THE EU PROJECT MATCHING: MATERIALS & TECHNOLOGIES FOR PERFORMANCE IMPROVEMENT OF COOLING SYSTEMS IN POWER PLANTS

Geochemistry of Geothermal Fluids
Miskolc, 26 - 27 October 2017

INTRODUCTION

- MATChING is the acronym of a project titled: “Materials & technologies for performance improvement of cooling systems in power plants” which has been submitted for the call NMP-15 of H2020 EU funding program.

- CALL NMP 15 – 2015: “Materials innovations for the optimisation of cooling in power plants” The CALL is within Section 5 of HORIZON 2020 – WORK PROGRAMME 2014-2015 : Leadership in enabling and industrial technologies. Nanotechnologies, Advanced Material, Biotechnology and Advanced Manufacturing and Processing

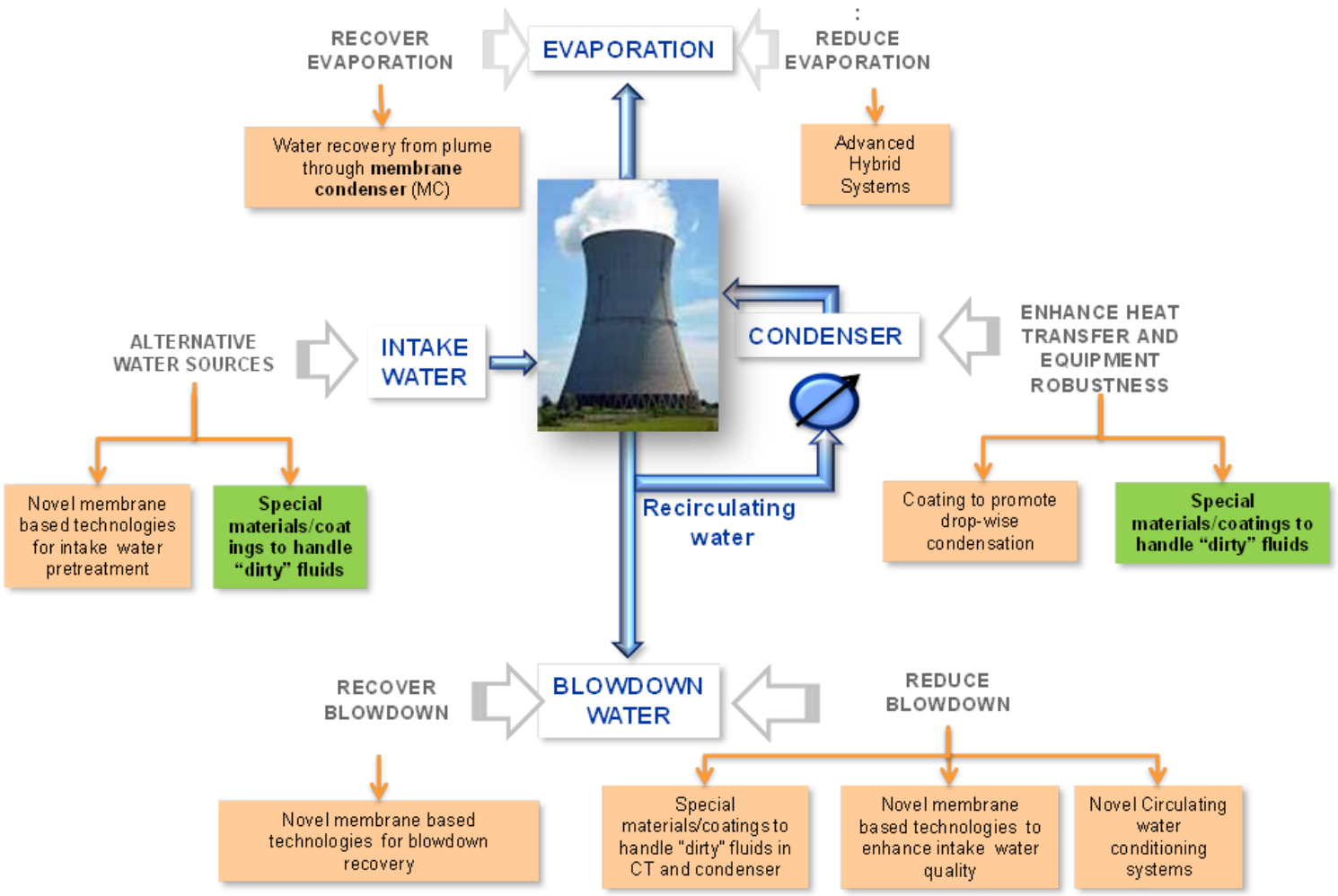
OBJECTIVES OF THE MATCHING PROJECT

	Geothermal Power Plant	Thermal Power Plant
OBJECTIVES	Reduce evaporative losses and plume visibility in geothermal power plants and to increment the geo-fluid re-injected fraction	Increase the robustness of cooling equipments to allow the use of non-traditional waters; Increase the heat exchange efficiency of condenser and cooling equipments; Promote the use of alternative water sources (low quality waters, blow down waters, municipal waters)
TARGET	Overall reduction of geothermal steam emitted into the atmosphere up to 15% and extension of production wells life up to 10% using hybrid solutions for cooling towers and advanced materials and coatings for dry modules	Overall plant efficiency increase up to 0.4-0.5%, enhancing the heat transfer efficiency in the condenser both on the steam side and water side via the use of advanced nano-engineered coatings and surfaces. Overall reduction of fresh water abstraction in fossil fuelled power plants of about 30% validating a set of solutions (6) for the recovery and treatment of cooling water in CT equipped plants.

THE CONSORTIUM

Consortium is made of 4 Utilities, 5 Technology Providers, 6 Research institute and 1 Service provider.

MATCHING APPROACH AND METHODOLOGY



GEOTHERMAL POWER PLANTS IN MATCHING

- Low-T geothermal Source
  - Development and testing (BALMATT IN MOL- Belgium) of coatings for geothermal pipes with:
  - Anti-scaling properties
  - Anti-corrosion properties
  - Conceptual design of a hybryd cooling system coupling a ORC binary cycle with ground water cooling (GWC) and Air Cooled Condensers (ACC)

