ANNUAL REPORT
SFI SWIPA
2021

sfi Centre for Research-based Innovation

Swipa | Subsurface Well Integrity Plugging and Abandonment

R&D partners:

Financial industry partners:

In-kind industry partners:

Information about the Centre

Host:
SINTEF, SINTEF Industry, Department of Petroleum

Centre Director:
Harald Linga, SINTEF Industry

Contact:
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Homepage: www.swipa.no, LinkedIn: SFI SWIPA

Front page photo: Nicolaine Agofack testing mechanical properities of barrier materials. Photo: Thor Nielsen, SINTEF

Design and production: Berit Fossum, SINTEF Industry

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OF THE 2021 ANNUAL REPORT FOR SFI SWIPA

SUMMARY 2021

By Centre Director Harald Linga

After the centre award, significant effort has been paid on establishing a collaboration agreement, satisfying the requirements set by Research Council as well as all being acceptable for the industry partners. Finally, by February 24, 2021 we were happy to submit to the Research Council a mutually agreed collaboration agreement including 28 companies and organisations. By year end 2021 the number of partners has reached 32 companies and organisations. This includes 5 R&D partners, 3 operating companies and 24 service companies, vendors and organisations. The considerable attention and involvement by a large number of industry partners, is a definite asset for targeting innovations and research. Further, by the industrial involvement it allocates for implementing in industry, thus contributing to the target of 50% cost reduction for Plugging & Abandonment of petroleum wells at the NCS as compared to present technology.

The opening seminar for SWIPA was held at TEAMS on March 23, with a panel debate *"Plugging & abandonment of wells – a kinder egg for the Norwegian shelf"*. Speakers were represented by the Ministry of Petroleum and Energy (MPE), the Petroleum Safety Authority Norway, OG21, the research partners and industry partners. The panel debate was attended by Tony Tiller, State Secretary in the MPE, Elisabeth Birkeland, CTO Equinor, Mari Sundli Tveit, CEO Research Council Norway, Alexandra Bech Gjørv, Executive Vice President SINTEF and Anne Borg, Rector of NTNU. The approximately 120 participants in the seminar also had the opportunity to participate in the debate on *"How should we realize the possibilities"*.

The constitution of the organisational bodies of SWIPA has been completed during 2021. The Board is now chaired by Pål V. Hemmingsen, Equinor, the Scientific Committee by Bernt Aadnøy, University of Stavanger, and the Innovation and Exploitation Committee is chaired by Rune Godøy, Equinor. The 4 technical Work Packages are managed by Ragnhild Skorpa, SINTEF, Viktoriya Yarushina, IFE, Erlend Randeberg NORCE, and Anne Rita Bakken, SINTEF. Together with Ass. Prof. Mahmoud Khalifeh, UiS, Prof. Sigbjørn Sangesland, NTNU and Centre Director Harald Linga, SINTEF, this team makes up the SWIPA management team.

During 2021 Technical Review Meetings for the Work Packages have been held, with follow-up addressing the mapping of industry partners` priorities and capabilities for contributing to the R&D activities. This has served as a basis for the Annual Work Plans and budget priorities prepared.

An important part of the Centre is the education of experts for industry. Altogether NTNU and UiS has throughout 2021 engaged a total of 4 PhD-candidates and 1 postdoc engaged for SWIPA activities.

The visibility of the center has continued in 2021 through several media reports and interviews. The follow-up on editorial notes in e.g. Bloomberg, WorldOil and Teknisk Ukeblad has continued. Examples in 2021 are notices in Klassekampen, Bergens Tidende, E24 and ABCnyheter. On the basis of specific media reports, the topic of well plugging was also raised in the Norwegian Parliament weekly question session in August, where the Minister of Petroleum and Energy in her answer pointed to the center as a vehicle for handling the challenges of future well plugging costs.

On the technical side the potential of alternatives to Portland cement as barrier material has gained considerable attention. Long term exposure tests in sour well controlled environment have been initiated and are ongoing. This includes alternative barrier materials such as cement with additives, geopolymers and epoxy materials. The target for the alternative materials is reduced plug lengths as compared to standard solutionsas well as reduced CO_2 footprint.

ABOUT SFI SWIPA

VISION: ***The vision for the centre is to obtain a scientific understanding of permanent well barriers and allocate for improved well barrier design methodologies.***

SFI SWIPA is a centre for research-based innovation (SFI) appointed by The Research Council of Norway for 2020-2028. A centre for research-based innovation is a dedicated, long-term initiative designed to strengthen and further develop elite, creative research and innovation groups or to build research groups in strategically important areas.

