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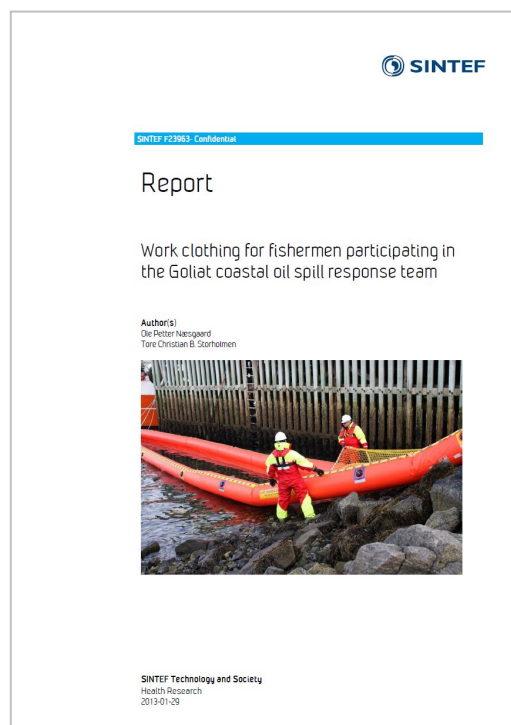
Report

Work clothing for fishermen participating in the Goliat coastal oil spill response team

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Original report and amendments are attached.

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- Original report F23963 dated 2013-01-29
 - 1st amendment dated 2013-12-20
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ABSTRACT

Eni Norge AS have requested an evaluation of the work clothing for the regional fishermen participating in the coastal oil spill response team in the Goliat contingency organization, and recommendations regarding the most suitable work clothing for these fishermen. Eni Norge AS have also requested recommendations regarding the most suitable work clothing for the personnel participating in the immediate shoreline task force (IGSA).

The objectives of the project have been to:

1. Establish a specification of requirements for the functionalities and demands of the work clothing for the regional fishermen in the oil spill response team.
2. Compare their existing work clothing used during oil spill preparedness operations with the specification of requirements, and identify any gaps.
3. Provide recommendations regarding suitable work clothing to be used during both oil spill preparedness operations and during regular work of fishing.
4. Provide recommendations regarding suitable work clothing for the personnel participating in the immediate shoreline task force (IGSA).

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ABSTRACT

Eni Norge AS have requested an evaluation of the work clothing for the regional fishermen participating in the coastal oil spill response team in the Goliat contingency organization, and recommendations regarding the most suitable work clothing for these fishermen. Eni Norge AS have also requested recommendations regarding the most suitable work clothing for the personnel participating in the immediate shoreline task force (IGSA).

The objectives of the project have been to:

1. Establish a specification of requirements for the functionalities and demands of the work clothing for the regional fishermen participating in the coastal oil spill response team (Chapter 5.1).
2. Compare the existing work clothing for use by the fishermen during oil spill preparedness operations with the specification of requirements, and identify any gaps (Chapter 5.2).
3. Provide recommendations regarding suitable work clothing that can be used during both oil spill preparedness operations and during regular work on board the fishing vessel (Chapter 5.4).
4. Provide recommendations regarding suitable work clothing for the personnel participating in the immediate shoreline task force (IGSA) (Chapter 5.5.4).

Fishing vessels will be used in the coastal oil spill preparedness (barrier 3) as part of the Goliat contingency organization. These vessels will form a separate task force and a permanent oil spill preparedness resource called *Innsatsgruppe Kyst*. Also as part of the Goliat oil spill preparedness, a specialized first response task force (IGSA) has been established to perform immediate oil spill response operations in coastal/shoreline areas in the event of an offshore oil spill. The task force will operate in between barrier 3 and 4. The IGSA operate in particularly harsh and challenging coastal/shoreline areas.

The methodologies that have been utilized to reach the recommendations are review of Eni documents, interviews, observations and workshops. The recommendations have been worked out in collaboration with the users, which have been involved by interviews and workshops.

A user requirement specification for the work clothing of the coastal fishermen has been made. The work clothing currently used by the fishermen has been compared to this user requirement specification, and gaps have been identified where requirements are not fulfilled. The identified gaps were primarily related to thermal comfort, ventilation of sweat and level of buoyancy, and to some extent manual performance and head protection compatibility.

The users need practical work clothing that will be suitable for varying climatic conditions and changing activity levels. The constant high level of insulation in the currently used worksuit makes it not suitable for such variations. This results in a limited range of use. Instead of a work clothing system with a constant high level of insulation, a three-layer clothing system (inner, middle and outer layer) is recommended, where each layer serves a specific purpose and the middle/insulation layer is flexible. Compared to the currently used work clothing, the recommended work clothing ensemble is composed to improve thermal comfort and ventilation of sweat, range of use, work efficiency and manual performance. In addition, the recommended work clothing ensemble for the coastal fishermen is composed to provide them with improved safety also during their daily work of fishing (by the integrated buoyancy in the bib)

It is recommended that the users try out the recommended work clothing ensembles during oil spill preparedness training to ensure the suitability and practicality of the work clothing ensemble.

1 BACKGROUND

Eni Norge AS have requested an evaluation of the work clothing for the regional fishermen participating in the coastal oil spill response team in the Goliat contingency organization, in order for SINTEF to provide recommendations regarding the most suitable work clothing for these fishermen. Eni Norge wants to provide the fishermen participating in the Goliat oil spill preparedness organization with the best suitable work clothing for the oil spill preparedness tasks. In addition, it is desirable that that the same work clothing can be suitable and practical for the fishermen during their daily work as well, and contribute to improved safety of the fishermen.

Eni Norge AS also have requested that SINTEF provide recommendations regarding the most suitable work clothing for the personnel participating in the immediate shoreline task force (IGSA). This task was included in the project in October 2012.

The start-up of the project was delayed because it had to await the formation of contracts between NOFO and the fishermen participating in the coastal oil spill response team.

2 OBJECTIVES

The objectives of the project have been to:

1. Establish a specification of requirements for the functionalities and demands of the work clothing for the regional fishermen participating in the coastal oil spill response team (Chapter 5.1).
2. Compare the existing work clothing for use by the fishermen during oil spill preparedness operations with the specification of requirements, and identify any gaps (Chapter 5.2).
3. Provide recommendations regarding suitable work clothing that can be used during both oil spill preparedness operations and during regular work on board the fishing vessel (Chapter 5.4).
4. Provide recommendations regarding suitable work clothing for the personnel participating in the immediate shoreline task force (IGSA) (Chapter 5.5.4).

3 INTRODUCTION

3.1 Fishing vessels in the Goliat contingency organization

Fishing vessels will be used in the coastal oil spill preparedness (barrier 3) as part of the Goliat contingency organization. These vessels will form a separate task force and a permanent oil spill preparedness resource called *Innsatsgruppe Kyst*. A pool of 30 to 40 contracted fishing vessels will be established, and each fishing vessel must be approved according to *Forskrift om bruk av fartøy i oljevern (FOR-2011-02-08-130)*. These fishing vessels will have a length of 32-34 feet.

The task group will be a well-trained and highly skilled preparedness resource, and involved personnel will undergo a systematic oil spill preparedness education and training program. The task force will collect free-floating oil in coastal waters and/or protect prioritized coastal areas from oil spillage. The task force will focus on oil spills that have escaped barrier 1 and 2, and the area of operation will be coastal areas and fjords. The number of personnel per vessel may vary from vessel to vessel, but normally it will be 3 fishermen per fishing vessel.

An oil spill response operation at the Goliat field will evolve over time and the overall scope of the operation will depend on factors such as size and duration of the oil spill, oil type, weather conditions and whether or not the oil drifts towards land.

Phase by phase, the operation for the involved fishing vessels will progress as follows:

- i) *Notification, mobilization and preparation* (notification and attendance at appointed time/position, unloading of cargo and fishing equipment, loading of oil spill preparedness equipment and refueling)
- ii) *Action* (accumulation and combating oil spills in coastal areas)
- iii) *Completion and demobilization* (cleaning, preparation and control)

3.2 The oil spill preparedness work of the fishermen

The task group of fishermen performs activities involving low to moderate intensity work. Typical tasks include:

Rigging of the NOFI Harbour Buster system:

- Unpacking oil booms from container (Figure 1, moderate intensity work)
- Inflating oil booms using air blowers
- Launching the oil boom (Figure 2, moderate intensity work)
- Mounting of paravane boomvane (fine motoric task with bolts and nuts)
- Loading paravane onto vessel
- Launching the paravane
- Maneuvering the oil boom and oil collection system



Figure 1, Unpacking oil booms from container.

Rigging of Markleen skimmer:

- Loading skimmer onto vessel
- Connecting the hydraulics to the generator (fine motoric work)
- Launching the skimmer
- Maneuvering the skimmer unit (fine motoric work)

Rigging of Markleen oil booms:

- Unpacking booms from container (moderate intensity work)
- Joining boom lengths (fine motoric work)
- Launching the booms (moderate intensity work)
- Maneuvering the oil boom

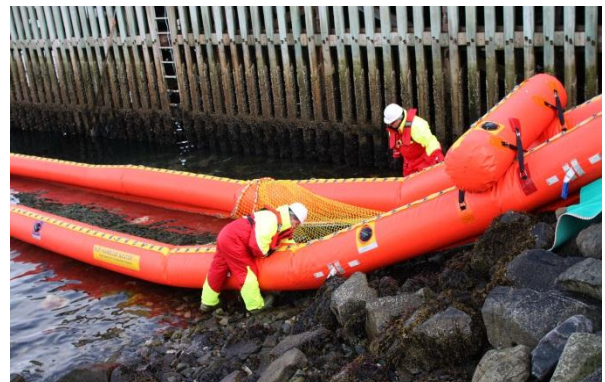


Figure 2, Launching the oil boom.

These tasks were observed at an oil spill preparedness training course in Honningsvåg. According to instructions, oil contaminated equipment should not be brought on board the vessel. Typical risks involved with the oil spill preparedness work of the fishermen include:

- Falling overboard (cold shock response and swimming failure)
- Fracture, fall and pinching injuries
- Cooling and frost bites during work
- Poisoning

3.3 The current work clothing ensemble of the fishermen

The current work clothing and personal protection equipment (PPE) to be used by the fishermen during oil spill preparedness operations includes (Figure 3):

1. Outerwear:

- Regatta Offshore Worksuit 957 (50 N)

2. Lifejacket

- Inflatable Life jacket, Omega (275 N)

3. Footwear:

- Dunlop Purofort thermo boots

4. Gloves:

- Protex gloves, Granberg (winter gloves)
- Rubber work gloves, BW Bulldog (oil resistant)

5. Head protection

- Helmet with integrated protective glasses (MSA)
- Helmet beanie (Bulldog)

6. Other:

- Headlamp (Petzl)
- Separate protective glasses



Figure 3, The current work clothing ensemble of the fishermen.

This equipment is handed out to the fishermen during the oil spill preparedness training course, and is stored onboard the fishing vessel in case of an oil spill preparedness operation.

4 METHODOLOGY

The methodologies that have been utilized in the project to reach recommendations regarding suitable work clothing for the coastal fishermen and for the personnel of IGSA are review of Eni documents, interviews, observations and workshops.

Work clothing for fishermen

Interviews and observations

SINTEF has carried out interviews and observations with different relevant informants in order to obtain insight and understanding into the work situation of the fishermen participating in the Goliat coastal oil spill response team. Experiences of use with the current work clothing have been collected, and user requirements related to the work clothing have been identified in order to establish a specification of requirements. The informants have included:

- Oil spill response advisor at Eni Norge
- Technical advisor at NOFO
- 4 instructors at Nordkapp Maritime Fagskole (training course)
- 18 fishermen registered in the Goliat coastal oil spill response team (training course)
- 3 fishermen registered in the Goliat coastal oil spill response team (workshop)

Two researchers from SINTEF participated at a 3-day oil spill preparedness training course for fishermen registered in the coastal oil spill response team. 18 fishermen attended the course, and semi-structured interviews with both fishermen and course instructors were carried out during the training course. The fishermen were also observed during practical oil spill preparedness training, e.g. when preparing and operating oil spill combating equipment. The informants at Eni Norge and NOFO were interviewed independent of the training course and by phone.

