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Technical Group: TGS-1 Ore agglomeration and Ironmaking

Independent industrial water supply by digitalization, simulation and innovative treatment technologies

IndiWater

Project ID 101034072

D6.2: Report on publication activities (CFT)

Public

Responsible organization: **CERAFILTEC**

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Saarbrücken in April 2025

SUMMARY

To face the increasing water stress in middle Europe, IndiWater focuses on the prediction of operating status from zero liquid discharge (ZLD) orientated wastewater treatment plants under consideration of sensitive online measured parameters. Following the industrial demands to ensure the water supply, three main objectives of the project are: I.) development of a prediction tool based on modelling, simulations and impact evaluation of different circuits using new digital monitoring and control systems; II.) use and development of online measurement to include this in the prediction tool; III.) improvement and adaptation of treatment processes to operate these with zero liquid discharge. These objectives lead to an improved water management using digitalisation and an increased internal water reuse exploring new fresh water sources such as various wastewaters.

Focus of the performed work described in the delivery report is enabling energy savings in the European steel industry by the dissemination of the project results and providing direct industrial contact to facilitate implementation.

In the project, 11 dissemination activities as publications, presentations and a youtube video were performed. Additional to this, Cerafiltec visited the 11 European and international fairs. Further on, a workshop with 34 participants from 7 different industrial areas, mainly from iron and steel industry, but even plant manufactures for iron and steel industry or chemical industry and mineral producer as supplier of iron and steel industry, have been performed,

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1. INTRODUCTION

Increasing water stress in Central Europe is a challenge for the iron and steel industry. To face it, IndiWater focuses on the prediction and control of operating status of process water circuits and treatment plants under consideration of innovative online measurement techniques. Zero liquid discharge (ZLD) techniques will be introduced to mitigate the water stress. The proposal IndiWater focuses on these approaches in the context of circular economy and the European Green Deal.

Objectives of IndiWater are I.) development of a digital prediction tool and automated water circuits control system, II.) development and application of online NIR measurement, III.) improvement and adaptation of ZLD treatment processes by coupling with the prediction tool and NIR measurement. The progress of the proposal beyond the state of art is focussing for: “Industrial Water 4.0”, Prediction tool on basis of SIMBA#, Pre-filtration with new modular ceramic flat membranes and combination of desalting technologies to achieve near ZLD. These innovative approaches and solutions will be tested in two different use cases with complex wastewaters which are typical for the steel industry.

The well-balanced consortia of complementary partners from the steel industry, leading R&D companies for the steel production and specialised companies can achieve the addressed added values. IndiWater will lead to a safer water supply due decoupling from climate change to a prediction tool on basis of the common SIMBA# software for a reliable wastewater treatment plant operation and to a water recovery by innovative and energy saving technologies. Improvements will be assessed by the creation of an LCA which is linked to the prediction tool. The experienced partners coordinated by the applied R&D company VDEh-Betriebsforschungsinstitut (BFI) agreed about the IPR Management and included a risk as well as innovation management in the work plan.

2. DISSIMINATION ACTIVITES

During the project duration, the achieved results were discussed at 8 internal consortia meeting and publication of the partners fixed. Focus was the direct discussions with industrial representatives for direct dissemination, evaluation of transferability and implementation of results but also valuable input for development of technical solutions in the project. Further on, regular discussions provide industrial interest, facilitate implementation of developed technical solutions and water savings in the European steel industry.

A summary of the performed dissemination activities are shown in Table 1. This included the presentation at the participants homepages and conferences, publication of articles in journals and visit of fair by Cerafiltec, using the project flyer in Europe and outside Europe, Table 2. Examples are the presentation at the ESTEP Spring Event in March 2023 or regular technical discussions with the developer and manufacturer of the membrane based capacitive deionisation (MCDI), company Grünbeck AG. Further on, LIST produced a public promotion youtube video related to the IndiWater project (https://www.youtube.com/watch?v=9gMmooJC3_k) on the LIST youtube chanel with 1760 followers.

As continuing the already performed dissemination activities, BFI and LIST are prepairing publications in different journals in the I. quarter of 2025 to ensure a further transfer of the results.