THE **PRIMARY OBJECTIVE** OF SFI SWIPA IS TO:

- Facilitate rapid deployment of well barrier establishment and P&A technologies and system solutions that reduce offshore P&A costs with 50%.
- Increase value creation in the Norwegian O&G industry by the implementation of new P&A- and sidetrack solutions
- Create new solutions and products for well integrity issues for CO_2 storage, nuclear waste storage and reconversion of petroleum wells.

PARTNERS

R&D partners:

SINTEF · NORCE · IFE · NTNU

Financial industry partners:

AkerBP · equinor · wintershall dea

In-kind industry partners:

Baker Hughes · Archer · CANNSEAL · Disruptive Value Group · aDrilling · elogix · EXEDRA · FloPetrol · Funzionano · GCE NODE · Huisman · HydraWell · Innovation Energy · MAERSK DRILLING · Pigas · RESTONE · Saferock · ScanWell · Schlumberger · STRATUM · TYRFING · WellGuard · WELLSTROM

SUB OBJECTIVES

The sub objectives of SWIPA include:

- Develop experimentally verified solutions which lead to new innovative operations and qualification of new barrier materials.
- Develop a scientific-based new approach for more cost-efficient industry standards and regulations for P&A of wells.
- Perform case studies and technology audits relevant to demonstrate the potential of new well barrier solutions.
- Provide 15-20 innovative solutions.
- Generate 4 KPN, 8 IPN, 8 DEMO and 4 EU spin-off projects.
- Educate 9 PhD students, 4 Post Docs, 25 MSc candidates, and training, recruitment of 15 experts in well barrier technologies.
- Disseminate and communicate project results in 55 journal and conference papers, present in O&G specific workshops and meetings such as SPE events, ONS and OTC, and disseminate news articles.

As a result of the tax regulations for the Oil & Gas industry at the NCS, successful outcome will greatly reduce the future well abandonment costs imposed to the Norwegian State.

Links will be established to research consortiums, operators and universities focusing on well integrity issues, but with operations in other regions, such as UK and Brazil. The centre will have the ambitions to be an international knowledge-centre on well integrity and serve as a platform for innovation and value creation. SWIPA is an industrially oriented research consortium. The strong partnerships between the industry's end-users, vendors and research institutions will be a driving force in the collaborative development of next generation well barrier solutions. The involvement of vendors will stimulate the innovation process and shorten the path from research to commercial products. Thus, the Centre can be a stepping stone for fast-track transfer of state-of-the-art technology to the global market. The possibility for building such a hub for innovation within the area of well barrier solution for the oil and gas industry, serving also other energy industries, is one of the major advantages of such a Centre.

Centre's objectives related to the centre's expected impacts and to the overall objectives for the SFI scheme. The Centre results will impact the industry by scientific-based regulations and standards, innovative and qualified operations and well materials alternative to cement. The R&D on well integrity will be utilized for several applications, and skilled candidates will be available for an industry where in particular the need for P&A capacity and competence will be elevated.

RESEARCH

WORK PACKAGES, OBJECTIVES AND POTENTIALS

WP1: WELL BARRIER MATERIALS AND INTEGRITY

Ragnhild Skorpa
SINTEF

The sealing ability of well barriers is crucial to maintain well integrity. WP1 will provide much of the fundamental basis that leads to a scientific understanding of well barriers and their integrity, with respect to sealing abilities of different barrier materials and barrier envelope scenarios, development of new and improved materials, and an improved understanding of how barrier placement influences well integrity.

Research Objectives:
To obtain a fundamental understanding of different barrier materials, their sealing abilities, failure mechanisms and resulting leak rates.

Potential innovations and implementations:

- A scientific understanding of barrier materials is crucial when determining barrier acceptance criteria and developing a "fit-for-purpose", risk-based approach to P&A.
- Service providers in the Centre will be in position to use new scientific understanding to come up with ideas for new products and services as well as improving their present technology.

WP2: BARRIERS FOR STORAGE AND DISPOSAL

Viktoriya Yarushina
IFE

WP2 will focus on solution of specific challenges related to different energy technologies, and adapting current technologies developed for conventional oil and gas production to these applications with a specific focus on integrity of formation. WP2 will be based on both theoretical and experimental approaches. Every application has its own specific requirements for wells with respect to safety and security. The WP will target applications such as geothermal energy extraction, underground CO_2 storage and underground hydrogen storage, for which well integrity issues are crucial.