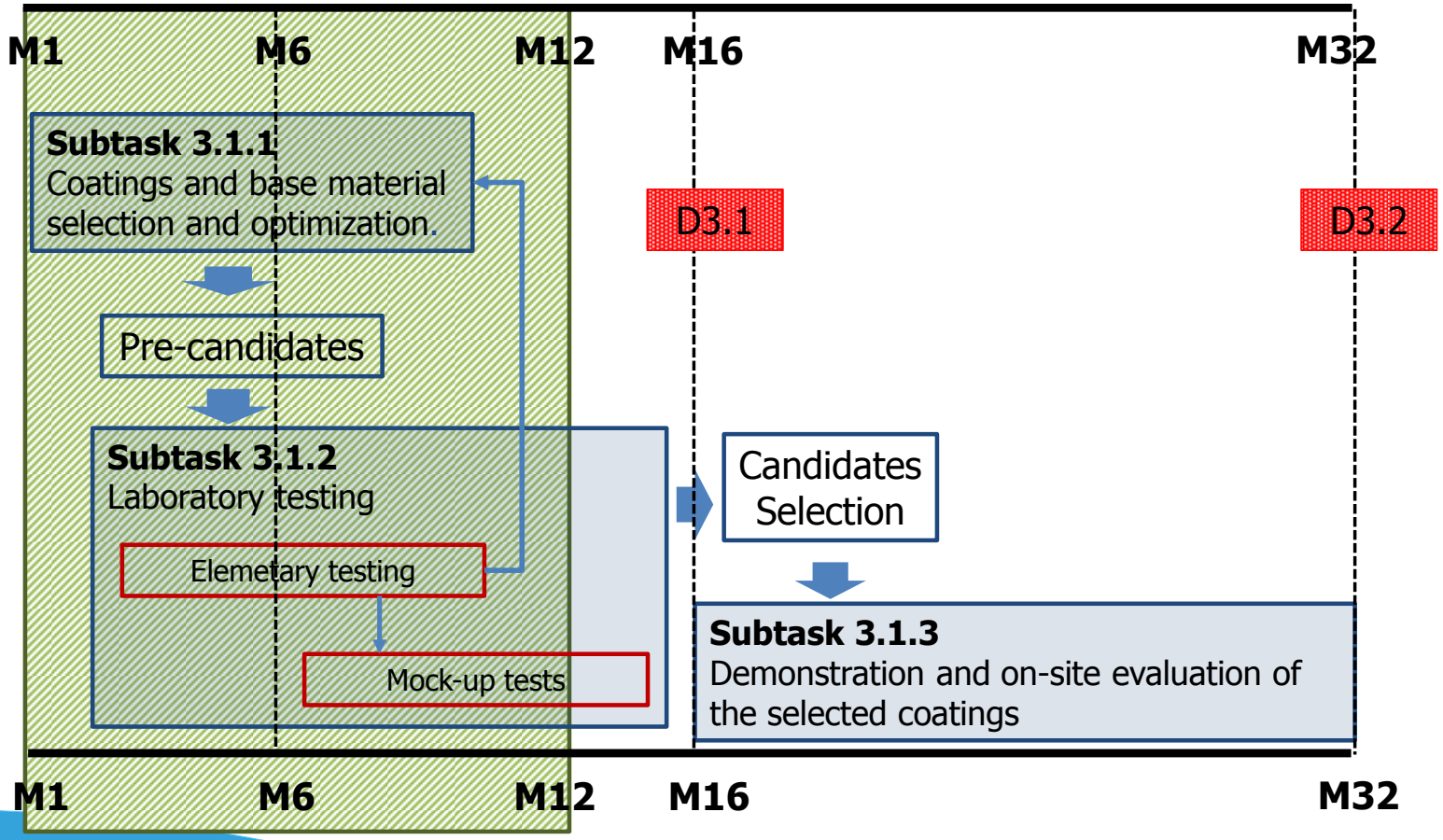
- High –T geothermal Source
  - New Filling media for Wet Cooling Towers (advanced geometries for PVC film filling and 3D splash plastic fillings) to be tested in Nuova Radicondoli (ITALY) geothermal site
  - Coatings for dry section modules of hybrid geothermal cooling Towers to be tested in Nuova Radicondoli (ITALY)

DEMONSTRATION PROGRAM LINKED TO GEOTHERMAL BRINE

DEMO SITE	MAP	Technology to be tested	Partners
BALMATT -GEOTHERMAL SITE The first drilling at Balmatt site was done in September 2015.Geothernal fluid will be used to to heat the disctrict area nearby and if steam properties are good enough to produce electricity via an ORC cycle. 	**MOL- BELGIUM** The Balmatt site is located in Mol, in the north part of Belgium. 	▪ **Coatings with nanometer-thin surface layers** - obtained through optimization of already commercial coatings or specifically developed within the Project- will be first selected in lab and then tested in real scale. ▪ Within MATChING **a bypass will be installed onto the georthermal brine circuit** for the evaluation of different coated materials in contact with the brine (at extraction temperature) ▪ Performance of coatings will be demonstrated trhough: periodic examination/in situ measurements of corrosion rates/post exposure lab analysis	vito DANISH TECHNOLOGICAL INSTITUTE aimen CENTRO TECNOLÓGICO Aqua|still Enel Green Power

TASK 3.1: COATINGS AND BASE MATERIAL SELECTION AND OPTIMIZATION

- The goal of the task is to develop/optimize coatings for binary geothermal power plants with upgrades corrosion protection and anti-fouling properties



BALMATT GEOTHERMAL PROJECT

Assumptions*

- Depth of the reservoir: 2.800 and 3.800 m
- Production temperature: 120 - 124°C
- Up to 5 drillings
- Total flow: 130 – 165 kg/s
- Electricity production using a binary system
- Heat delivery at high(>80°C) and low (< 65°C) temperature