Literature studies

In addition, the following Eni documents have been reviewed in order to identify additional user requirements related to the work clothing of the fishermen (Table 1):

Table 1. Documents that have been studied in order to identify user requirements related to the work clothing of the fishermen participating in the Goliat coastal oil spill response team.

Document	Studied
Operasjonsmanual for fartøy i kystnær oljevernberedskap – Del A1, Innledning	X
Operasjonsmanual for fartøy i kystnær oljevernberedskap – Del A2, Organisasjon, ansvarsforhold, ledelse og samband	X
Operasjonsmanual for fartøy i kystnær oljevernberedskap – Del A3, Krav til fartøy og mannskap	X
Operasjonsmanual for fartøy i kystnær oljevernberedskap – Del A4, HMS	X
Operasjonsmanual for fartøy i kystnær oljevernberedskap – Del B1, Igangsettingsfase	X
Operasjonsmanual for fartøy i kystnær oljevernberedskap – Del B2, Aksjonsfase	X
Operasjonsmanual for fartøy i kystnær oljevernberedskap – Del B3, Avslutningsfase	X
Operasjonelt konsept for bruk av fiskeflåten i kystnær oljevernberedskap for Goliatfeltet	X
Beredskap for Goliatfeltet, Eni Norge AS	X
F000-N-685 Sveise- og limeprosedyre for duk	X
L600-N-680 NOFI buster oljeoppsamlingssystemer rengjøringsveiledning	X
L602-M-660 NOFI Current Buster brukermanual	X
Oljevernberedskapen for Goliat, Eni Norge AS	X
Outdoor operations task analysis	X
Prosjektforslag informasjonsfolder for arbeid i kaldt klima	X
Prosjektforslag retningslinjer for arbeid i kaldt klima	X
Skjema Rapport – uønsket hendelse	X
Sikkerhetsdatablad råolje	X
Skjema Sikker jobbanalyse	X

Workshops

Based on the insights obtained by the interviews and observations, SINTEF developed three suggestions of improved work clothing for the fishermen. These suggestions were presented and discussed with three fishermen participating in the Goliat coastal oil spill response team in a workshop. The workshop was carried out in Hammerfest on November 15th 2012. The workshop had a holistic approach and all parts of an optimal work clothing setup for the fishermen were discussed. A final recommended work clothing ensemble for the fishermen was specified during the workshop in collaboration with the participating fishermen. The recommended work clothing ensemble is presented in chapter 5.4.

Work clothing for IGSA

Interview

SINTEF has also made a recommendation regarding suitable work clothing for personnel participating in IGSA. At first, an interview was carried out with the task group leader to obtain insight into the work

situation of the IGSA personnel. Based on the insights obtained from this interview, SINTEF came up with two suggestions to improved work clothing for IGSA.

Workshop

These suggestions were presented and discussed with four members of IGSA (including the task group leader) in a workshop. The workshop was carried out in Hammerfest on November 16th 2012. The workshop had a holistic approach and all parts of an optimal work clothing setup for IGSA were discussed. A final recommended work clothing ensemble for the personnel of IGSA was specified during the workshop in collaboration with the participating IGSA members. It is presented in chapter 5.5.4.

5 RESULTS

5.1 Specification of user requirements for work clothing of fishermen

The specification of user requirements in Table 2 has been made based on the insights obtained from the literature studies, interviews and observations carried out in the project. The lifejacket has been considered a part of the work clothing ensemble.

The currently used work clothing has been compared to the user requirement specification in order to identify gaps. The gaps represent user requirements that are not fulfilled by the currently used work clothing. The rows in Table 2 that contain user requirements that are not fulfilled by the current work clothing are highlighted in grey. The identified gaps are described in detail in chapter 5.2.

SINTEF has in previous projects established user requirement specifications for the work clothing of Norwegian fishermen operating in both coastal and deep-sea waters in these areas. These user requirement specifications have been examined, and relevant user requirements have been included in the user requirement specification for the work clothing of the fishermen participating in the Goliat coastal oil spill response team.

Table 2. User requirement specification for the work clothing of the fishermen. The rows containing user requirements that are not fulfilled by the current work clothing (GAPS) are highlighted in grey.

Requirement	Fulfilled	Comment	Recommendation
<i>Thermal comfort</i>			
Is suitable for both summer and winter use	No	<i>To ensure all-year usability and performance.</i> The fishermen became sweaty during work at 0 °C. Thus, the thermal worksuit is probably not suitable for summer use.	It is recommended to provide the fishermen with a thinner worksuit with a low level of insulation, and where mid and under layer clothing can be adjusted according to current ambient conditions.
Is suitable for both high and low intensity work	No	<i>To ensure usability and performance during both high and low intensity work.</i> Several of the fishermen became sweat during the low intensity work of preparing the oil spill preparedness equipment. The worksuit works fine for stationary work, but is too hot to work in (the ambient temperature was 0-5°C when this was stated by the fishermen).	It is recommended to provide the fishermen with a thinner worksuit with a low level of insulation and which ventilates sweat and heat, and where mid and under layer clothing can be adjusted according to the current work intensity of the fishermen.
Ventilates sweat and heat	No	<i>To ensure that hot and moist air can be vented out of the clothing.</i> The worksuit has underarm zipper openings for active ventilation. The material of the worksuit is not breathable, and the inherent buoyancy foam provides undesirable insulation and represents a barrier to moisture transport.	It is recommended to provide the fishermen with a worksuit with less insulation and improved ventilation of sweat and heat.

Comfort and fit			
Comes in different sizes to fit all users (including both men and women)	Yes	<p><i>To ensure a good fit independent of body shape and size.</i></p> <p>The worksuit is available in sizes XS-XXL.</p>	Ensure that all sizes are available at the training course so that each of the fishermen can be supplied with a worksuit of the correct size. A good fit is decisive for good work comfort and performance.
Provides good freedom of movement	Yes	<p><i>To ensure good work comfort.</i></p> <p>The fishermen passed no remarks regarding freedom of movement.</p>	No additional recommendation.
Design and functionality			
Is light weight	Yes	<p><i>To ensure work comfort and prevent fatigue.</i></p> <p>The fishermen passed no remarks regarding the weight of the worksuit. The worksuit weighs 1.8 kg, which is slightly lighter than their everyday work clothing.</p>	No additional recommendation.
Is durable	Yes	<p><i>To ensure endurance against the abrasion from work.</i></p> <p>The fishermen passed no remarks regarding durability. The worksuit is exposed to limited wear and tear and over a relatively limited timespan during an oil spill preparedness operation.</p>	No additional recommendation.
Is easy to put on and off	Yes	<p><i>To ensure easy and efficient dressing and undressing in urgent situations e.g. of mobilization/preparation or in the case of sudden contamination of the clothing.</i></p> <p>The fishermen commented that the suit was easy to put on and off. Some preferred a coverall design while others preferred a split design with a separate bib and jacket. During normal work most fishermen wear work clothing with a separate bib and jacket.</p>	No additional recommendation.
Hood is spacious enough to wear head protection underneath	Yes	<p><i>To ensure work comfort and adequate head protection.</i></p> <p>The fishermen passed no remarks regarding the fit and size of the hood related to use of a helmet.</p>	No additional recommendation.

Is highly visible	Yes	<p><i>The lifejacket should include at least 300 cm² retro-reflective material according to ISO 12402-3.</i></p> <p>The provided worksuit includes reflective tape on hood, sleeves and shoulders to provide high visibility in the water. The shoulders have a yellow contrast color.</p>	No additional recommendation.
Has an emergency light	Yes	<p><i>To ensure efficient retrieval in man overboard situations.</i></p> <p>The worksuit includes an emergency light.</p>	No additional recommendation.
Involves low risk of entanglement	Yes	<p><i>To prevent entanglement accidents.</i></p> <p>The worksuit has no outside details that involve a risk of entanglement.</p>	No additional recommendation.
Is compatible with the footwear	Yes	<p><i>To ensure work comfort and adequate foot protection.</i></p> <p>The trouser legs fit outside the top of the boots. The worksuit includes zippers at the trouser legs to make it easy to put the top of the boots inside the trouser legs.</p>	No additional recommendation.
Is compatible with helmet/head protection	No	<p><i>To ensure work comfort and adequate head protection.</i></p> <p>It was observed that the high collar of the worksuit frequently pushed up the helmet in the back during work. This caused the helmet to slide down in front of the eyes of the fishermen during work. This problem was enforced by the lack of a chin strap in the helmet.</p>	It is recommended that the worksuit should have improved compatibility with the helmet. The worksuit should have a lower collar which does not push the helmet out of position during work, and the helmet should include a comfortable chin strap to keep it in place and prevent it from falling off.
Is compatible with eye protection	Yes	<p><i>To ensure work comfort and adequate eye protection.</i></p> <p>The fishermen passed no remarks regarding the compatibility with eye protection, and no issues were observed during practical training.</p>	No additional recommendation.
Is compatible with the gloves	Yes	<p><i>To ensure work comfort and adequate hand and finger protection.</i></p> <p>The cuffs of the gloves fit outside the sleeves of the suit.</p>	No additional recommendation.

Is compatible with the hearing protection	Yes	<p><i>To ensure work comfort and adequate hearing protection.</i></p> <p>The fishermen passed no remarks regarding the compatibility with hearing protection, and no issues were observed during practical training.</p>	No additional recommendation.
Is compatible with breathing protection	Yes	<p><i>To ensure work comfort and adequate breathing protection.</i></p> <p>The fishermen passed no remarks regarding the compatibility with breathing protection, and no issues were observed during practical training.</p>	No additional recommendation.
Protection and safety			
Is oil-resistant	Yes	<p><i>To ensure adequate protection against oil spill</i></p> <p>According to Regatta, the suit is not designed to have especially good oil-resistance, but the worksuit have acceptable oil-resistance properties.</p>	Adequate oil-resistance is ensured by the use of the protective chemical suit.
Is waterproof	Yes	<p><i>To ensure adequate water protection.</i></p> <p>The worksuit is waterproof. Regatta recommends re-impregnation after washing of the worksuit.</p>	No additional recommendation.
Is windproof	Yes	<p><i>To ensure adequate wind protection.</i></p> <p>The worksuit is windproof</p>	No additional recommendation.
Is oil and dirt repellent	Yes	<p><i>To prevent rapid smudging of oil and dirt.</i></p> <p>The oil repellency is ensured by the use of either oilskins or chemical protective suit.</p>	No additional recommendation.
Keeps you floating in water	Yes	<p><i>To keep you floating in case of an immediate man-overboard situation</i></p> <p>The worksuit has 50N of inherent buoyancy, and is supplemented with a 275N lifejacket.</p>	To improve the thermal properties of the work clothing ensemble (see <i>suitable for both summer and winter use and suitable for both high and low intensity work</i>), it is recommended to provide the fishermen with a multi-layered clothing system including an uninsulated outer layer and a flexible

			<p>middle/insulation layer.</p> <p>Based on the fishermen's tasks and areas of operation, it is recommended to provide the fishermen with 150N lifejackets rather than 275N lifejackets. A buoyancy level of 150N should be adequate and most suitable for these fishermen.</p>
Maintenance			
Is machine wash friendly	Yes	<p><i>To ensure easy washing of the garments and preservation of the properties of the worksuit even after washing.</i></p> <p>The worksuit can be washed at max 40 °C, but should not be centrifuged heavily nor dried in a tumble drier.</p>	<p>Wash at max 40 °C. Do not centrifuge heavily nor dry in a tumble drier.</p>
Remains oil and dirt repellent, even after several washings	Unknown	<p><i>To ensure adequate oil-resistance also after washing.</i></p> <p>To preserve the properties of the fabric, Regatta recommends to wash the worksuit at max 40 °C.</p>	No additional recommendation.
Remains waterproof, even after several washings	Yes	<p><i>To ensure adequate oil-resistance also after washing.</i></p> <p>Regatta recommends re-impregnation after washing of the worksuit to uphold the waterproofness.</p>	Re-impregnate the worksuit after each washing.