Research Objectives:
To identify specific challenges and customize technologies for specific well integrity applications; P&A and selected energy applications (H_2 and CO_2 storage, geothermal, nuclear waste storage, etc).

Potential innovations and implementations:

- New solutions and guidelines for safety of various subsurface well integrity applications.
- New cements for storage of corrosive or dangerous substances.
- Methodologies for well drilling and life extension
- New simulator for well stability in aggressive environments.

WP3: UPSCALING AND TESTING

Erlend Randeberg
NORCE

Essential for development and implementation of new technology is testing under relevant conditions and in realistic scale. Scaling effects are both mechanical/physical and operational, as handling, mixing, pumping and curing of barrier material differ substantially between laboratory and field. WP3 will investigate physical and operational scaling effects and facilitate upscaled testing of selected technologies studied in the other work packages.

Research Objectives:
Investigate physical and operational scaling effects by large-scale testing under relevant conditions and by this enable development and implementation of new technology.

Potential innovations and implementations:
- Establish methodologies well barrier performance evaluation under relevant test conditions.
- Monitor performance of mixing procedures for selected barrier materials, and as a first step addressing Portland cement as a reference material.

WP4: INNOVATIONS AND TECHNOLOGY DEVELOPMENT

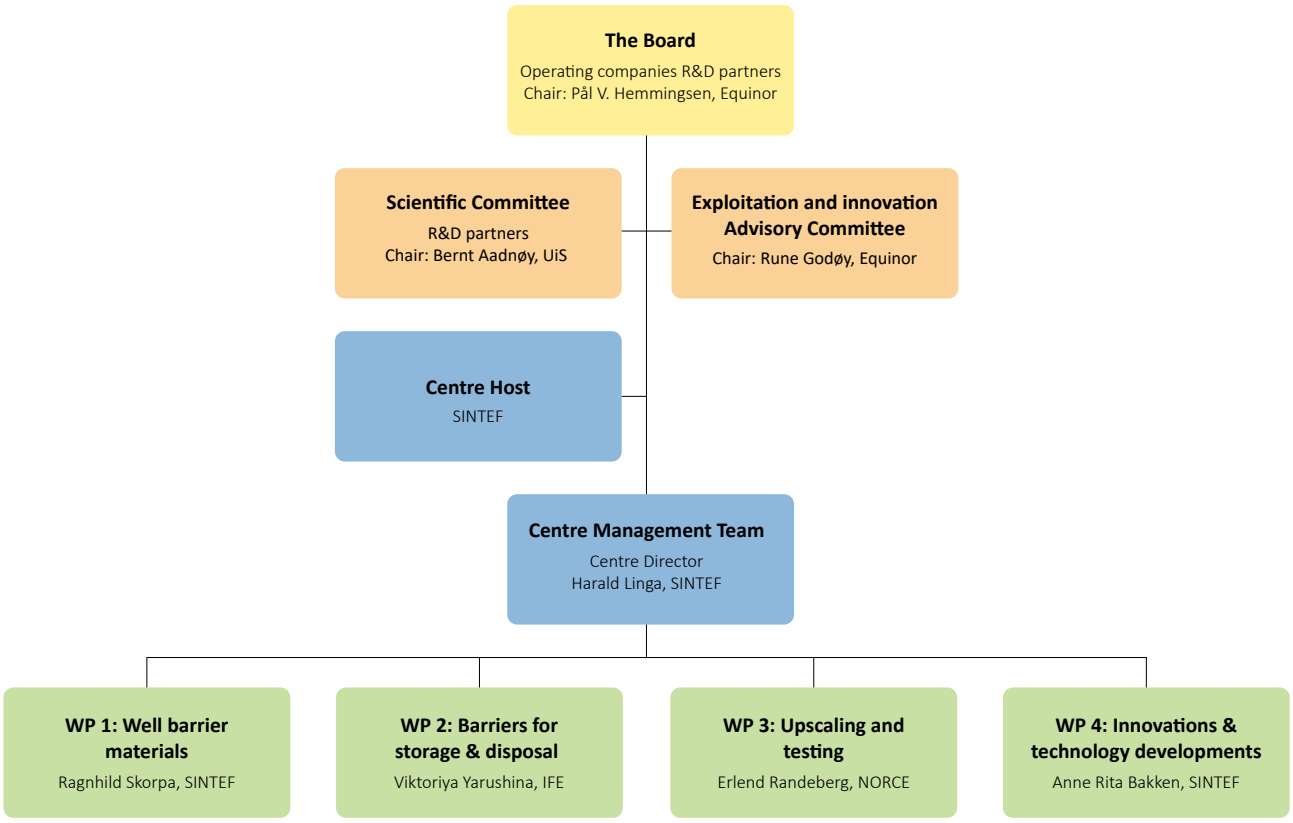
Anne Rita Bakken
SINTEF

In order to efficiently bring forward scientific results towards industrial implementation of well barrier solutions, close collaboration between research partners, operators, vendors and national authorities are required. This WP is established in order to safeguard this ambition.

Research Objectives
- Through the Exploitation and Innovation Advisory Committee review and prioritize results and innovations towards further technology qualification and identify potential test campaigns at high TRL.
- Evaluate how a potential risk-based approach to technical barriers affects the holistic risk picture including non-technical aspects such as organizational barriers.
- Establish close communication with national authorities as PSA (Petroleum Safety Authority Norway) and international consortiums such as Net Zero TC (formerly OGTC, The Oil & Gas Technology Centre) in the UK.
- Perform technical audits and business case studies.

Potential Innovations and implementations:
- Safeguard follow-up towards technology qualification .
- Actively target and identify potential for implementation of new results into standards and regulations.

ORGANISATION



Organisation of SFI SWIPA as hosted by SINTEF.

The roles and representation for the different units are as follows:

The Board: Led by industry. The cash-contributing operating companies will each have a permanent seat in the Board together with the Research partners and the Research Council and will hold the Chair of the Board. This safeguards the end-users` impact on priorities set forth for technology development and qualification described in the annual work plan. The Board is responsible to the financial contributors for the scientific quality and progress of work in the Centre, discusses overall and annual work plans, addresses conflict resolution, approves background and admits new partners.

Pål Viggo Hemmingsen, Equinor has been the Chair of the Board. By year end 2021 the other board members are Martin Knut Straume, AkerBP, Frode Angell-Olsen Wintershall, DEA, Lars Sørum, SINTEF, Aina Margrethe Berg, NORCE, Viktoriya Yarushina, IFE, Ute Mann, NTNU and Øystein Arild, UiS. Research Council with representative Øyvind Veddeng Salvesen has observatory status in the Board. Egil Tjåland represented NTNU until August, and Liv Jorunn Jenssen represented the Research Council until November.

Scientific Committee: NTNU and UiS will alternate on leading the scientific committee. Representatives: all academic partners. Safeguard the scientific quality of the work. Bernt Aadnøy is the Chair of the Scientific Committee. Other members are Sigve Hovda, NTNU, Erling Fjær, SINTEF, Steinar Kragset, NORCE and Stephane Polteau, IFE.

Exploitation and Innovation Advisory Committee: Lead: industry. Representatives: all industry partners and research partners. Evaluate commercial potential and identify spin-off projects. Advise the Board on new research directions. The Chair of the committee is Rune Godøy, Equinor. Administrative support is given by the staff in WP 4: Innovations & technology development

Centre Director: will serve as main contacts for the WP leaders, the educational program and above-mentioned organisational bodies. The Centre Director will be in charge of administrative, financial and legal tasks. The Centre is managed by SINTEF with Harald Linga as Centre Director

Technical advisory committees: Representatives: WP leaders, including industry representatives. Technical advisory committees will be established for specific R&D topics to ensure knowledge transfer between the Centre partners. In 2021 Technical Review meetings, were held in August 2021, followed by request for feedback on partners priorities of interest in identified projects and contribution to the research activities.

Board

Pål V. Hemmingsen
Equinor

Frode Angell-Olsen
Wintershall DEA

Lars Sørum
SINTEF

Martin K. Straume
Aker BP

Aina Margrethe Berg
NORCE

Ute Mann
NTNU

Viktoriya Yarushina
IFE

Øystein Arild
UiS

Øyvind Vedding Salvesen
Research Council

The Centre management team consists of the WP leaders, representing all the R&D institutes, and also one representative each from the universities UiS and NTNU. This safeguards involvement by the research partners on recommendations to be set forward to the Board. SWIPA will imply an innovation work process, supported and introduced by professionals for promoting innovation processes. This will facilitate tailored evaluation of the research activities and directions and ensure that the Centre reaches its ultimate goals for new and cost-efficient well barrier solutions while balancing scientific excellence, technological innovations, and integration of research and education.