3. WORKSHOP

A summary of the final results of the project was presented in a workshop on industrial water management “Process water treatment and concentrate handling in steel plants” on the 12th of December 2024 at the Stahl-Akademie (Stahlinstitut VDEh) in Düsseldorf.

Finaly 34 participants from 7 different countries took part, Figure 1. All in all companies from 7 different areas, especially from chemical industry, mineral and lime producer and plant manufacturers beside the iron and steel production or related to this, Figure 2. Impressions of the workshop are shown in the Figure 3 up to Figure 5.

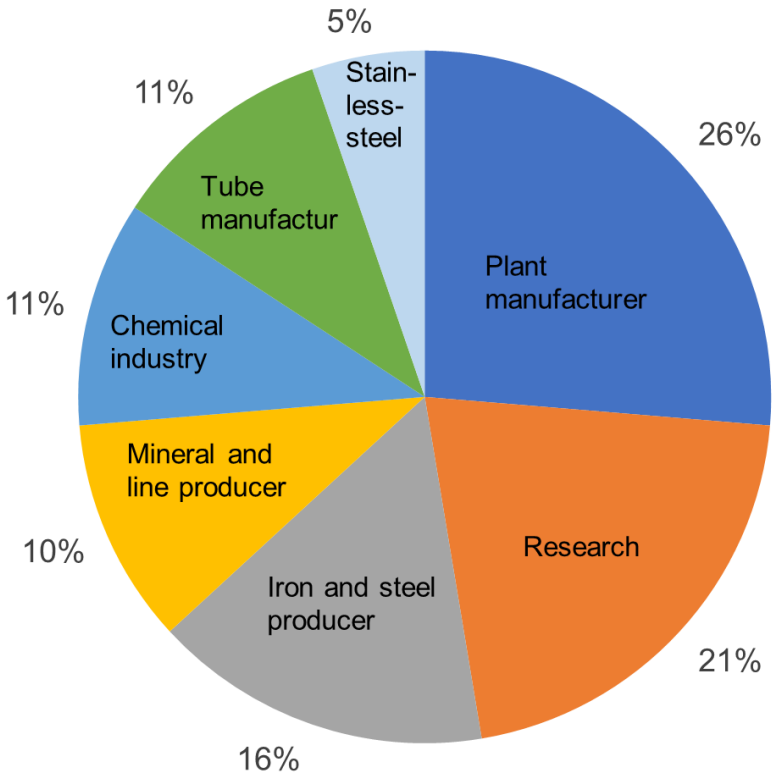

Figure 1 Distribution of participating companies and institutions

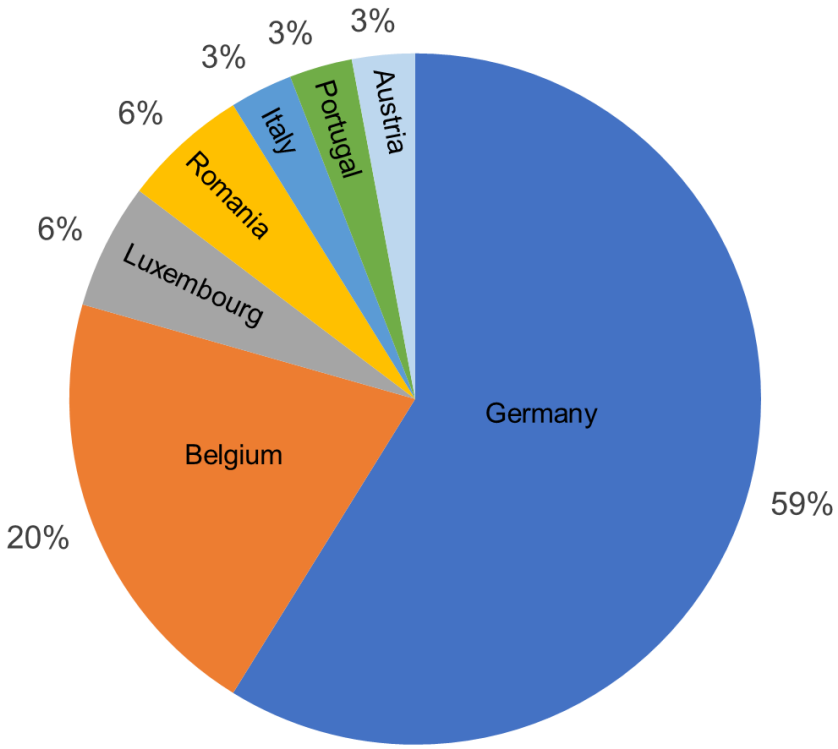

Figure 2 Distribution of participating countries

Figure 3 Exemplary presentations at Workshop - wastewater treatment (left), simulations (right)

Figure 4 Auditorium of workshop, Stahl-Akademie, Düsseldorf, Germany

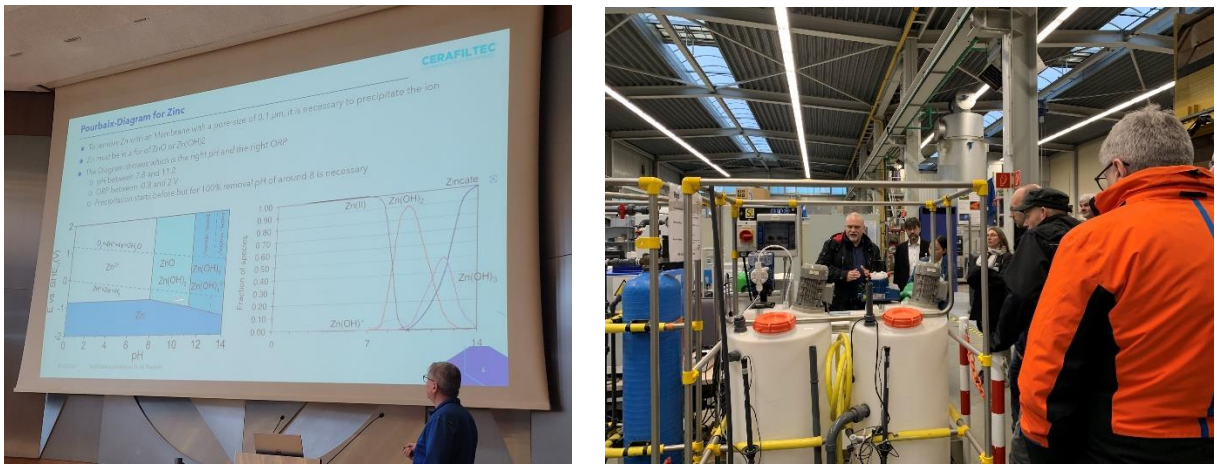

Figure 5 Presentation of removal of zinc containing particle (left), visit of BFI technical centre (right)

4. ANNEX

Table 1 Overview of dissemination activities