5.2 Gap analysis regarding currently used work clothing

The currently used work clothing has been compared to the user requirement specification developed in the project in order to identify gaps. The gaps represent user requirements that are not fulfilled by the currently used work clothing. The following gaps have been identified:

5.2.1 Work clothing

Thermal properties

The currently used worksuit has inherent buoyancy foam distributed into most parts of the suit. The high level of insulation makes it *not suitable for both summer and winter use* and *not suitable for both high and low intensity work*. During the training course, most fishermen became sweaty during the moderate intensity work of preparing the oil spill preparedness equipment (ambient temperature of 0 °C). Thus the worksuit will not be suitable for higher work intensities or higher ambient temperatures. The fishermen stated that the worksuit works fine for stationary work, but quickly becomes too hot for performing moderate to high intensity work. A high level of insulation will represent a challenge in work situations involving alternating high and low activity levels (like the fishermen experience during oil spill preparedness operations). When the fishermen get sweaty in the moderate activity period of preparation, this build-up of moisture inside the clothing will represent a challenge to both safety and comfort in following periods of low activity work on board the fishing vessel. The moisture inside the clothing will accelerate the cooling of the body when working in the cold. The inherent buoyancy foam also represents an undesirable barrier to moisture transport.

Level of buoyancy

The worksuit has 50N of inherent buoyancy, and is supplemented with a 275N lifejacket. The level of 275N is intended primarily for offshore use under extreme conditions. It is also of value to those who are wearing clothing which traps air and which may adversely affect the self-righting capacity of the lifejacket. The 50N of inherent buoyancy in the worksuit is neither necessary nor beneficial to the fishermen in their work situation.

Considering the fishermen's tasks and areas of operation, a buoyancy level of 150N (approved according to ISO 12402-3) is considered to be adequate and most suitable. This level is intended for general application or for use with foul weather clothing. It will turn an unconscious person into a safe position and requires no subsequent action by the user to maintain this position.

The lifejacket worn outside the work suit has no crotch strap, and because of this the users might slip out of the lifejacket during inflation in the water.

5.2.2 Gloves

Fishermen that had practical experience with the rubber work gloves from oil spill combating work commented that these become slippery when oil is spilled on them. This makes it difficult to grab/hold/handle tools and equipment. The fishermen commented that these were not as good as the gloves they use during their daily work, and wanted gloves with a more textured grip.

5.2.3 Head protection

An issue was observed related to the compatibility between the currently used worksuit and the helmet of the fishermen. It was observed that the high collar of the worksuit frequently pushed the helmet up in the back during work (Figure 4). This caused the helmet to either fall off or slide down in front of the eyes of the

fishermen and hamper them during work. This problem was enforced by the lack of a chin strap in the helmets.

Figure 4. Compatibility issue between the collar of the worksuit and the helmet.



5.2.4 Other equipment

- Use of the generator for running the skimmer exposes the fishermen to high noise levels.
- When inflating the lenses, the fishermen are exposed to high noise levels. The NOFI harbor buster containers have signs indicating that the use of hearing protection is mandatory, but hearing protection is not available in the containers.
- In case of an oil spill prevention operation, the fishermen should in principle not be exposed directly oil and chemicals. However, the fishermen commented that in a real oil spill preparedness operation it will be difficult to prevent oil spills on board and some direct exposure to oil.

Based on these identified gaps, the currently used Regatta worksuit in combination with a 275N lifejacket is not a recommended work clothing to be used by the fishermen during oil spill preparedness operations. Recommendations regarding the work clothing ensemble for the fishermen are presented in chapter 5.4.

5.3 Considerations

This chapter presents the considerations that form the basis for the recommendations that have been composed regarding suitable work clothing for the coastal fishermen and for the personnel of IGSA. The final recommendations for the fishermen are presented in chapter 5.4 and for the personnel of IGSA in chapter 5.5.4.

5.3.1 General considerations

Eni Norge wants to provide the fishermen participating in the Goliat oil spill preparedness organization with the best suitable work clothing for the oil spill preparedness tasks. In addition, it is desirable that the same work clothing can be suitable and practical for the fishermen during their daily work as well, and contribute to improved safety for the fishermen.

In preparations for the workshop with fishermen participating in the Goliat oil spill preparedness organization, three suggestions for work clothing ensembles for the fishermen were developed (Table 3). These were developed based on considerations regarding:

- the characteristics and work intensities related to the two relevant work situations (oil spill preparedness and regular fishing)
- the ambient conditions in the areas of operation
- the developed user requirement specification
- the identified gaps related to the current work clothing
- suitable work clothing available on the market
- the possibilities of altering the work clothing during an oil spill preparedness operation
- necessary routines/logistics to ensure the functionality of the work clothing

Multi-layered work clothing

The gap-analysis showed that the constant high level of insulation in the currently used worksuit is not suitable for the work situation of the fishermen involving alternating levels of high and low work intensity and work in both warm and cold ambient conditions. The fishermen need practical work clothing that will be suitable for varying climatic conditions and changing activity levels¹. A multi-layered clothing system is suitable for these work situations, where each layer serve a specific purpose. A three-layer clothing system is recommended where the layers have the following main functions:

- i) inner layer (underwear) – Moisture absorption and moisture transport
- ii) middle layer (insulation layer) – insulation and moisture transport
- iii) outer layer – protection against external environment

It will be important to change the solution of insulation. Instead of a work clothing system with a constant high level of insulation, it is recommended to introduce a flexible middle/insulation layer. In low-activity and rest periods the middle layer clothing should be worn by the fishermen to reduce heat loss. In high-activity periods and when working in warm ambient temperatures, the middle layer clothing can be removed to minimize heat load and sweat production.

Oilskins

The three initial suggestions, presented in Table 3, involves the use of oilskins outer layer clothing combined with i) a 150N lifejacket and ii) inner layer and middle layer clothing. These three suggestions were presented and discussed with fishermen participating in the Goliat oil spill preparedness in a workshop in Hammerfest, in order to identify the best suitable and practical work clothing ensemble for the fishermen.

¹ Health aspects of work in extreme climates. A guide for oil and gas industry managers and supervisors. OGP Report nr. 398.

The properties of oilskins outer layer rain gear make them suitable for use during oil spill preparedness operations. From previous studies we know that fishermen especially appreciate work clothing that is durable, provide work comfort and freedom of movement, protects against water, wind and dirt, is light weight, withstands tear and cut, do not represent entanglement hazards etc^{2,3}. During their regular work on board coastal fishing vessels, most fishermen today wear regular oilskins. Thus the fishermen are familiar with these garments and know how to use them and exploit their properties.

Oilskins are suitable for oil spill preparedness work in the respect that they are durable and have good oil resistance, provide good protection against the external environment and are easy to clean. Some oilskins are flame retardant as well. The oilskins are suitable for work in both summer and winter months, because the fishermen can regulate the insulation level of the total clothing system by adjusting their inner and middle layer clothing (in comparison to a constantly insulated work suit). The oilskins represent a barrier to hot air and moisture transport, but has a fit that utilize the chimney-effect which draws cool air into the clothing from the waist hem and displaces warm, light air that exits primarily out of the neck hem. The oilskins are relatively comfortable to work in, even though some are quite heavy.

Oilskins are offered in a bib/jacket solution. This is usually preferred by the fishermen in their regular work, because they frequently like to work without the jacket (when the ambient conditions allow it) and it is more practical for moving between the wheelhouse and fishing deck of the vessels. A bib/jacket solution is likely to be most appreciated by the fishermen also during oil spill preparedness operations.

Buoyancy

During their daily work, the fishermen face a significant risk of falling overboard⁴, and this is a relevant risk also during an oil spill preparedness operations. Despite of this risk, most coastal fishermen rarely wear personal flotation devices (PFDs) while working on deck. The reason for this is that wearing a PFD on top of the bib/jacket work clothing is considered to reduce the work comfort and freedom of movement, feels bulky and obstructs their work, and involves an entanglement hazard³. Wearing a PFD greatly increases the probability of survival in case of a fall overboard, because it promotes survival despite of cold shock and swimming failure³. However, there is a trend towards increased use of PFDs during work, and studies have indicated that the fishermen themselves desire work clothing with integrated PFD as long as it does not reduce work comfort and obstruct their work¹. This trend is supported by the development of snugger and more comfortable lifejackets, and increased focus on safety among the fishermen.

5.3.2 Preliminary work clothing suggestions

In order for Eni Norge to contribute to improved safety for the fishermen also during their regular fishing activities, it might be necessary to provide them with work clothing with integrated buoyancy. In case the fishermen choose not to wear the lifejacket during their regular work of fishing, they will still have the integrated buoyancy to increase the probability of survival in case of a fall overboard. Thus, suggestion 2 and 3 includes integrated buoyancy to ensure the fishermen are provided with buoyancy also during their regular work of fishing.

² Storholmen TCB et al. *Design for end-user acceptance: requirements for work clothing for fishermen in the Mediterranean and northern fishing grounds*. International Maritime Health 62, 4 (2011) 32-39.

³ Holmen Geving I et al. *Safer work clothing for fishermen*. International Maritime Health (2006) 1-4.

⁴ Lucas D et al. *Worker satisfaction with personal flotation devices (PFDs) in the fishing industry: Evaluations in actual use*. Applied Ergonomics 43 (2012) 747-752.

The three suggestions, presented in Table 3, involves the use of oilskins outer layer clothing combined with i) a 150N lifejacket and ii) inner layer and middle layer clothing.

Table 3, Suggestions for work clothing ensembles for fishermen.

Work clothing ensemble	Oil spill preparedness operations	Regular fishing (without lifejacket)
Suggestion 1 (oilskins)	Regular oilskins + 150N inflatable lifejacket	Regular oilskins (no buoyancy)
Suggestion 2 (oilskins)	Regatta Fisherman (50N inherent) + 150N inflatable lifejacket	Regatta Fisherman (50N inherent)
Suggestion 3 (SOTA)	HH Safe@Sea (80N inflatable) + 150N inflatable lifejacket	HH Safe@Sea (80N inflatable)

Suggestion 1 – Regular oilskins in combination with 150N inflatable lifejacket

As described, the properties of oilskins outer layer rain gear make them suitable for use during oil spill preparedness operations. Thus, an option is to provide the fishermen with regular oilskins in combination with a 150N lifejacket and inner layer and middle layer clothing. During their regular work on board coastal fishing vessels most fishermen wear regular oilskins, and they are familiar with the optimal use of these garments. There are several oilskins to choose from, and oilskins from providers like Aalesund Oljeklede, Helly Hansen and Guy Cotton are the most widely used products. The fishermen that participated in the workshop suggested that oilskins from Helly Hansen ([Stavanger](#) or [Nusfjord](#)) or Guy Cotten (Isopro or [X-trapper](#)) would be the best suitable for their application. This work clothing ensemble will not provide buoyancy to the fishermen if they choose not to wear the lifejacket during their regular work of fishing.