* Based on the feasibility study carried out in 2010 - 2011

DRILLING AND TESTING EXPLORTION WELL MOL-GT-01

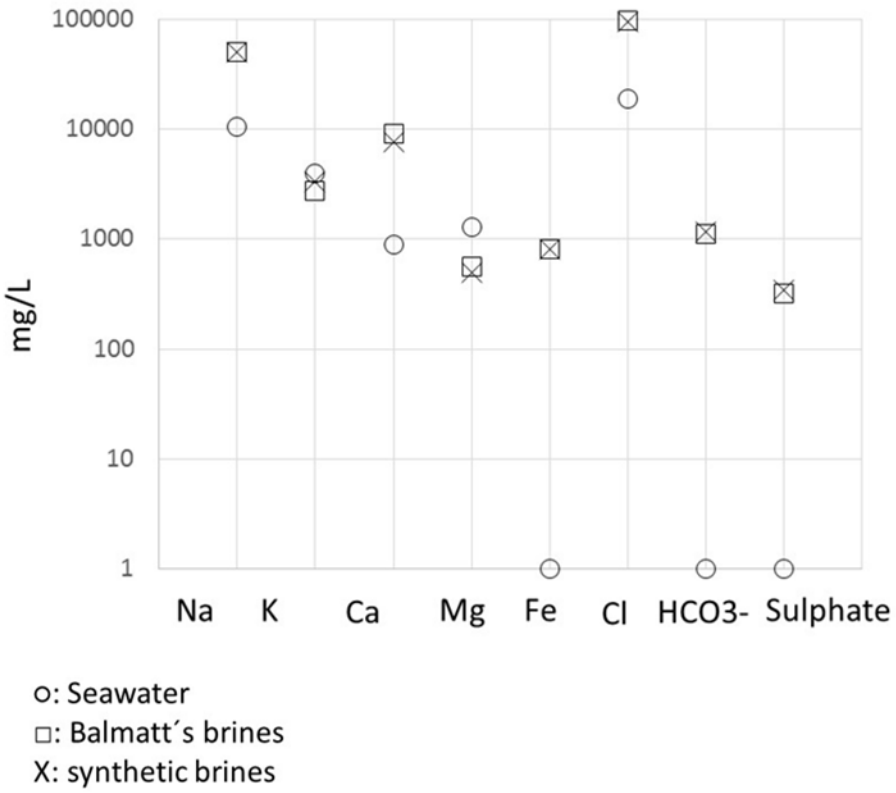
COMPOSITION OF THE GEOTHERMAL BRINE AT BALMATT

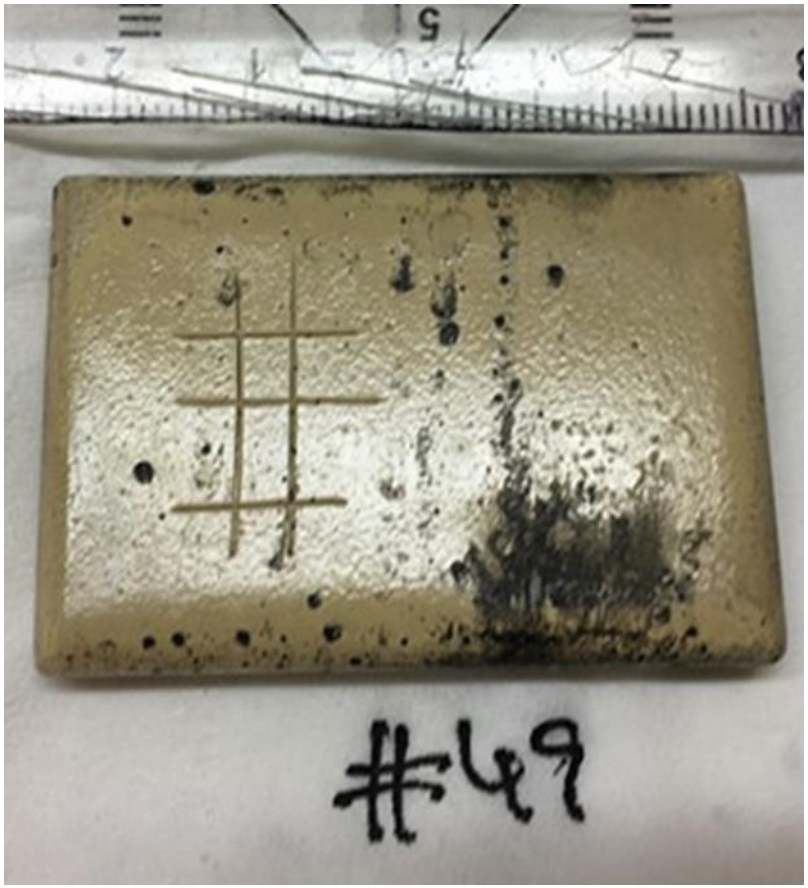
Parameter	unit	MOL-GT01-3400m	MOL-GT01-3280m
Na+	mg/l	49800	49600
K+	mg/l	2770	2870
Ca++	mg/l	9160	9130
Mg++	mg/l	557	560
Sr++	mg/l	396	400
Ba++	mg/l	16.8	16.5
Fe++	mg/l	809	806
Mn++	mg/l	13.6	13.6
HNH4+	mg/l	267	264
Cl-	mg/l	98100	100200
HCO3-	mg/l	1117	1129
SO4--	mg/l	323	380
Br-	mg/l	153	134
F-	mg/l	< 0.88	< 0.88
pH		5.47	5.44
EC	mV	184.8	182.7