Partner	Autor	Title	Event/Journal	Form of dissimination	Date/Location
BFI	Hubrich, Martin; Kozariszczuk, Matthias; Werner, Matthias	Independent industrial water supply by digitalization. simulation and innovative treatment technologies (IndiWater)	https://www.bfi.de/en/projects/independent-industrial-water-supply-by-digitalization-simulation-and-innovative-treatment-technologies-indiwater/	Homepage	2021
CFT	Kaschek, Martin	Independent industrial water supply by digitalization. simulation and innovative treatment technologies (IndiWater)	https://www.cerafiltec.com/funded-projects/	Homepage	2021
BFI	Stubbe, Gerald; Hubrich, Martin; Kozariszczuk, Matthias; Werner, Matthias	Independent Industrial Water-Supply by Digitalization and Simulation	European Steel Technology Platform (ESTEP) Spring Dissemination Event 2023	Presentation	29./30.03.2023. Pisa. Italy
BFI	Hubrich, Martin; Kozariszczuk, Matthias	Desalination of wastewater to ensure fresh water supply	METEC & 6th ESTAD (European Steel Technology and Application Days)	Presentation	12./16.06.2023 Düsseldorf. Germany
BFI	Hubrich, Martin; Kozariszczuk, Matthias	4th International Conference for Membrane Technology & Its Applications		Presentation with abstract	2023