Suggestion 2 – Regatta Fisherman in combination with 150N inflatable lifejacket

The [Regatta Fisherman](#) is an available oilskin with integrated buoyancy that report acceptable user satisfaction among the fishermen. It received good PFD satisfaction scores especially among gillnetters (typically coastal fishermen) in the study by Lucas et al⁵. The Regatta Fisherman was launched in 2007 and is appreciated and used by an increasing number of fishermen because of the integrated PFD properties. It has 50N of inherent buoyancy and is approved according to EN ISO 12402-5. The inherent buoyancy foam is fully integrated in the front top of the bib. This involves some added volume and weight compared to regular oilskins, and the inherent buoyancy foam provides some additional insulation. The 50N level of buoyancy is "intended for use by those who are competent swimmers and who are near to bank or shore, or who have help and a means of rescue close at hand. These garments have minimal bulk, but they are of limited use in disturbed water, and cannot be expected to keep the user safe for a long period of time. They do not have sufficient buoyancy to protect people who are unable to help themselves. They require active participation by the user"⁶. Considering the area of operation of the fishermen during Goliat oil spill preparedness operations, the work clothing ensemble should include a 150N lifejacket to ensure adequate safety of the fishermen. If the fishermen choose not to wear the lifejacket during their regular work of fishing, they will still have 50N of integrated buoyancy to increases the probability of survival in case of a fall overboard when fishing. No regular maintenance is required in order for the buoyancy to function properly.

⁵ Lucas D et al. *Worker satisfaction with personal flotation devices (PFDs) in the fishing industry: Evaluations in actual use*. Applied Ergonomics 43 (2012) 747-752.

⁶ ISO 12402-5: 2006 Personal flotation devices – Part 5: Buoyancy aids (level 50).

Suggestion 3 – HellyHansen Safe@Sea in combination with 150N inflatable lifejacket

The Helly Hansen Safe@Sea work clothing represents state-of-the-art within fishermen's work clothing, and is expected on the market during Autumn 2013. It is the result of a R&D project financed by the European Commission which ended in September 2012. The project has focused on improving the safety of the fishermen without reducing work comfort. It includes a new PU fabric which is lighter and more durable compared to traditional PVC oilskins, while providing similar performance regarding external environment protection (wind, water), washability and oil resistance. The Helly Hansen Safe@Sea includes an inflatable lung that provides 80N of buoyancy, which is integrated in the top front of the bib. Compared to the Regatta Fisherman, it has an additional 30N of buoyancy and self-righting properties. The HH Safe@Sea jacket includes an integrated emergency light, and the bib might also include an integrated man-overboard. To ensure adequate safety of the fishermen during oil spill preparedness operations, the work clothing ensemble should include the use of a standard 150N lifejacket on top. To ensure compatibility with a lifejacket on top, the oral tube of the integrated inflatable PFD is fitted with an overpressure valve, but compatibility testing must be performed in order to ensure this. If the fishermen choose not to wear the lifejacket during their regular work of fishing, they will still have 80N of integrated buoyancy and an emergency light (and possibly a MOB alarm) to increase the probability of survival in case of a fall overboard when fishing. The Safe@Sea garment will require yearly service of the inflator mechanism to ensure the functionality of the inflatable PFD (and possibly the integrated MOB alarm).

5.3.3 Preferred work clothing ensemble

These three suggestions were presented to three fishermen participating in the Goliat coastal oil spill response team in a workshop that was carried out in Hammerfest on November 15th 2012. The workshop had a holistic approach and all parts of an optimal work clothing setup for the fishermen were discussed. The three suggestions were considered and discussed based on the work situation of the fishermen and the challenges they face related to the work clothing ensemble. A final recommended work clothing ensemble for the fishermen was specified during the workshop in collaboration with the participating fishermen. *Suggestion 3*, the Safe@Sea garment from Helly Hansen, was considered to be preferable by the fishermen primarily because of the light weight, improved work comfort and durability and the integrated inflatable buoyancy.

The second priority of the fishermen was *suggestion 1* (regular oilskins in combination with a 150N lifejacket).

5.4 Recommendations

Based on the results of the gap-analysis and the workshop with fishermen, it is recommended to provide the fishermen with the work clothing ensemble described in Table 5 below.

Table 4 shows the user requirement fulfilment of the recommended work clothing ensemble compared to the currently used work clothing. The recommended work clothing gives an improved degree of user requirement fulfilment. Compared to what the fishermen use today, the recommended work clothing ensemble is composed to improve:

- Thermal comfort and ventilation of sweat
- Range of use – suitable for alternating levels of high and low work intensity and work in both warm and cold ambient conditions
- Work efficiency and freedom of movement
- Manual performance
- Improved safety for the fishermen during their daily work of fishing (integrated buoyancy)

Table 4. The user requirement fulfilment of the recommended work clothing ensemble compared to the currently used work clothing.

Requirements	Requirement fulfilment	
	Currently used work clothing	Recommended work clothing
<i>Thermal comfort</i>		
Is suitable for both summer and winter use	No	Yes
Is suitable for both high and low intensity work	No	Yes
Ventilates sweat and heat	No	Yes
<i>Comfort and fit</i>		
Comes in different sizes to fit all users (including both men and women)	Yes	Yes
Provides good freedom of movement	Yes	Yes
<i>Design and functionality</i>		
Is light weight	Yes	Yes
Is durable	Yes	Yes
Is easy to put on and off	Yes	Yes
Hood is spacious enough to wear head protection underneath	Yes	Yes
Is highly visible	Yes	Yes
Has an emergency light	Yes	Yes
Involves low risk of entanglement	Yes	Yes
Is compatible with the footwear	Yes	Yes
Is compatible with helmet/head protection	No	Yes
Is compatible with eye protection	Yes	Yes

Is compatible with the gloves	Yes	Yes
Is compatible with the hearing protection	Yes	Yes
Is compatible with breathing protection	Yes	Yes
Protection and safety		
Is oilproof/oil-resistant	Yes	Yes
Is waterproof	Yes	Yes
Is windproof	Yes	Yes
Is oil and dirt repellent	Yes	Yes
Keeps you floating in water	Yes	Yes
Maintenance		
Is machine wash friendly	Yes	Yes
Remains oil and dirt repellent, even after several washings	Unknown	Unknown
Remains waterproof, even after several washings	Yes	Yes

Table 5. Recommended work clothing ensemble for the coastal fishermen.

Component	Comment	Recommendation
Inner layer	The inner layer is important for the direct cooling of the skin and for absorbing sweat. It must be effective in transporting moisture away from the body's surface to the middle layer for subsequent evaporation. Wool is preferred due to its efficient absorption of moisture. Modern woollen underwear, with a knit construction that facilitates moisture transport, should be used for cold work.	<i>Underwear clothing (wool)</i> – underpants and sweater (crew neck, with long trunk/dropped hem that covers well over the back/thighs). Example: JanusPro and Devold Spirit
Middle layer	The middle layer should serve as an insulator and provide protection against heat loss. It should be flexible, and it is recommended that the fishermen alter their work clothing by wearing the middle layer clothing during low-activity and rest periods (to reduce heat loss) or by removing the middle layer clothing during high-activity periods (to minimize heat load and sweat production). The middle layer clothing should also have good sweat transport abilities to transport the sweat as far out in the clothing system as possible.	- <i>Fleece/ullfrotte jacket</i> (with long trunk/dropped hem to avoid exposure of the small of the back when bending forward). Example: Helly Hansen Langley fleece and Univern Midlayer fleece - <i>Fleece/ullfrotte pants</i>

Outer layer	<p>This layer should protect against the external environment, and must therefore be waterproof, windproof and durable. When exposed to heavy rain the fishermen can put on the "oilskins" outside the work coverall. If exposed to oil spill, they can also put on the "oilskins" or the disposable chemical protective suit outside the work coverall to ensure adequate oil-resistance. The oilskins represent a barrier to moisture transport, but have a design that facilitates microclimate ventilation with movements and includes openings for active ventilation.</p> <p>The Helly Hansen Safe@Sea work clothing is expected to be available in the market during Summer 2013. It is suggested to test the suitability of this work clothing during realistic oil spill preparedness exercises, to ensure the suitability for the fishermen. To ensure compatibility with a lifejacket on top, the oral tube of the integrated inflatable PFD is fitted with an overpressure valve, but compatibility testing must be performed in order to ensure this. Because of the inflatable PFD, the Safe@Sea garment will require yearly service of the inflator mechanism to ensure its functionality. The fishermen are reluctant to wear a lifejacket during their regular work of fishing. The Helly Hansen Safe@Sea work clothing will still provide them with 80N of inflatable buoyancy. Hence, Eni Norge will contribute to enhanced safety of the fishermen also during their regular work of fishing.</p> <p>Alternatively, the second priority of the fishermen was <i>suggestion 1</i> (regular oilskins in combination with a 150N lifejacket) instead of the Helly Hansen Safe@Sea work clothing. Examples of good regular oilskins are Stavanger or Nusfjord from Helly Hansen.</p>	<ul style="list-style-type: none"> - Univern Seaman Protec work coverall (uninsulated, wind/water resistant, underarm zippers, compatible with 150N lifejacket) - Helly Hansen Safe@Sea, bib and jacket (80N integrated inflatable buoyancy, emergency light, uninsulated, wind/water resistant, underarm zippers, compatible with 150N lifejacket, to be used in heavy rain and when exposed to oil)
Chemical protection	<p>Because of the risk of exposure to oil spills, disposable chemical protective suits should be easily available to the fishermen⁷. It is recommended to provide the fishermen with two protective suits to ensure they have a backup.</p>	<p>Continue to provide at least two <i>disposable chemical suits (white)</i> like included in the existing work clothing ensemble.</p>

⁷ HSE handbook for oil spill preparedness.

Lifejacket	The fishermen should wear a lifejacket during oil spill preparedness operations ⁷ . To prevent the lifejacket from slipping over the heads of the fishermen during inflation in water, it is recommended to supply the fishermen with a lifejacket with a crotch strap.	<i>150 N work lifejacket</i> - with good work comfort, oil resistance and emergency light. Example: Regatta Challenger Offshore and Hansen Protection Sea Lion
Gloves	The fishermen perform tasks that require both fine and gross manual dexterity. To ensure good manual performance while wearing gloves, it is important to provide gloves in the appropriate size for each of the fishermen and ensure a proper fit. The fishermen prefer a selection of gloves, and the ability to select the ones most practical for efficient task completion and thermal comfort. It is recommended to supply the fishermen with rubber gloves with a more textured grip and improved friction in the palm, even if oil is spilled on them. It is recommended to supply the fishermen with inner gloves (compatible with the rubber gloves) as an option for increased insulation in cold weather operations.	<ul style="list-style-type: none"> - Continue to provide the <i>black Granberg Protex</i> gloves included in the existing work clothing ensemble. - One pair of <i>15L Center gloves with long cuffs</i> (without lining) - One pair of <i>15T Center gloves with long cuffs</i> (with lining) - One pair of <i>inner gloves</i>. Example: http://www.aeo.no/node/396195
Head protection	The fishermen should wear head protection during the oil spill preparedness operations ⁸ . It is recommended to supply the fishermen with helmets with with i) headband with adjustment wheel (to ensure tight fit and easy adjustment of the fit), ii) integrated protective glasses/visor (to make sure eye protection is always accessible) and iii) chin strap (to prevent the helmets from falling off during work).	<ul style="list-style-type: none"> - <i>Buff</i> (wool) - <i>Helmet</i>, with i) headband with adjustment wheel, ii) integrated protective visor and iii) chin strap. Example: 3M Peltor G3000 Uvicator and MSA V-Gard 500
Footwear	The fishermen should wear protective boots during the oil spill preparedness operations ⁸ . Antiskid and oil resistance are important properties related to the footwear. The distributed boots to be used during oil spill preparedness operations are commonly used by the fishermen during their daily work, and the fishermen consider these boots to be very good regarding both comfort and thermal properties.	Continue to provide the <i>Dunlop Purofort boots</i> included in the existing work clothing ensemble.
Other equipment	The oil spill preparedness operations will take place in areas with cold and harsh climatic conditions. A man-over-board accident will be dramatic because of the cold water and air temperatures in the areas of operation.	Hence, it is recommended to have <i>equipment to prevent heat loss and hypothermia</i> on board the fishing/support vessels in case of MOB situations. E.g. product from Less .

⁸ HSE handbook for oil spill preparedness.