The Centre management team

Harald Linga
SINTEF

Ragnhild Skorpa
SINTEF

Viktoriya Yarushina
IFE

Erlend Randeberg
NORCE

Anne Rita Bakken
SINTEF

Mahmoud Khalifeh
UiS

Sigbjørn Sangesland
NTNU

Chairs of SWIPA Centre Committees

Chair of Scientific Committee

Bernt Sigve Aadnøy
UiS

Chair of Exploitation and Innovation Advisory Committee

Rune Godøy
Equinor

PARTNERS

R&D partners:

SINTEF NORCE IFE NTNU Universitetet i Stavanger

Financial industry partners:

AkerBP equinor wintershall dea

In-kind industry partners:

Baker Hughes Archer CANNSEAL Disruptive Value Group əDrilling elogix logical minds EXEDRA FloPetrol WELL BARRIER Funzionano GCE | NODE | AN INDUSTRY-DRIVEN CLUSTER FOR OCEAN TECHNOLOGIES Huisman HydraWell Innovation Energy MAERSK DECOM Net Zero Technology Centre Technology Driving Transition Prores RESTONE Saferock ScanWell Schlumberger STRATUM RESERVOIR TYRFING Innovation as WellGuard® WELLSTRØM

RESULTS
FROM THE WORK PACKAGES IN 2021

Installation of cement plug prior to temperature and pressure exposure.

Preparation of barrier materials.

A study has been performed on Leakages Through Radial Cracks in Cement Sheaths. Annular cement sheath is considered to be one of the most important barrier elements in the well, both during production and after well abandonment. It is however well-known that mechanical damage to the cement sheath might result in leakage pathways, such as micro- annuli and radial cracks, and thus loss of zonal isolation. The study has addressed the effect of geometry, aperture, and viscosity on the resulting pressure-driven flow through real radial cracks in cement sheaths using computational fluid dynamics (CFD) simulations. The simulation results show that fluid flow through real cracks in cement sheath is complex with torturous paths, especially around bottlenecks and narrow sections. Additionally, the results show that flow of both methane gas- and water are not linear and hence does not follow Darcy's law. This illustrates that simple models are not able to fully describe fluid flow through such complex geometries.

Alternative barrier materials to cement are targeted when it comes to mechanical performance evaluation as well as the climate footprint.
The experimental results from advanced and relevant test facilities, in particular the research infrastructure Norwegian P&A Laboratories, are used continuously by the industry partners in their evaluation of barrier materials for tailoring materials for relevant plugging operations. In SWIPA materials are examined in the first test campaign including different types of geopolymers and epoxy mixtures from four of SWIPA's industry partners . Compared with traditional well cement, the new materials can have significant advantages in terms of climate footprint (CO_2 produced in the fabrication of the material), robustness and reduced requirements for plug length.

A method has been established for long-term exposure of selected barrier materials as alternatives to cement for plugging wells. Robustness and durability of new well materials are investigated in acidic environments that contain the aggressive sour gas H_2S. Material samples provided by industry partners have been processed and installed in an ongoing long-term test. The results from the long-term tests will be central to which new alternative materials can meet the criteria set for barrier materials, in particular the requirement "no leakage - for eternity".

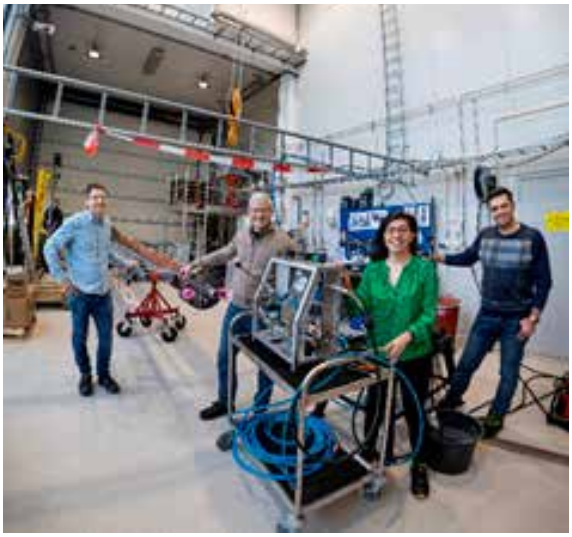
The leakage of gas through or along wellbores has been identified as one of the main challenges for the secure underground fluid and material disposal. During 2021 a new method based on a core-flow apparatus was developed for testing the scaling performance in a fracture or similar leakage pathway through a cement sample. This will allow the study of potential self-healing behaviour of sealing materials when exposed fluids containing controlled fractions of sour compounds such as H_2S, O_2, SO_x and NO_x.