Partner	Autor	Title	Event/Journal	Form of Dissemination	Date/Location
CFT	Kaschek, Martin	Independent industrial water supply by digitalization, simulation and innovative treatment technologies (IndiWater)	Fairs, please see separate table 2	Flyer	Different locations in 2023 and 2024, please see separate table 2
ISQ	Henriques, J.; Castro, P.M.; Dias, R.; Magalhães, B.; Estrela, M.	Potential Industrial Synergies in the Steelmaking and Metal-Processing Industry: By-Products Valorization and Associated Technological Processes	Sustainability MDPI https://doi.org/10.3390/su152115323 https://zenodo.org/records/14892513	Article	2023
BFI	Martin Hubrich	Desalination of Wastewater to Ensure Fresh Water Supply	4th MTAIC 2021	Presentation + Proceeding	2023
BFI	Martin Hubrich, Matthias Kozariszczuk	Nachhaltige Wasserwirtschaft in Zeiten des Klimawandels zur Sicherstellung der Produktion durch Anwendung der membranbasierten kapazitiven Deionisation	Jahrbuch Oberflächentechnik 2024, Band 80 ISBN-10, 3-87480-388-0 / 3874803880	Article	2024
BFI	M. Werner, M. Hubrich, M. Kozariszczuk	Independent industrial water supply through digitalisation and simulation	30. SIMBA#-User Meeting (ifak)	Presentation	23. - 24. April 2024, Magdeburg, Germany
tkRa BFI	Kalter, Susanne; Kinner, Carsten; Kiewitz, Chrysantus; Hubrich, Martin;	Basement for a sustainable water supply	Componay journal tkyseenkrupp	Article	02/2024, Andernach, Germany
All partner	All	Process water treatment and concentrate handling in steel plants	Steel Akademie	Workshop	12.12.2024, Düsseldorf, Germany
LIST	Camerin, Maura; Marjorie Morales	Indiwater	https://www.youtube.com/watch?v=9gMmooJC3_k	Video	28.11.2024

LIST	Marjorie Morales, Maura Camerin, Laurent Chion, Matthias Werner, Martin Hubrich	Innovative wastewater treatment and reuse solutions in the steel industry: A Life Cycle Assessment	The International Journal of Life Cycle Assessment	Article	I. Quarter 2026
BFI	Hubrich, Martin; Kozariszczuk, Matthias	New developments of sustainable water supply by application of membrane-based capacitive deionisation	STEEL + TECHNOLOGY	Article	II. Quarter 2025

Table 2 Fairs visited by CFT, using project flyer

Event/Journal	**Date/**	**Location**
American Membrane Technology Association (AMTA) Conference 2023	22.02.2023-24.02.2023	Knoxville, Tennessee United States
BlueTech Forum 2023	16.05.2023-18.05.2023	Edinburgh, Scotland, United Kingdom
Watrex Expo 2023	15.05.2023-17.05.2023	Cairo, Egypt
Aquatech	11.03.23 15.03.23	Amsterdam, Netherlands
6th MENA Desalination Projects Forum	11.03.23 15.03.23	Abu Dhabi, United Arab Emirates
Oman Water Week (Organized and supported by German Water Partnerhip)	22.01.2024-24.01.2024	Muscat, Sultanate of Oman
AMTA/AWWA Membrane Technology Conference	04.03.24-07.03.24	Knoxville, Tennessee United States
IFAT „Internationale Fachmesse für Abwassertechnik“ (world's leading trade fair for environmental technologies)	13.05.24-17.05.24	Munich, Germany
ACHEMA (world's largest process industry trade fair for chemical engineering, process technology and biotechnology)	10.06.2024 – 14.06.2024	Frankfurt (Main), Germany
Singapore International Water Week (SIWW)	19.06.24-22.06.24	Singapore, Singapore
Water, Energy, Technology, and Environment Exhibition (WETEX) (Organised by Dubai Electricity and Water Authority (DEWA))	01.10.24-03.10.24	Dubai, Dubai

Onsite workshop on
industrial water management

Process water treatment and concentrate handling in steel plants

12 Dec 2024, Düsseldorf, Germany

Aim

Water is a mandatory medium in iron and steel production for cooling applications, material treatment and gas washing processes. Due to climate change, water stress increases and limits the availability of water and change the water composition. This requires innovative approaches, to open up new water sources as blow down and cooling water in combination with an optimisation of the water management by simulations and forecast tools.