Other equipment		It is recommended to supply the fishermen with <i>hearing protection</i> (ear plugs or banded ear plugs), which can be used when running the generator.
Other equipment		It is recommended to supply the NOFI harbour buster containers with <i>hearing protection</i> for the fishermen inflating the lenses. The containers can be supplied with sufficient number of helmets with ear muffs for the fishermen that will perform this task.
Other equipment		In case of unexpected oil spills on board the fishing vessels or direct exposure to oil, it is recommended to make sure that <i>disposable chemical protective suits</i> are easily available to the fishermen on board the fishing vessels.

5.5 IGSA – immediate shoreline task force

As part of the Goliat oil spill preparedness, the Norwegian Clean Seas Association for Operating Companies (NOFO) and Arctic Protection AS has established a specialized first response task force (IGSA) to perform immediate oil spill response operations in coastal/shoreline areas in the event of an offshore oil spill. The task force includes 40 persons, and will operate in between barrier 3 and 4. The task force concept has been developed by Eni Norge, Statoil and NOFO. In immediate situations, the task force personnel will be set into action operating high-speed boats (20 foot open aluminum boats at >40 knots speed) and other suitable equipment for efficient collection and clean-up of free-flowing oil spills in the shoreline areas. The task force will be in operative oil spill preparedness from late summer 2012.

5.5.1 Work situation

The IGSA operate in particularly harsh and challenging coastal/shoreline areas. During the oil spill response operations, the personnel of IGSA will be continually exposed to sea spray and wind over longer periods of time. They must operate in confined spaces (in boats and work platforms) and move between work in the boats and on shore/shoreline. The group should be self-sufficient for 48 hours. A typical oil spill response operation includes the phases of *mobilization, transportation, establishment, oil spill clean-up and completion*. The IGSA personnel experience strong variations in work intensity between these phases (from stationary work including exposure to heavy wind and sea spray during the transport phase, to high intensity work in the clean-up phase), but have limited space or facilities to alter their work clothing ensemble during work. There is a significant risk of both falling overboard and exposure to oil spills during the work.

This puts challenging demands on the work clothing in all phases of an immediate oil spill response operation regarding especially durability, resistance to water, wind and oil spills, ventilation and comfort. The work situation of the IGSA personnel is different from the work situation of the fishermen participating in the oil spill preparedness, thus they need a different work clothing ensemble.

5.5.2 Current work clothing ensemble

Currently, the IGSA personnel are provided with the similar equipment as the fishermen participating in the coastal oil spill preparedness. The IGSA personnel are provided with a separate summer and winter work clothing ensemble. The work clothing ensemble for the summer months include:

- Underwear
- Cotton work coverall
- Oilskins

The work clothing ensemble for the winter months include:

- Underwear (wool)
- Cotton work coverall
- Regatta Offshore Worksuit 957 (50 N inherent buoyancy)

In addition, the personnel of IGSA wear a 275 N lifejacket, boots, gloves and a helmet during work in both the summer and winter months.

5.5.3 Workshop and mapping of user requirements

A workshop was carried out in Hammerfest 16th November including the task leader of IGSA and three IGSA personnel in order to collect use experiences with the current work clothing and to obtain insight into the needs and preferences of IGSA regarding the work clothing.

During oil spill response operations, the major challenges related to the work clothing are related to staying dry and warm (adequate water resistance, adapted level of insulation and ventilation of sweat and heat), man-over-board situations and altering the work clothing during work.

The IGSA personnel seem content with the summer work clothing ensemble, but the water resistance and thermal comfort is poor when using the offshore worksuit in the winter months. The oilskins used during summer months provide adequate water resistance, but the IGSA personnel quickly become wet during work in the offshore worksuit. The IGSA personnel need a worksuit with improved water resistance.

Similar to the situation of the fishermen, the constant high level of insulation in the currently used worksuit is not suitable for the work situation of IGSA involving alternating levels of high and low work intensity and work in both warm and cold ambient conditions. IGSA need practical work clothing that will be suitable for varying climatic conditions and changing activity levels⁹. A multi-layered clothing system is suitable for these work situations, thus a three-layer clothing system is recommended for IGSA as well. Instead of a work clothing system with a constant high level of insulation, it is recommended to introduce a flexible middle/insulation layer. In low-activity and rest periods the middle layer clothing should be worn to reduce heat loss. In high-activity periods and when working in warm ambient temperatures, the middle layer clothing can be removed to minimize heat load and sweat production.

5.5.4 Recommended work clothing ensemble for IGSA

Based on the conclusions from the workshop with IGSA personnel, it is recommended to provide IGSA with the work clothing ensemble described below. Compared to what is used by IGSA today, this work clothing ensemble is composed to provide improved:

- Thermal comfort and ventilation of sweat
- Range of use – suitable for alternating levels of high and low work intensity and work in both warm and cold ambient conditions
- Work efficiency and freedom of movement
- Resistance to water penetration

Table 6. Recommended work clothing ensemble for the IGSA personnel.

Component	Comment	Recommendation
Inner layer	The inner layer is important for the direct cooling of the skin and for absorbing sweat. It must be effective in transporting moisture away from the body's surface to the middle layer for subsequent evaporation. Wool is preferred due to its efficient absorption of moisture.	<ul style="list-style-type: none"> - <i>Underwear briefs/bra (wool)</i> - <i>Underwear clothing (wool)</i> – underpants and sweater (tight-fitting high-neck with zipper for easy venting, with long trunk/dropped hem that covers well over the back/thighs). Example: JanusPro and Devold Spirit

⁹ Health aspects of work in extreme climates. A guide for oil and gas industry managers and supervisors. OGP Report nr. 398.

Middle layer	<p>The middle layer should serve as an insulator and provide protection against heat loss. It should be flexible, and it is recommended that the IGSA personnel alter their work clothing by wearing the middle layer clothing during low-activity periods (e.g. boat transport) to reduce heat loss, or by removing the middle layer clothing during high-activity periods (e.g. oil spill combating) to minimize heat load and sweat production. The middle layer clothing should also have good sweat transport abilities to transport the sweat as far out in the clothing system as possible. It is easier to put on/take of the mid layer jacket during work compared to the pants (with a coverall on top). Fleece pants with all-way zippers on the sides would make it possible to put on/take of the pants while wearing a coverall on top.</p>	<ul style="list-style-type: none"> - <i>Fleece jacket</i> (with long trunk/dropped hem to avoid exposure of the small of the back when bending forward). Example: Helly Hansen Langley fleece and Univern Midlayer fleece - <i>Fleece pants</i>
Outer layer	<p>This layer should protect against the external environment, and must therefore be waterproof, windproof and durable. The following two work suits have been considered to be suitable for the IGSA personnel. It is suggested to test the suitability of these work suits during realistic oil spill preparedness exercises, to identify which of these are the most suitable for the IGSA personnel. In addition it is recommended to continue to provide the IGSA personnel with a rain gear setup (oilskins like included in the existing work clothing ensemble), to be used during work involving heavy water exposure.</p>	<ul style="list-style-type: none"> - <i>Oilskins</i>, bib and jacket. Example: Stavanger or Nusfjord from Helly Hansen - Univern Seaman Protec work coverall (uninsulated, wind/water resistant, underarm zippers, compatible with 150N lifejacket) <p style="text-align: center;">OR</p> <ul style="list-style-type: none"> - Hansen Protection SeaWind work suit (uninsulated, wind/water resistant, underarm zippers, compatible with 150N lifejacket)
Chemical protection	<p>Because of the risk of exposure to oil spills, disposable chemical protective suits should be easily available to the IGSA personnel like today¹⁰.</p>	<p>Continue to provide at least two <i>disposable chemical suits (white)</i> like included in the existing work clothing ensemble.</p>
Lifejacket	<p>The IGSA personnel should wear a lifejacket during oil spill preparedness operations¹⁰. To prevent the lifejacket from slipping over their heads during inflation in water, it is recommended to supply them with a lifejacket with a crotch strap.</p>	<p><i>150 N work lifejacket</i> - with good work comfort, oil resistance and emergency light. Example: Regatta Challenger Offshore and Hansen Protection Sea Lion</p>

¹⁰ HSE handbook for oil spill preparedness.

Gloves	The IGSA personnel perform tasks that require both fine and gross manual dexterity. To ensure good manual performance while wearing gloves, it is important to provide the gloves in the appropriate size for each personnel and ensure a proper fit.	<ul style="list-style-type: none"> - Continue to provide the <i>black Granberg Protex</i> gloves included in the existing work clothing ensemble. - Continue to provide the <i>orange gloves</i> included in the existing work clothing ensemble. - One pair of <i>assembly gloves</i>. Example: Odin Feelflex and Maxiflex Ultimate
Head protection	The IGSA personnel should wear head protection during oil spill preparedness operations ¹⁰ . It is recommended to supply them with helmets with with i) headband with adjustment wheel (to ensure tight fit and easy adjustment of the fit), ii) integrated protective glasses/visor (to make sure eye protection is always accessible) and iii) chin strap (to prevent the helmets from falling off during work).	<ul style="list-style-type: none"> - <i>Buff</i> (wool) - <i>Helmet</i>, with i) headband with adjustment wheel, ii) integrated protective visor and iii) chin strap. Example: 3M Peltor G3000 Uvicator and MSA V-Gard 500
Footwear	Antiskid and oil resistance are important properties related to the footwear.	Continue to provide the <i>Dunlop Purofort boots</i> included in the existing work clothing ensemble.
Other suggestions	In addition to the recommendations presented above, it is suggested to provide the IGSA personnel with the following equipment to ensure optimal task performance.	<ul style="list-style-type: none"> - <i>Leatherman multi-tool</i> with plier/knife - <i>Larger bags for storage</i> of all the equipment (except for the boots) and with compression straps (a similar bag to the NOFO special team would be more suitable). - It is recommended that the suggested work clothing ensemble is supported with facilities on board the operation support vessel, that allow the IGSA personnel to adjust their mid-layer clothing and put on dry clothes during the oil spill response operation. The IGSA personnel have limited possibilities to adjust their clothing in their operation boats. - A <i>vacuum-packing machine</i> can be provided at the depot, in order to obtain waterproof and compressed packing of spare clothing.

6 CONCLUSIONS

Recommendations regarding the most suitable work clothing for respectively the coastal fishermen and the personnel of the immediate shoreline task force (IGSA) have been worked out in the project. The recommendations have been worked out in collaboration with the users, which have been involved by interviews and workshops.

In the project, a user requirement specification for the work clothing of the coastal fishermen has been made. The work clothing currently used by the fishermen has been compared to the user requirement specification, and gaps have been identified. The identified gaps were primarily related to thermal comfort, ventilation of sweat and level of buoyancy, and to some extent manual performance and head protection compatibility.

The users need practical work clothing that will be suitable for varying climatic conditions and changing activity levels. The constant high level of insulation in the currently used worksuit makes it not suitable for such variations. This results in a limited range of use. Instead of a work clothing system with a constant high level of insulation, a three-layer clothing system (inner, middle and outer layer) is recommended, where each layer serves a specific purpose and the middle/insulation layer is flexible.

Compared to the currently used work clothing, the recommended work clothing ensemble is composed to improve thermal comfort and ventilation of sweat, range of use, work efficiency and manual performance. In addition, the recommended work clothing ensemble for the coastal fishermen is composed to provide them with improved safety also during their daily work of fishing (by the integrated buoyancy in the bib).

Considering the tasks and areas of operation of the fishermen and IGSA, a buoyancy level of 150N (approved according to ISO 12402-3) is considered to be adequate and most suitable, rather than a buoyancy level of 275N. The 150N level is intended for general application or for use with foul weather clothing, while the level of 275N is intended primarily for offshore use under extreme conditions.

It is recommended that the users try out the recommended work clothing ensembles during oil spill preparedness training to ensure the suitability and practicality of the work clothing ensemble.