A work has been carried out on investigating the occurrence and severity of fluid seepage through clay-rich barriers. The analysis used analytical solutions for borehole closure in creeping formations under hydrostatic and non-hydrostatic stress fields. Expected time for borehole closure are estimated for various shale types was addressed. The first paper documenting results was published in the international scientific journal together with international collaborators (Yarushina et al., 2021).

Scan of cross-section of material sample exposed to CO_2. Photo: Reinier Van Noort, IFE.

An in-line measurement system for the characterization of slurry properties of barrier materials during mixing has been proposed and described, using cement as reference material. The instrumented batch mixer system is currently under development at Ullrig as a part of NorPALabs (Norwegian P&A laboratories). A report describing field-scale challenges and requirements for upscaling has been made available to SWIPA partners. The quality and consistency of cement slurries tend to depend on mixing equipment and mixing conditions. Cement optimization at the lab-scale normally relies on low-volume and extremely high shear mixing in a blender. Contrary to this, in the field, m^3-scale batch mixers mix the same slurry in a very different geometry and at quite different shear and energy input.

SWIPA has, together with four other RCN-supported innovation centres, established a collaboration forum for systematically developing methodologies for innovations. This addresses both motivation, culture and competence for innovation focus for researchers, university affiliates (PhD & postdocs) as well as the contribution from industry partners and collaboration with authorities and organisations. As an example for the latter close communication has been established with national authorities as PSA (Petroleum Safety Authority Norway), and international consortiums such as NetZero Technology Centre in the UK.



NORCE` R&D staff addressing in-situ measurements of slurry properties.

INTERNATIONAL COLLABORATION

During the year, the following international collaborations have been established:

United Kingdom

- Collaboration with Prof. Bob Eden, University of Manchester by the fact that Prof. Eden will be a co-supervisor for PhD student Manataki Andriani at NTNU. Topic: Properties of Bismuth alloys as barrier material in well completion and well plugging.
- The center NetZero TC has signed as a partner in SWIPA.

Brazil

- A collaboration has been established on the development of a spin-off project initiated by SWIPA partners Funzionano and SINTEF together with Brazilian industrial companies GreatEnergy , DBO Energy and the Brazilian academic partners of SWIPA; PUC, UFRN. The theme here is the development of an environmentally friendly drilling fluid that can be triggered to act as a permanent barrier in the well. An application has been made for project support within the Research Council's Brazil-Norway collaboration (RCN project application no. 32877).

Russia

- As initiated through a RCN-funded Russia-Norway research collaboration, project owner IFE, a collaboration is carried out with Moscow University. Topic: Mechanical and properties of shale and leakage to characterize.

Denmark

- Maersk Decom has signed as a partner in SWIPA .

SPIN-OFF PROJECTS

Reinier van Noort
IFE

The project CEMENTEGRITY has started as a result of the work and collaboration in SWIPA. The project is a part of the program ACT, Accelerating CCS Technologies, an international initiative to establish CO_2 capture, utilisation and storage (CCUS) as a tool to combat global warming. The ambition of the 16 countries supporting ACT is to fund research and innovation projects that can lead to safe and cost-effective CCUS technology. The ACT program is supported by ERA NET Cofund, a part of the EU Horizon 2020 program for research and innovation, and is also supported by a number of countries outside Europe.

The main purpose of CEMENTEGRITY is to develop and improve cement mixtures to achieve stable high-quality well integrity for CCUS. The project is managed by Reinier van Noort, IFE, and has a total of 7 partner institutions from Norway, the Netherlands and the United Kingdom. The project started in November 2021, duration 3 years, and has a total budget of ~ 2 M €.

ACT - Accelerating CCS Technologies

RECRUITMENT
- OUR POSTDOC AND PHDs

Postdoc-candidates and PhDs play a vital role in achieving the goals of the Centre. During 2021 we have recruited in total 4 PhD-candidates and one postdoc candidate.