The workshop gives an overview on the latest developments for Process water and concentrate handling by opening new water sources as waste waters in iron and steel industry. Innovative research institutes, plant manufactures and companies from metal and steel production industry will give an insight into their latest approaches.

Who should participate

- Operating staff / engineers from steel plants
- Staff from innovation departments or production optimization
- Technical purchasing agents in the steel and related industry
- Plant manufacturers for the steel and related industry
- Supplying industry for water reuse technologies

Registration Fee

Registration fee: 70 €* / 100 € including lunch and beverages

* for staff of the IndiWater, WEISS4PN and KonzentratBiozid projects or employees of member companies and individual members of the Steel Institute VDEh

A cancellation from the seminar is possible until two weeks prior to the start. Then, 25% of the seminar fee must be paid. The total registration amount will be charged for no show or cancellation from the first day of the event.

Registration / Organization

Steel Academy · Steel Institute VDEh
Mr Peter Schmieding
Sohnstraße 65
40237 Düsseldorf, Germany
Tel +49 211 6707-458
seminars@vdeh.de / www.steel-academy.com

© BFI: Field trial with BFI test plants at an industrial site

R&D Projects on Process water and concentrate treatment in steel plants

The workshop is organised as an activity within EU and German government funded R&D projects. The aims of these projects are to develop and demonstrate technologies and tools under industrial environment for recovery of water, handling of concentrates and optimized water use.
By this scientific event, the steel industry and its related sectors will be informed about the R&D activities and practical results.

Organizers

The workhop is organized as an activity within the projects IndiWater- "Independent industrial water supply by digitalization, simulation and innovative treatment technologies", WEISS4PN - Integrative application of innovations and digital cooling performance management to reduce water consumption in steel production, and Konzentrat-Biozid – "Closing of cooling water cycles through innovative desalination and biocide production from the resulting concentrates".The projects are funded by the Research Fund for Coal and Steel (RFCS), Federal Ministry of Education and Research and German Federal Ministry for Economic Affairs and Climate Action.

In the projects involved companies, universities and institutes:

- VDEh-Betriebsforschungsinstitut GmbH, Germany
- thyssenkrupp Rasselstein GmbH, Germany
- ArcelorMittal Eisenhüttenstadt, Germany
- Hüttenwerke Krupp Mannesmann GmbH, Germany
- CERAFILTEC Germany GmbH, Germany
- INSTITUTO DE SOLDADURA E QUALIDADE, Portugal
- Luxembourg Institute of Science & Technology, Luxembourg
- SMS group GmbH, Germany
- Technische Universität Berlin, Germany
- Universität Duisburg-Essen, Germany
- WEHRLE Umwelt GmbH, Germany
- aixprocess GmbH, Germany

Figure 6 Workshop program 12.12.2024

PROGRAMME

Thursday, 12 December 2024

09:30 **Welcome and introduction**

09:45 **Fresh water supply – current situation and future perspectives**
Matthias Kozariszczuk

10:00 **Water use in tine plate production**
Susanne Kalter

10:15 **Water recovery form waters of the iron and steel industry by reverse osmosis**
Stefan Schmidt

10:30 **Discussion with the referents**

10:45 Coffee Break

11:15 **Modelling of the water supply and distribution of an integrated steel work**
Matthias Werner

11:30 **Simulation of different scenarios and its impact to the process water quality in a site**
Martin Hubrich

11:45 **Monitoring of Zn content in water and sludges**
Pavel Ivashechkin

12:00 **Discussion with the referents**

12:15 Lunch Break

13:15 **Separation of suspended solids and Zn containing particles with ceramic flat sheet membranes**
Martin Kaschek

13:30 **Ion separation with membrane-based capacitive deionisation of continuous casting cooling water circuits**
Benedikt Bosch

13:45 **Discussion with the referents**

14:00 Coffee Break

14:15 **Valorisation of concentrates from iron and steel industry and desalting processes**
Marco Estrela