A APPENDIX – WORKSHOP PREPARATIONS

Hammerfest 15. november 2012

Arbeidsbekledning for fiskere i kystnær oljevern

Ole Petter Næsgaard
Tore Christian B. Storholmen
SINTEF Avd. Helse



Foto: oljevern.no

Agenda

- Bakgrunn
- Aktiviteter
- utfordringer med dagens arbeidsbekledning
- Forslag til arbeidsbekledning
- Diskusjon av forslag
- Konklusjon

Mål for dagen:

Enig om forslag til arbeidsbekledning for fiskerne i kystnær oljevernberedskap

Om SINTEF...

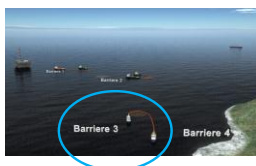
- SINTEF er Skandinavias største uavhengige forskningselskap
- En ikke-kommersiell forskningsstiftelse
- Ledende kompetanse innen naturvitenskap, teknologi, miljø, helse og samfunnsvitenskap
- Vår avdeling: utvikling av avansert arbeidsbekledning, redningsdrakter o.l. for utfordrende arbeidsmiljø



PROSJEKTET

Prosjektet

- Eni Norge AS ønsket en vurdering av arbeidsbekledningen for fiskere som skal inngå i den kystnære oljevernberedskapen (barriere 3) rundt Goliat.
- Anbefalinger om best mulig arbeidsbekledning for dette arbeidet.
- Kan det også brukes av fiskerne i deres daglige arbeid?
- Kan det bidra til økt sikkerhet for fiskerne i deres daglige arbeid?



Aktiviteter

- Intervju med oljevernrådgivere i Eni Norge og NOFO
- Gjennomgang av div. operasjonsmanualer for oljevernarbeidet
- 3-dagers kurs i oljevernarbeid for fiskere (Nordkapp Maritime, Honningsvåg)
 - Intervju og observasjon under praktisk trening
- Kravspesifikasjon for arbeidsbekledningen basert på funn fra disse aktivitetene
- Vurdert dagens arbeidsbekledning mot kravspesifikasjonen
- Identifisert områder der arbeidsbekledningen må forbedres (inkl. personlig verneutstyr)



ARBEIDSBEKLEDNING

Dagens arbeidsbekledning

Arbeidsdress:

- Regatta Offshore Worksuit 957, 50 N

Redningsdress:

- Oppblåsbar redningsvest, Omega (275 N)

Fottøy:

- Dunlop Purofort termostøvler

Hansker:

- Protex hansker, Granberg (vinter)
- Arbeidshansker, gummi, BW Bulldog (oljebestandig)

Hodebeskyttelse:

- Hjelmer med integrerte vernebriller (MSA)
- Hjelmlue (Bulldog)

Other:

- Hodelykt (Petzl)
- Separate vernebriller



Utfordringer

Arbeidsdressen

- Uegnet ved moderat/høy arbeidsintensitet
- Ikke egnet i sommerhalvåret
- Heldress
 - Enkel å ta på (positivt)
 - Vanskelig å regulere beklædningen når man går inn og ut av styrhus (ulempet)
- Noe høye krav ved bruk av hjelm
- Vil neppe bli brukt ved vanlig fiske?

Annet

- Ingen skrittropp på redningsvest/feste på dress
- Hjelmer mangler hakestropp
- 50 N dress + 275 N vest = mye oppdrift...



FORSLAG

Oljehyre

- God beskyttelse mot vann, vind og søl
- Slitesterkt
- Lett å rengjøre
- Oljebestandig
- Arbeidskomfort og bevegelsesfrihet
- Jakke/bukse-løsning
- Kjent beklædning – kunnskap om bruk
- Egnet for arbeid med varierende arbeidsintensitet og i lave/høye temperaturer
 - Regulering av under- og mellombeklædning
- Flammehemmende
- Kan bruke samme klær ved oljevareberedskap og fiske (plassbesparende?)
- Oljehyre + 150N redn vest + ullundertøy + mellombeklædning

Hvilket oljehyre?

- Vanlig oljebeklædning
- Oljebeklædning med integrert flyt

3 forslag

Oljehyre

Forslag: Oljehyre + 150N redn vest + ullundertøy + mellombekledning

Arbeidsbekledning	Oljevernarbeid	Fiske (hvis arbeid uten redningsvest)
Forslag 1 Vanlig oljehyre	Vanlig oljehyre + 150N oppblåsbar redningsvest	Vanlig oljehyre (ingen flyt)
Forslag 2 * Regatta Fisherman	Regatta Fisherman (50N integrert) + 150N oppblåsbar redningsvest	Regatta Fisherman (50N integrert)
Forslag 3 * HH Safe@Sea	HH Safe@Sea (80N integrert) + 150N oppblåsbar redningsvest	HH Safe@Sea (80N integrert)

* Bekledning med integrert flyt

SINTEF

SINTEF Teknologi og samfunn

Forslag 1 Vanlig oljehyre

- Mange ulike produsenter å velge mellom
- Noen mer slitesterke enn andre



- Arbeidskomfort
- Lett å regulere isolasjon
- Kompatibilitet m/150N redn vest



- Fiske – Ingen flyt
- Nødlys



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Forslag 2 Regatta Fisherman

- 50N flyteskum integrert i bukka



- Økt sikkerhet ved vanlig fiske (flyt)



- Arbeidskomfort (volum og temp)
- Kompatibilitet m/150N redn vest
- Nødlys



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SINTEF Teknologi og samfunn

Forslag 3 HH Safe@Sea

- SOTA – På markedet sommer 2013
- Lettere og mer slitesterkt materiale
- Ventilasjonsåpninger
- 80N oppblåsbar flytelunge integrert i bukka
- Automatisk nødlys



- Arbeidskomfort/lett
- Slitesterkt
- Ventilasjon
- Økt sikkerhet ved vanlig fiske (flyt, nødlys, transparent hette)



- Ikke utprøvd over lengre tid
- Kompatibilitet m/150N redn vest (må testes)



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SINTEF Teknologi og samfunn

Forslag

1



2



3



- Diskusjonspunkter:**
- Høy/lav arb intensitet
 - Høy/lav temperatur
 - Ekstremvær
 - Flyt/oppdrift
 - Sikkerhet/beskyttelse
 - Oppbevaring
 - Logistikk
 - Oljevern/fiske

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Teknologi for et bedre samfunn



SINTEF Teknologi og samfunn

Hammerfest 16. november 2012

Arbeidsbekledning for innsatsgruppe strand akutt

Ole Petter Næsgaard
Tore Christian B. Storholmen
SINTEF Avd. Helse



Foto: oljevern.no



SINTEF Teknologi og samfunn 1

Agenda

- Om prosjektet
- Presentasjon av IGSA
- Utfordringer med dagens arbeidsbekledning
- Forslag til arbeidsbekledning
- Diskusjon av forslag til arbeidsbekledning
- Konklusjon

Mål for dagen:

Enig om forslag til arbeidsbekledning for IGSA



SINTEF Teknologi og samfunn 2

Om SINTEF...

- SINTEF er Skandinavias største uavhengige forskningsselskap
- En ikke-kommersiell forskningsstiftelse
- Ledende kompetanse innen naturvitenskap, teknologi, miljø, helse og samfunnsvitenskap
- Vår avdeling: utvikling av avansert arbeidsbekledning, redningsdrakter o.l. for utfordrende arbeidsmiljø



SINTEF Teknologi og samfunn 3

PROSJEKTET



SINTEF Teknologi og samfunn

Prosjektet

- Eni Norge AS ønsket en vurdering av arbeidsbekledningen for fiskere som skal inngå i den kystnære oljevernberedskapsen (barriere 3) rundt Goliat
- Anbefalinger om best mulig arbeidsbekledning for dette arbeidet.
- Også inkludere IGSA

Mål:

- Gi IGSA en best mulig arbeidsbekledning basert på deres arbeidssituasjon og behov i arbeidet



"Barriere halv fire"



SINTEF Teknologi og samfunn 5

Utfordringer

- Holde seg tørr og varm
- Beskyttelse mot vann (regn, sjøsprøyt)
- Ventilasjon av varm, fuktig luft/svette
- Mann-over-bord
- Oljesøl i båten
- Skifte av bekledning



SINTEF Teknologi og samfunn

ARBEIDSBEKLEDNING



SINTEF Teknologi og samfunn

Oljehyre?

Oljehyre + 150N redn vest + ullundertøy + mellombekledning



SINTEF Teknologi og samfunn

8

SeaWind arbeidsdress

- Vanntett – tette mansjetter
- God kompatibilitet med flytevest
- Ergonomisk passform – god arbeidskomfort
- Slitesterk og lav vekt
- GoreTex – gode pusteegenskaper
- Ventilasjonsåpninger under armene
- Lommer
- Kombinert med egnet under- og mellombekledning



SINTEF Teknologi og samfunn

Diskusjonspunkter

- Kompatibilitet med flytevest
- Kompatibilitet med personlig verneutstyr
- Vanntetthet
- Behov for mer/mindre isolasjon – regulering av bekledningen
- Varierende arbeidsintensitet
- Sommer/vinter
- Skiftmuligheter – personlig utstyr?
- Løsninger hender/føtter
- Oljebestandighet
- Funksjonalitet (lommer til nødvendig utstyr etc.)
- Logistikk
- Rengjøring/tørking/vedlikehold



SINTEF Teknologi og samfunn



Teknologi for et bedre samfunn



SINTEF Teknologi og samfunn

B APPENDIX – WORK CLOTHING ENSEMBLE FOR FISHERMEN

Illustration showing most of the recommended garments and equipment for the fishermen of the coastal oil spill preparedness:



- A. Inner layer - Underwear clothing (wool)
- B. Mid layer - Fleece/Ullfrotte jacket and pants
- C. Outer layer - Univern Seaman Protec work coverall and Helly Hansen Safe@Sea bib and jacket
- D. Lifejacket - 150 N work lifejacket - example: Regatta Challenger Offshore or Hansen Protection Sea Lion
- E. Gloves - Granberg Protex, 15L Center gloves with long cuffs, 15T Center gloves with long cuffs and a pair of inner gloves
- F. Head protection - Buff (wool) and Helmet with i) headband with adjustment wheel, ii) integrated protective visor and iii) chin strap
- G. Footwear - Dunlop Purofort boots

C APPENDIX – WORK CLOTHING ENSEMBLE FOR IGSA

Illustration showing most of the recommended garments and equipment for the personnel of IGSA:



- A. Inner layer – Underwear briefs/bra (wool) and underwear clothing (wool)
- B. Mid layer - Fleece/Ullfrotte jacket and pants
- C. Outer layer – Regular oilskins and Univern Seaman Protec work coverall or Hansen Protection SeaWind work suit
- D. Lifejacket - 150 N work lifejacket - example: Regatta Challenger Offshore or Hansen Protection Sea Lion
- E. Gloves - Granberg Protex, orange gloves and a pair of assembly gloves
- F. Head protection - Buff (wool) and Helmet with i) headband with adjustment wheel, ii) integrated protective visor and iii) chin strap
- G. Footwear - Dunlop Purofort boots

D APPENDIX – TRYING ON RECOMMENDED GARMENTS

Pictures showing some of the recommended work clothing garments.





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Amendment

Work clothing for the Immediate Shoreline Task Force (IGSA)

Amendment to the SINTEF report F23963 Work clothing for fishermen participating in the Goliat coastal oil spill response team

VERSION
1

DATE
2013-12-20

AUTHOR(S)
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Eni Norge AS

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PROJECT NO.
102.004.050

NO. OF PAGES AND APPENDICES:
8 + 1 appendix

ABSTRACT

As part of the project 'Work clothing for fishermen participating in the Goliat coastal oil spill response team', SINTEF have provided Eni Norge AS with recommendations regarding suitable work clothing for the personnel participating in the immediate shoreline task force (IGSA). The recommended work clothing setup for the personnel of IGSA was prepared by a process of user involvement, where IGSA personnel participated in a workshop to specify the new work clothing setup.