Postdoctor
Paulo Moreira

Research Topic: Sealing ability and gas tightness of different barrier materials

Period: 2021 - 2023

Supervisor: Ass. Prof. Mahmoud Khalifeh, UiS

PhD candidate
Adriani Manataki

Research Topic: Properties of Bismuth alloys as barrier materials

Period: 2021 - 2024

Supervisor: Prof. Sigbjørn Sangesland, NTNU and Prof. Bob Eden, Univ. of Manchester

PhD candidate
Lewaa Hmadeh

Research Topic: Applications of Bismuth alloys for well integrity

Period: 2021 - 2024

Supervisor: Prof. Behzad Elahifar and Prof. Sigbjørn Sangesland, NTNU

PhD candidate
Madhan Nur Agista

Research Topic: Materials for Shallow Gas

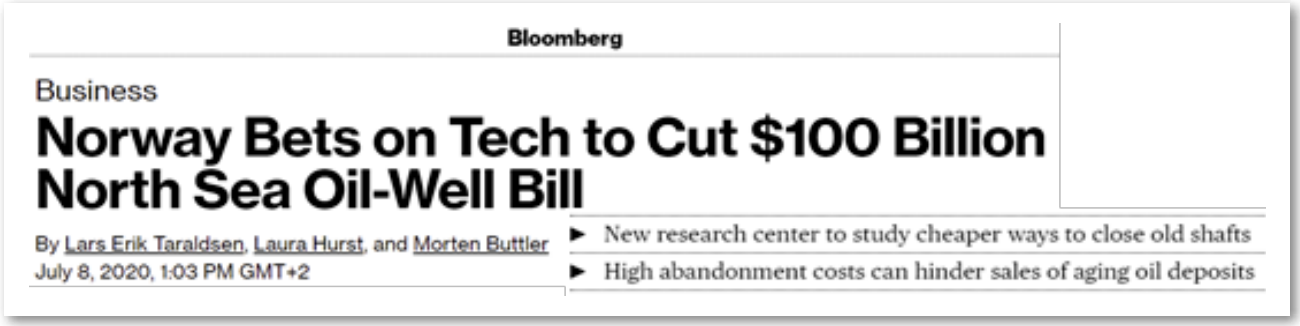
Period: 2021 - 2024

Supervisor: Ass. Prof. Mahmoud Khalifeh, UiS

COMMUNICATION AND DISSEMINATION ACTIVITIES

Research communication includes both communicating to your research fellows through scientific publications, conference presentations etc, as well as communicating to user groups, the general public and policymakers. Scientists have a responsibility to build bridges between science, industry and society, and to transfer the new knowledge to potential user groups and society as a whole. During 2020- 2021 SFI SWIPA has been visible at several internal and external/public arenas.

Here are some examples:



Bloomberg

Business

Norway Bets on Tech to Cut $100 Billion North Sea Oil-Well Bill

By Lars Erik Taraldsen, Laura Hurst, and Morten Buttler
July 8, 2020, 1:03 PM GMT+2

- New research center to study cheaper ways to close old shafts
- High abandonment costs can hinder sales of aging oil deposits

2020-07-08, www.bloomberg.com

World Oil Magazine News Data Resources Events

Norway to tackle $100 billion P&A liabilities with new oilfield tech

Lars Erik Taraldsen, Laura Hurst and Morten Buttler 7/8/2020

2020-07-08, www.worldoil.com

OILPRICE.com
The No. 1 Source for Oil & Energy News

Researchers Look For Ways To Cut Norway's Gargantuan $100 Billion Decommissionin

By Charles Kennedy - Jul 08, 2020, 2:30 PM CDT

2020-07-08, www.oilprice.com


TU Energi

Nytt innovasjonssenter har som mål å halvere dagens kostnader for å plugge oljebrønner

Kan spare staten for hundrevis av milliarder.

2020-08-28, www.tu.no

2021-03-23, SWIPA kick-off seminar

Webpage estabilished, www.swipa.no

2021-08-21, www.klassekampen.no

2021-08-21, www.e24.no

PERSONNEL
INVOLVED IN THE CENTRE IN 2021

Centre

Harald Linga	SINTEF	Centre Director
Marte O. Rosvoldaunet	SINTEF	Centre Coordinator
Eva Kristin Bjørseth	SINTEF	Adm. support

Key Researchers (name of RD leader in bold)