14:30 **Concentrate valorisation by production of a disinfection agent**
Martin Hubrich

14:45 **Life cycle assessment of process water and concentrate treatment technologies**
Maura Carmin

15:00 **Discussion with the referents**

15:15 Network meeting / discussions in BFI testing hall (beverages and snacks)

18:00 End of the Seminar

SPEAKERS Matthias Kozariszczuk, VDEh-Betriebsforschungsinstitut GmbH, Germany ▪ Susanne Kalter, thyssenkrupp Rasselstein GmbH, Germany ▪ Stefan Schmidt, SMS group GmbH, Germany ▪ Matthias Werner, VDEh-Betriebsforschungs-institut GmbH, Germany ▪ Pavel Ivashechkin, VDEh-Betriebsforschungsinstitut GmbH, Germany ▪ Martin Kaschek, Cerafiltec Germany GmbH, Germany ▪ Benedikt Bosch, Grünbeck Wasseraufbereitung GmbH, Germany ▪ Marco Estrela, INSTITUTO DE SOLDADURA E QUALIDADE ISQ, Portugal ▪ Martin Hubrich, VDEh-Betriebsforschungsinstitut GmbH, Germany ▪ Maura Carmin, Luxembourg Institute of Science & Technology

HOTELS NEARBY

Hotel Haus am Zoo
Sybelstr. 21, 40237 Düsseldorf
Fon 0211 6169610, welcome@haz-dus.de

B&B Hotel Düsseldorf City
Toulouser Allee 2-4, 40211 Düsseldorf
Fon 0211 415500, duesseldorf-city@hotelbb.com

NH Düsseldorf City Nord
Münsterstr. 230-238, 40470 Düsseldorf
Fon 030 22388599, www.nh-hotels.de/hotels/duesseldorf

Figure 7 IndiWater - Flyer

European Commission

Research Fund for Coal & Steel

Independent industrial water supply by digitalization, simulation and innovative treatment technologies (IndiWater)

Initial situation

- Increasing water stress leading to limited or insufficient water availability of ground and river water with negative effects to production processes as continuous casting, hot rolling,
- No reuse of waste waters because of to high fluctuating contents of salts, hardness and organic in effluents from emulsion, chemical, biological treatment plants and vacuum treatment
- No suitable recovery technologies under technological or economic aspects available
- Lak of information about flow rates, compositions and complex water systems an effective water management – upcoming problems in wastewater treatment plants could not be predicted

Process water samples

Project objektives

- Water recovery from waste waters containing e.g. oil, fat, heavy metals, bacteria or particles as effluents from degreasing bath, biological/chemical treatment or gas washing water
- Improvement of water management and treatment plant operation by prediction tool based on modelling and simulations of the different circuits using new installed digital monitoring and control systems
- Decrease of dependency of production processes from freshwater intake by internal wastewater reuse as make up water

Flat sheet filtration

Selective nanofiltration

Membrane based Capacitive Deionization (MCDI)

Project partner

STAHL. DAS SIND WIR.

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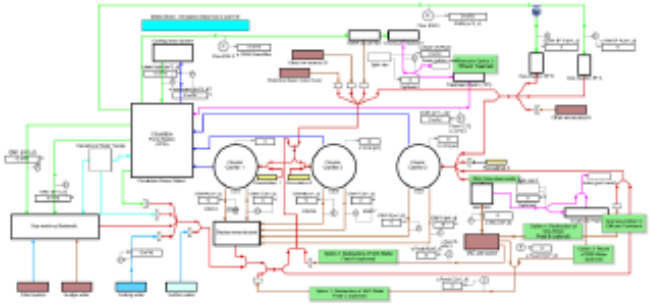
BFI Excellence in Applied Research



Digital mapping of an integrated steel shop for simulations

This project has received funding from the Research Fund for Coal and Steel under grant agreement No 101034072.

Project data

- Project duration: 07/2021 – 12/2024
- Project Management Agency: European Research Executive Agency (REA)
- Funding provider: Research Fund for Coal and Steel (RFCS)

Contact (coordinator)

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