The project report, SINTEF report F23963, was handed over to Eni Norge AS in January 2013.

SINTEF presented the results of the project at the IGSA seminar arranged by The Norwegian Clean Seas Association For Operating Companies (NOFO) in Alta 21st of November. This amendment summarizes this presentation.

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PROJECT MEMO NO.
Amendment no. 1

CLASSIFICATION
Confidential

Enterprise /VAT No:

1 BACKGROUND

As part of the project 'Work clothing for fishermen participating in the Goliat coastal oil spill response team', SINTEF have provided Eni Norge AS with recommendations regarding the most suitable work clothing for the personnel participating in the immediate shoreline task force (IGSA).

The project report, SINTEF report F23963, was handed over to Eni Norge AS in January 2013¹.

SINTEF presented the results of the project (appendix 1) at the IGSA seminar arranged by The Norwegian Clean Seas Association for Operating Companies (NOFO) in Alta 21st of November. This amendment summarizes this activity.

The recommended work clothing setup for the personnel of IGSA was prepared by a process of end-user involvement, and was specified during a workshop in collaboration with participating IGSA personnel.

2 RESULTS

This paragraph presents the presented results of the project. Table 1 presents the recommended work clothing setup for IGSA (like presented in SINTEF report F23963), compared to the work clothing setup of today.

Table 1. Recommended work clothing setup, compared to the work clothing setup of today.

Product type	Today's work clothing setup	Recommended work clothing setup	Comments
Inner layer / underwear		Underwear briefs/bra (wool)	Example: Aclima sports top
	Underwear clothing (wool) underpants and sweater	Underwear clothing (wool) underpants and sweater (tight-fitting high-neck with zipper for easy venting, with long trunk/dropped hem that covers well over the back/thighs).	Same as today. Other examples: JanusPro or Devold Spirit
Middle layer		Fleece jacket with long trunk/dropped hem to avoid exposure of the lower back when bending forward.	Example: Helly Hansen Langley fleece or Univerm Midlayer fleece
		Fleece pants	Example: Helly Hansen Whiterock

¹ SINTEF report no. F23963, Work clothing for fishermen participating in the Goliat coastal oil spill response team, Næsgaard OP and Storholmen TCB, 2013.

Outer layer	Oilskins, bib and jacket	Oilskins, bib and jacket	Same as today. Other example: Helly Hansen Stavanger
	Regatta Offshore Worksuit 957 (50 N)	<u>Univern Protec allværskjeledress</u> work coverall (uninsulated, wind/water resistant, underarm zippers, compatible with 150N lifejacket) OR <u>Hansen Protection SeaWind</u> work suit (uninsulated, wind/water resistant, underarm zippers, compatible with 150N lifejacket)	
Chemical protection	Disposable chemical suits	Disposable chemical suits	Same as today
Lifejacket	Omega (275 N) inflatable life jacket	150N work life jacket with good work comfort, oil resistance and emergency light.	Example: Regatta Challenger Offshore or Hansen Protection Sea Lion
Gloves	Black Granberg Protex gloves	Black Granberg Protex gloves	Same as today
	Orange gloves	Orange gloves	Same as today
		Assembly gloves	Example: Odin Feelflex or Maxiflex Ultimate
Head protection	Work helmet (MSA)	Work helmet suitable for work in wet environments, with i) adjustment wheel, ii) integrated protective visor and iii) chin strap.	Examples: Preferably Gecko helmet , otherwise regular work helmet like 3M Peltor G3000 Uvicator or MSA V-Gard 500
	Helmet beanie (Bulldog)	Balaclava (wool)	
		Buff (wool)	
		Neoprene facemask and ski goggles that are compatible with the helmet	When riding the boat in rain and sleet

Footwear	Dunlop Purofort boots	Dunlop Purofort boots	Same as today
Other equipment suggestions		Leatherman multi-tool with plier/knife	
		Larger storage bags with compression straps	For storage of all the equipment (except for the boots) and with compression.
		Watertight bags (with roll-top) / Vacuum-packing machine	Can be provided at the depot, in order to obtain waterproof and compressed packing of spare clothing.
		It is recommended that the suggested work clothing setup is supported with facilities on board the operation support vessel, that allow the IGSA personnel to adjust their mid-layer clothing and put on dry clothes during the oil spill response operation. The IGSA personnel have limited possibilities to adjust their clothing in their operation boats.	

3 CONCLUSION

This paragraph sums up discussions following the presentation, and immediate feedback from the IGSA personnel regarding the recommended work clothing setup.

Overall, the recommendations from the project were appreciated by the members of IGSA. However, some important issues remain to be clarified, and were discussed at the IGSA seminar after the presentation.

3.1 Discussion

3.1.1 Use trials

SINTEF brought the two recommended outer layer work suits (*Univern Protec All-weather coverall* and *Hansen Protection SeaWind*) to the IGSA seminar, in order for the IGSA personnel to take a closer look at these suit alternatives. Although these work suits are recommendations, SINTEF emphasize the importance of performing realistic use trials in order to finally determine whether these work suits are the most practical for the IGSA personnel or not. SINTEF recommend that a group of IGSA personnel try out these work suits during realistic work situations, in order to evaluate the suitability of the suits.

If the project is extended, SINTEF will assist with evaluation of the work clothing setup (especially regarding selection of the most suitable outer layer) during a realistic field test. Eni Norge/NOFO will consider if the field test can be carried out in 2014.

3.1.2 Buoyancy solution

NOFO must consider and decide on the most suitable buoyancy solution for the IGSA personnel; inflatable buoyancy or inherent buoyancy. There are advantages and disadvantages related to both solutions, and below is a list of issues to be considered. The decision must be based on an overall risk analyses, considering and comparing the advantages and disadvantages of an inherent vs. an inflatable buoyancy solution related to the tasks and risk level of the IGSA personnel.

Inherent buoyancy, 50N (e.g. Regatta Seafarmer 50N)

Advantages

- Faultless and does not require maintenance.

Disadvantages

- Does not have self-turning properties in water (the life jacket will not automatically turn an unconscious and faced down person in the water into a safe position)
- Provides a lower level of buoyancy (50N)
- EN ISO 12402-5 (regarding 50N products) states that "such buoyancy products are intended for use by those who are competent swimmers and who are near to bank or shore, or who have help and a means of rescue close at hand ...they are of limited use in disturbed water, and cannot be expected to keep the user safe for a long period of time. They do not have sufficient buoyancy to protect people who are unable to help themselves. They require active participation by the user"
- Are considered more bulky and restricts freedom of movement compared to inflatable lifejackets
- Provides undesirable insulation (especially during summertime and during high intensity work), and the inherent foam represents a barrier towards moisture transport.

Inflatable buoyancy, 150N (lifejackets that comply with EN ISO 12402-3)

Advantages

- Has self-righting properties. Turns unconscious person faced down in the water into a safe position within 5 seconds
- Does not require swimming skills. EN ISO 12402-3 states that "this level (150N) is intended for general application or for use with foul weather clothing. It will turn an unconscious person into a safe position and requires no subsequent action by the user to maintain this position"
- Does not restrict freedom of movement (compared to rigid inherent solutions)
- Does not provide undesirable insulation. Suitable all year and during high intensity work.

Disadvantages

- Risk of malfunction (not inflating)
- Requires regular maintenance routines (check/change of salt/paper bobbin, gas cylinder etc.) to ensure proper function, e.g. before every exercise. Without establishment and follow-up of such maintenance routines, inflatable lifejackets can represent a false sense of safety
- Need routines for replacing old/worn out lifejacket
- What happens if a lifejacket accidentally inflates during an oil spill operation? Is that person unavailable until a new life jacket has been put on?

Recommendation regarding buoyancy solution

Based on the insights established from IGSA personnel in the project, SINTEF recommends that the IGSA personnel are equipped with 150N inflatable lifejackets. This recommendation is based on the following arguments:

- Lifejackets have self-righting properties, and therefore provides a higher level of safety
- Provides a higher freeboard and more stable floating position in the water (which is especially important in rough sea)
- Does not require swimming skills
- Will not degrade thermal comfort during work, and involves less undesirable insulation

However:

- If unintended inflations during work (because of heavy rain, sea spray, splashes etc.) occur and prove to be a frequent issue, one should consider lifejackets with a hydrostatic inflator mechanism (Hammar automatic inflator). These mechanisms are activated when submerged under water, rather than by contact with water.
- If the IGSA personnel are provided with inflatable lifejackets, it is necessary to establish and follow-up good and reliable routines for:
 - Regularly checking the functionality of gas cylinder and inflator mechanism
 - Regular maintenance/service
 - Replacement of worn out and inflated lifejackets

3.2 Feedback from IGSA personnel

This paragraph repeats the immediate feedback from IGSA personnel after the presentation:

- All IGSA members should be equipped with a communication system
- Communication system should be well integrated so that hands are free to operate tools/equipment
- Important that gloves are available also in small sizes. Not only size 10
- It is desirable with woolen balaclava and buff. Need ski goggles and neoprene facemask as well
- Must ensure that the life jacket retains its flexibility also at low temperatures
- The Univern Protec suit
 - Several of the IGSA personnel have positive experience with this suit from their daily work
 - Positive that it is equipped with inside braces
 - Desirable with longer zips at the legs, to make it easier to put on/off boots
- The Hansen Protection SeaWind suit
 - Positive feedback from IGSA personnel. Would like to evaluate it during an exercise
 - Several persons are concerned that the integrated socks will get worn out easily. Would prefer neoprene gaiters at the ankles (but this would make the suit less watertight)
 - The integrated lifting strap is unnecessary

A Presentation given by SINTEF at IGSA seminar in Alta 21st of November

Alta 22. november 2013

ARBEIDSBEKLEDNING FOR IGSA

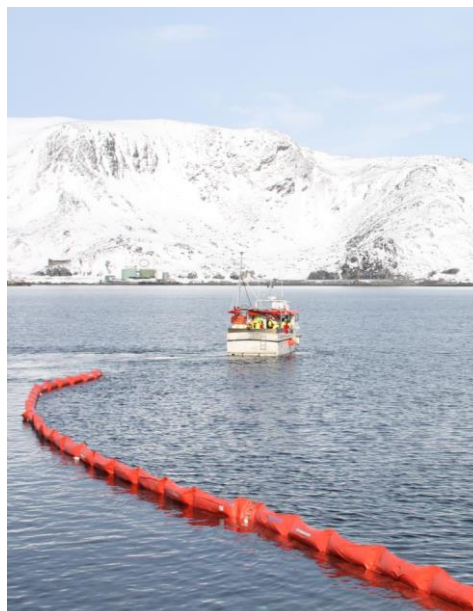
Tore Christian B. Storholmen
Ole Petter Næsgård

SINTEF Teknologi og samfunn, Avd. Helse



AGENDA

- Kort om SINTEF
- Om prosjektet
- utfordringer med dagens arbeidsbekledning
- Forslag til bekledningsoppsett
- Spørsmål og prøving



SINTEF

- SINTEF er Skandinavias største uavhengige forskningsselskap
- Ledende kompetanse innen naturvitenskap, teknologi, miljø, helse og samfunnsvitenskap
- Avdeling Helse: utvikling av avansert arbeidsbekledning, redningsdrakter o.l. for utfordrende arbeidsmiljø



PROSJEKTET

PROSJEKTET

- Eni Norge ønsket vurdering av arbeidsbekledning for fiskere som skal inngå i IGK (barriere 3) rundt Goliat-feltet
- Anbefaling om best mulig arbeidsbekledning for IGK
- Også inkludere arbeidsbekledning for IGSA

Mål:

- Anbefaling av hensiktsmessig arbeidsbekledning for IGSA basert på deres arbeidsoppgaver, -situasjon og -omgivelser
- Innspill til Eni/NOFO mtp anskaffelse av bekledning og utstyr



"Barriere halv fire"

AKTIVITETER

- Intervju og observasjon under oljevernkurs for IGK
- Intervju med innsatsleder IGSA
- Workshop med innsatsleder og 3 operative fra IGSA for diskusjon av hensiktsmessig bekledningsoppsett
- Tilgjengelig SOTA – Med bakgrunn i kunnskap om arbeidsoppgaver, -situasjon og -omgivelser
- Målsetting: prøve ut foreslått bekledningsoppsett under en realistisk øvelse



DISKUSJONSPUNKTER I WORKSHOP

- Kompatibilitet med flytevest og personlig verneutstyr
- Vanntetthet
- Behov for isolasjon – ventilering av svette
- Arbeidsintensitet og -forhold
- Sommer/vinter – oppsett for helårs bruk
- Skiftemuligheter – personlig utstyr?
- Løsninger hender/føtter (hansker/støvler)
- Nødvendig funksjonalitet (lommer til nødvendig utstyr etc.)
- Rengjøring/tørring/vedlikehold
- Osv.