WP1

Ragnhild Skorpa*	SINTEF	Well barrier materials and integrity
Nils Opedal	SINTEF	Sealing ability of plugging materials
Blandine Feneuil	SINTEF	Verification and sealing ability of annulus barrier materials
Mahmoud Khalifeh	UiS	Zonal isolation in shallow gas zones
Sigbjørn Sangesland	NTNU	Bismuth applications in well completion and P&A
Kamila Gawel	SINTEF	Settled barite as barrier material

WP2

Viktoriya Yarushina	IFE	Barriers for storage and disposal
Reinier van Noort	IFE	Self-healing behaviour of sealing materials by scaling
Jelena Todorovic	SINTEF	Durability of barrier materials in corrosive environments
Viktoriya Yarushina	IFE	Creep properties of shale
Mario Silva	IFE	Tracer flow and interactions with sealing materials
Nicolaine Agofack	SINTEF	Durability of barrier materials in corrosive environments

WP3

Erlend Randeberg	NORCE	Upscaling and testing
Neda Olsen	NORCE	Barrier material handling procedures
Hans Joakim Skadsem	UiS	Barrier material handling procedures

WP4

Anne Rita Bakken	SINTEF	Innovations and technology development
Trine Stene	SINTEF	Review and evaluation of results for industrial implementation
Lone S. Ramstad	SINTEF	Collaboration with national authorities
Gunnar Lamvik	SINTEF	Collaboration with national authorities

*Position held by Torbjørn Vrålstad until August 31, 2021

Postdoctoral Researcher with financial support from the centre budget

Paulo Moreira	(2021-2023)	Sealing ability of plugging materials

PhD students with financial support from the centre budget

Madhan Nur Agista	(2021-2024)	Materials for Shallow Gas
Lewaa Hmadeh	(2021-2024)	Applications of Bismuth alloys for well integrity
Andriani Manataki	(2021-2024)	Properties of Bismuth alloys as barrier materials

Harald Linga
SINTEF

Marte O. Rosvoldaunet
SINTEF

Eva Kristin Bjørseth
SINTEF

Ragnhild Skorpa
SINTEF

Nils Opedal
SINTEF

Blandine Feneuil
SINTEF

Mahmoud Khalifeh
UiS

Sigbjørn Sangesland
NTNU

Kamila Gawel
SINTEF

Viktoriya Yarushina
IFE

Reinier van Noort
IFE

Jelena Todorovic
SINTEF

Mario Silva
IFE

Nicolaine Agofack
SINTEF

Erlend Randeberg
NORCE

Neda Olsen
NORCE

Hans Joakim Skadsem
UiS

Anne Rita Bakken
SINTEF

Trine Stene
SINTEF

Lone S. Ramstad
SINTEF

Gunnar Lamvik
SINTEF

Madhan Nur Agista
UiS

Lewaa Hmadeh
NTNU

Andriani Manataki
NTNU

Paulo Moreira
UiS

ANNUAL ACCOUNTS FOR 2021

Funding (1000 NOK)	Amount
Research Council	3 691
Host institution (SINTEF)	0
R&D Partners	475
Industry Partners	7 355
Total	11 521

Costs (1000 NOK)	Amount
Host institution (SINTEF)	4 208
R&D Partners	5 958
Industry Partners	1 355
Equipment	0
Total	11 521

PUBLICATIONS 2020 - 2021

Bakker, Steffen J.; Linga, Harald; Alvheim, Frode; Gullestad, Frida. Roper ut om rådyr ryddesjau. *Klassekampen [Avis]* 2021-08-21

Linga, Harald. Sintef-forsker: Ryddejobben etter oljealderen blir dyr. *E24 [Internett]* 2021-08-21

Yarushina, Viktoriya M.; Makhnenko, Roman Y.; Podladchikov, Yuri Y.; Wang, L. Hongliang; Räss, Ludovic. Viscous behavior of clay-rich rocks and its role in focused fluid flow. *Geochemistry Geophysics Geosystems 2021*; Volume 22 (10)

Kennedy, Charles; Linga, Harald. Researchers Look For Ways To Cut Norway's Gargantuan $100 Billion Decommissionin. *Oilprice.com [Internett]* 2020-07-08 SINTEF

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SFI **SWIPA 2021**

SFI SWIPA (Centre for Subsurface Well Integrity, Plugging and Abandonment) is a centre for research-based innovation (SFI) appointed by The Research Council of Norway for 2020-2028. A centre for research-based innovation is a dedicated, long-term initiative designed to strengthen and further develop elite, creative research and innovation groups or to build research groups in strategically important areas.

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