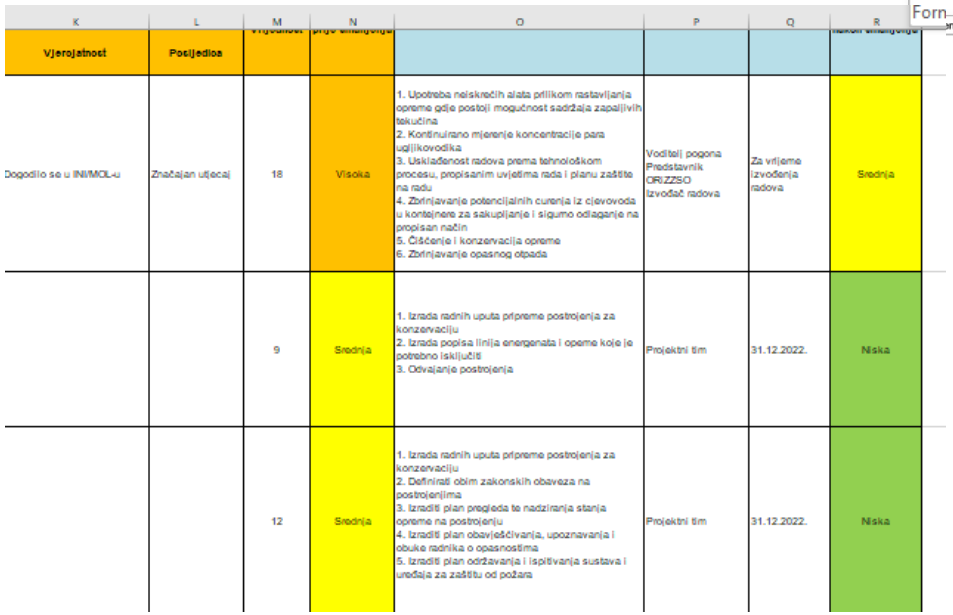

50001178/KP-6/5
Izdanje: 01 | Stranica 2/153



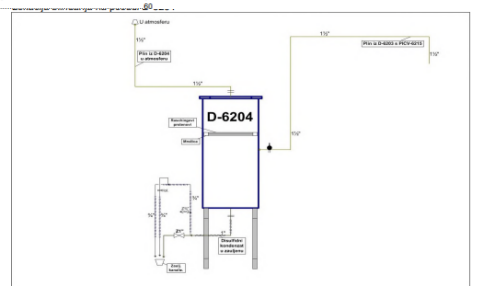


Aktivnost	Ime i prezime /	Potpis	Funkcija	Datum
Izrada:	Zoran Vida		Voditelj pogona u smjeni 2	20.09.21.
Odgovornost:	Jurica Petrinjak		Rukovoditelj KP-6	20.09.21.
Suglasnost	Roberta Gorup		Rukovoditelj Tehnologije	25.1.21.
	Deni Džafo		Vodeći stručnjak za održavanje	27.1.21.
	Željka Piskač		Vodeći specijalist za proces i upravljanje kvalitetom	27.01.21
Forn	Ivana Štagljar Milac		Rukovoditelj Proizvodnje	25.01.21.


Oznaka: 50001178/KP-6/5
Izdanje: 01 | Stranica 58/153



K	L	M	N	O	P	Q	R
Vjerojatnost	Posljedica						
Dogodilo se u INI/MOL-u	Značajan utjecaj	18	Visoka	1. Upotreba neiskrećih alata prilikom rastavljanja opreme gdje postoji mogućnost sadržaja zapaljivih tekućina 2. Kontinuirano mjerenje koncentracije para ugljikovodika 3. Usklađenost radova prema tehnološkom procesu, propisanim uvjetima rada i planu zaštite na radu 4. Zbrinjavanje potencijalnih curenja iz cjevovoda u kontejnere za sakupljanje i sigurno odlaganje na propisan način 5. Čišćenje i konzervacija opreme 6. Zbrinjavanje opasnog otpada	Voditelj pogona Predstavnik ORIZZSO Izvođač radova	Za vrijeme izvođenja radova	Srednja
		9	Srednja	1. Izrada radnih uputa pripreme postrojenja za konzervaciju 2. Izrada popisa linija energenata i opreme koje je potrebno isključiti 3. Odvajanje postrojenja	Projektni tim	31.12.2022.	Niska
		12	Srednja	1. Izrada radnih uputa pripreme postrojenja za konzervaciju 2. Definirati obim zakonskih obaveza na postrojenjima 3. Izraditi plan pregleda te nadzirana stanja opreme na postrojenju 4. Izraditi plan obavještavanja, upoznavanja i obuke radnika o opasnostima 5. Izraditi plan održavanja i ispitivanja sustava i uređaja za zaštitu od požara	Projektni tim	31.12.2022.	Niska