OTHER CHALLENGES: NORM

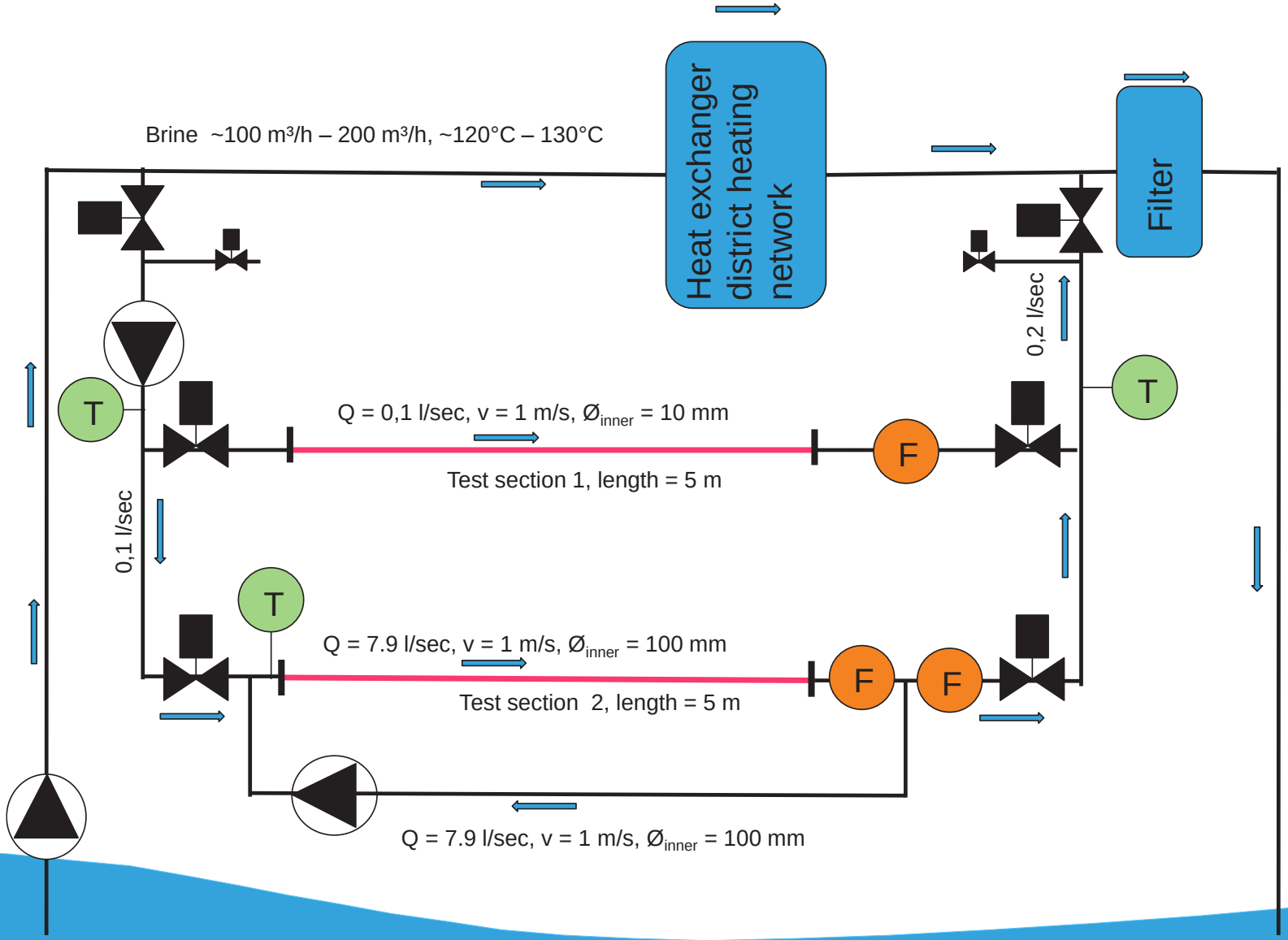
	Concentration (Bq/l)		Disposal limit
	average	stdev	(Bq/l)
Ra226	86.36	22.05	3.6
Ra228	11.80	8.62	1.4
Pb210	0.039	0.033	1.4
U234	0.0012	0.0003	-
U235	< 0.18	-	-
U238	0.00085	0.00028	22
K40	82	11	-

LAB TESTING AND COATING SELECTION

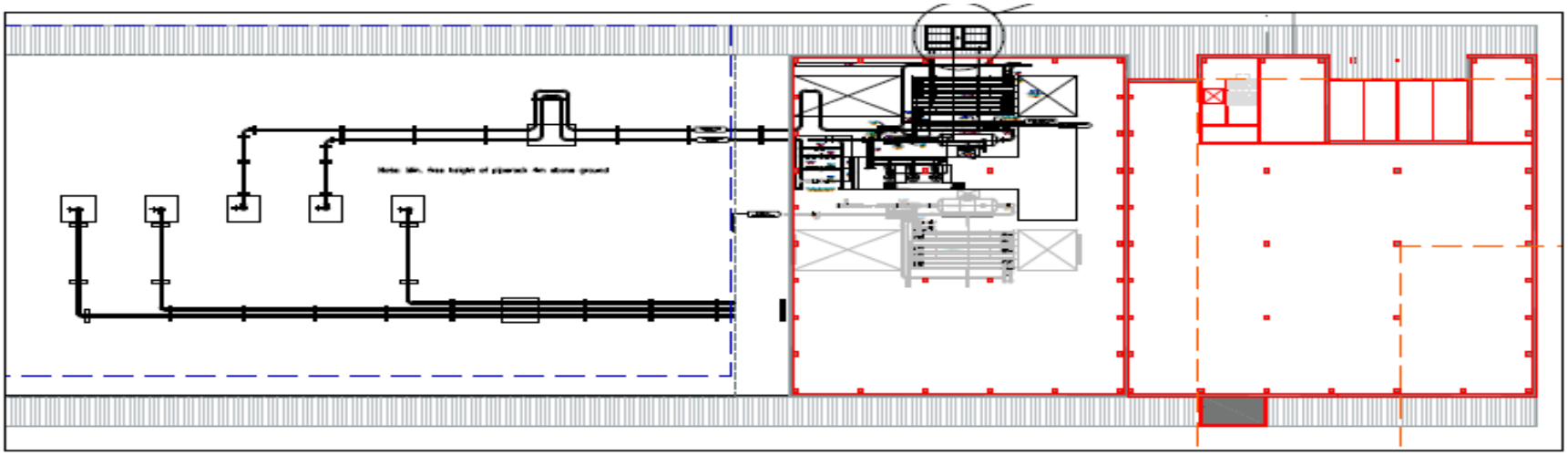




SET-UP COATING DEMONSTRATION



CURRENT STATUS



"BY 2050, WE SAVE NEARLY €4 TRILLION PER YEAR THROUGH ENERGY EFFICIENCY AND REDUCED FUEL COSTS"

"When you work for eternity your worldly logic does not hold. In the light of eternity time and economics become relative values. What then counts is love for your fellow man and respect for God's creation."