PSM & HSE

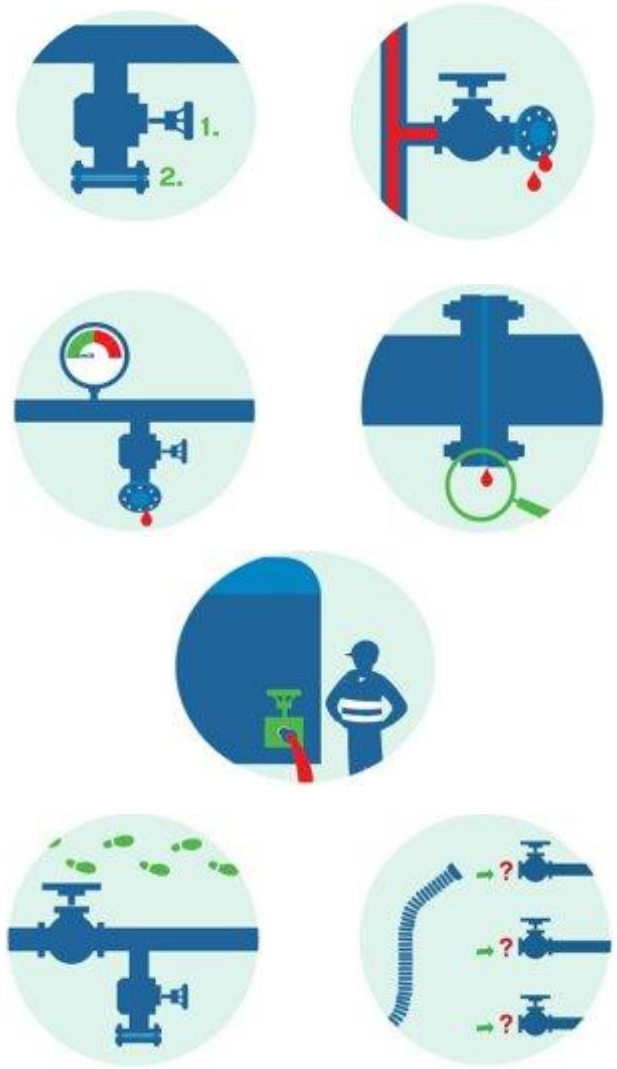
Process Safety Fundamentals

- **PSF 1**: Ensure proper equipment isolation for normal operation and maintenance works
  - LOTO (Lock Out Tag Out)
  - Blind list preparation and signing during work

- **PSF 2**: De-energize equipment before opening and reenergize it before start-up
  - Isolation plan marked on P&ID
  - Emptying, cleaning and intertization of equipment
  - Signing and issueing Work Permits

- **PSF 3**: Monitor open drain
  - Identifying critical draining points
  - Drainig only during the day with supervision of draining location

- **PSF 5**: Walk the line (to ensure operational readiness via pipeline and valve line-ups)
  - Checking and marking all relevant connections before pressurization of equipment



PSM & HSE DURING PLANT CONSERVATION

HSE

WORK PERMITS

- Cold work permit: 9077
- Permit to work with fire: 3624
- Permit to enter confined spaces and work in locations with increased hazards: 2728

- Occupational health and safety supervisions: 1829
- Incompliances: 9 (Inappropriate documentation and protective equipment)
- Alcohol substances test: 1292 (0 positive)
- Average number of workers per day: 50

MAIN HSE CHALLENGES

- High number of works inside confined space; cleaning inside columns and vessels (increased number of work permits)
- Focus on PSM and HSE regulation compliance

Q&A

REFINERY PLANT CONSERVATION PROJECT

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