UTFORDRINGER I DAG

- Holde seg tørr og varm
- Beskyttelse mot vann (regn, sjøsprøyt)
- Ventilasjon av varm, fuktig luft/svette
- Risiko for fall-over-bord
- Oljesøl i båten
- Skifte av bekledding





NYTT BEKLEDNINGSOPPSETT

- God beskyttelse mot vind (og kulde)
- Beskyttelse mot kulde - Kontroll av fuktighet
 - God beskyttelse mot eksponering for vann/sjøsprøyt fra utsiden
 - Begrense fuktighet fra innsiden ved svetting
- Flerlags bekledningssystem
 - Variasjon avhengig av ytre forhold og egen arbeidsintensitet
- Underbekledning
 - Absorbere og transportere svette/fuktighet bort fra huden
- Mellombekledning
 - Isolere (varierende) og redusere varmetap
 - Transportere svette/fuktighet videre ut
- Ytterbekledning
 - Beskytte mot eksponering fra omgivelsene (vind, nedbør etc.)
 - Redusere fuktigheten inne i bekledningen

ANBEFALING



SINTEF Teknologi og samfunn

BEKLEDNINGSSOPPSETT

Underbekledning



Mellombekledning



Ytterbekledning



Regntøy



SINTEF Teknologi og samfunn

PERSONLIG VERNEUTSTYR



SINTEF Teknologi og samfunn

UNDERBEKLEDNING

Absorbere og transportere svette/fuktighet bort fra huden

- Ull-undertøy
- Også BH og boxer i ull
- F.eks. JanusPro eller Devold Spirit



SINTEF Teknologi og samfunn

MELLOMBEKLEDNING

Isolere (varierende) og transportere svette/fuktighet videre ut

- Fleece jakke og bukse
- God fukttransport
- Variere bruk
- F.eks. HH Langley fleece jakke



SINTEF Teknologi og samfunn

YTTERBEKLEDNING

Beskytte mot eksponering fra omgivelsene (vind, nedbør etc.) og redusere fuktigheten inne i bekleddingen

- 2 alternativer
 - UniverN NanoTec – Allværs arbeidsdress
 - Hansen Protection SeaWind – Tørrdrakt våtsonen
- Vindtett, vanntett og pustende
- Uisolert
- Slitesterk
- Ventilering - Glidelåsåpninger under armene
- Vernestøvler / vernesko



UniverN NanoTec



HP SeaWind



SINTEF Teknologi og samfunn

REGNTØY

Til skikkelig regn- og ruskevær

- Oljehyre
- Brukes over skalldressen
- Regnjakke og -bukse
- F.eks. Helly Hansen Stavanger



SINTEF Teknologi og samfunn

PERSONLIG VERNEUTSTYR

- Redningsvest
 - 150N - opererer kystnært
 - F.eks. Regatta Challenger Offshore
- Arbeidshansker
 - Som i dag (Granberg Protex og oransje)
 - + Monteringshansker
- Hjelm
 - Med strammehjul, integrert øyevern og evt hakest
 - F.eks. Peltor G3000 eller MSA V-Gard 500
- Støvler
 - Som i dag – Dunlop Purofort
- Engangs kjemisk beskyttelsesdrakt
 - I tiffelle oljesøl



SINTEF Teknologi og samfunn

ANDRE FORSLAG

- Stor bag for å oppbevare/medbringe alt utstyret (inkl støvler)
 - Med kompresjonsstropper
- Leatherman multitool
- Vakuumpakkemaskin
 - For vanntett og komprimert oppbevaring av skiftetøy
- Skiftefasiliteter

OPPSUMMERING

- Vårt innspill til Eni/NOFO mtp anskaffelse av arbeidsbekledning og annet personlig utstyr for IGSA
- Mer hensiktsmessig bekledningsoppsett
- Bedre kontroll på fuktighet i bekledningen – Termisk komfort og ventilering av svette
- Utstrakt bruk - Bedre egnet for skiftende værforhold og arbeidsintensitet
- Forbedret arbeidskomfort og –effektivitet
- Prøving under realistisk øvelse



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2nd Amendment

Field test of work clothing for the Immediate Shoreline Task Force (IGSA)

2nd amendment to SINTEF report F23963 Work clothing for fishermen participating in the Goliat coastal oil spill response team

VERSION

1

DATE

2014-12-19

AUTHOR(S)

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CLIENTS REF.

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HSEQ/Oil spill adviser

PROJECT NO.

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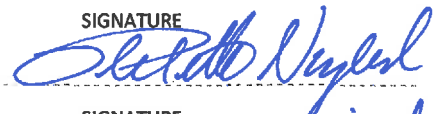
ABSTRACT

As part of the project 'Work clothing for fishermen participating in the Goliat coastal oil spill response team', SINTEF have provided Eni Norge AS with recommendations regarding suitable work clothing for the personnel participating in the immediate shoreline task force (IGSA). The project report, SINTEF report F23963, was handed over to Eni Norge AS in January 2013. Two alternative worksuits were initially recommended for IGSA, and SINTEF have participated during realistic field tests of these in Hammerfest (September 9-10th 2014) in order to identify the one most suitable for IGSA.

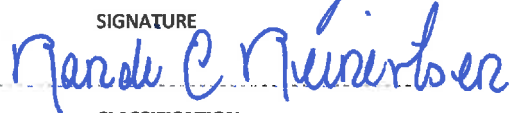
IGSA personnel must perform a variety of tasks. Work *onshore* and *offshore* represent two different work situations, which place different requirements to the worksuit to be used. Work involves much moving around both in/between the different boats, and between the boats and shore. There is a considerable risk of falling overboard, which involves a safety risk in the cold waters in which IGSA operate. SINTEF recommends that the IGSA personnel are provided with both worksuits, in order for the personnel to have a suitable worksuit for both the onshore and offshore (immersion suit) work situation.

PREPARED BY

Ole Petter Næsgaard, Research Scientist

SIGNATURE**APPROVED BY**

Randi Eidsmo Reinertsen, Research Director

SIGNATURE**PROJECT MEMO NO.**

2nd Amendment

CLASSIFICATION

Confidential

1 BACKGROUND

As part of the project 'Work clothing for fishermen participating in the Goliat coastal oil spill response team', SINTEF have provided Eni Norge AS with recommendations regarding suitable work clothing for the personnel participating in the immediate shoreline task force (IGSA). The recommended work clothing setup for IGSA was prepared by a process of end-user involvement, and was specified during a workshop in collaboration with participating IGSA personnel. The initial project report, SINTEF report F23963, was handed over to Eni Norge in January 2013¹. A report amendment presenting the recommended work clothing for IGSA was handed over to Eni Norge in December 2013². SINTEF presented the results of the project (appendix 1) at the IGSA seminar arranged by The Norwegian Clean Seas Association for Operating Companies (NOFO) in Alta 21st of November 2013.

Two alternative worksuits (the Protec and SeaWind worksuits) were recommended for IGSA, as improvements compared to the currently used Regatta worksuit. SINTEF recommended that a group of IGSA personnel tried out these two worksuits during realistic oil spill combatment work, in order to finally determine the suitability of the suits.

The objective of the project has been to consider the suitability of the Protec and SeaWind suits for the total work situation of IGSA (regarding thermal, ergonomic and functional properties and personal safety), in order to suggest the most practical solution for IGSA regarding worksuits.

2 WORK SUITS

IGSA are currently provided with a worksuit with inherent insulation and buoyancy (Regatta offshore worksuit 957, Image 1). Two alternative worksuits were presented in the first amendment to SINTEF report F23963:

1. Protec all-weather work suit (Univern, art. 87120, Image 2)³
2. SeaWind immersion/work suit (Hansen Protection, model SeaWind, Image 3)⁴

¹ SINTEF report no. F23963, Work clothing for fishermen participating in the Goliat coastal oil spill response team, Næsgaard OP and Storholmen TCB, 2013.

² Amendment to SINTEF report F23963, Work clothing for the immediate shoreline task force (IGSA), Næsgaard OP and Storholmen TCB, 2013.

³ <http://www.univern.no/Arbeidsklaer/Synlighet>

⁴ <http://hansenprotection.no/survival/l-offshore.html>



Image 1 Currently used Regatta offshore work suit 957.



Image 2 Protec all-weather worksuit (Univern, art. 87120).



Image 3 SeaWind immersion/worksuit (Hansen Protection).

Compared to the currently used Regatta worksuit, the Protec and SeaWind are *uninsulated* outer shell worksuits, which should be complemented with underwear and middle layer garments for insulation (multi-layer clothing system). The Protec and SeaWind represent different types of worksuits. While the Protec is a regular all-weather worksuit, the SeaWind is a drysuit/immersion suit (fulfils the requirements of the IMO/SOLAS LSA Code as 1 hour immersion suit). This means that the SeaWind can be fully sealed to keep water completely out of the worksuit, and it is primarily designed for work on or close to water. Both worksuits:

- Are made of waterproof fabric
- have air permeable properties
- have underarm zippers for enhanced ventilation
- should be used together with a lifejacket

3 METHODS

The two worksuits were tried out by 12 IGSA personnel in a one-day realistic oil spill preparedness exercise outside Hammerfest (week 38, 2014). This field test involved oil spill combatment work (shoreline oil spill protection) typical for IGSA. Seven worksuits of SeaWind and seven worksuits of Protec were made available to the personnel, and were tested by different personnel during the field test. Representatives from SINTEF participated during this field test. The environmental conditions was 0-5 °C and 0-5 m/s wind during this field test.

After encouragement from operative leader of IGSA, the worksuits were available to the personnel during similar one-day exercises in Hasvik (week 40, 2014) and Havøysund (week 42, 2014).

The user experiences of the worksuits were collected by the following methods

Questionnaire

13 respondents answered the questionnaire (appendix A) involving comparative questions of thermal, ergonomic and functional properties of the SeaWind and Protec, and a ranking of the SeaWind, Protec and Regatta worksuits. After trying out a worksuit during field test, the participating IGSA personnel were encouraged to evaluate it by filling out the questionnaire.

The participants were encouraged to try out both worksuits for comparison, but only one person tested both suits. Since most participants only tested one suit, one cannot make definite conclusions based on the questionnaire. The questionnaire will therefore be used as descriptive characteristics and not for direct comparisons between the two worksuits.

Interview

Semi-structured interviews with IGSA personnel were carried out when possible during the field test in week 38, in order to collect their considerations and use experiences related to the worksuits. An interview guide was developed prior to the field test, and formed the basis for the questions of the interviews (appendix B). Interviews were carried out with individual accessible personnel during the test, and a group interview with most members of the task force was carried out during the field test debrief.

After the field test, a telephone interview with operative leader of IGSA was carried out in order to collect his use experiences of the SeaWind and Protec worksuits and to form a recommendation for IGSA. The interview was based on the developed interview guide

Observation

The IGSA personnel were observed during the field test, in order for SINTEF to compare the performance and suitability of the worksuits and identify challenges regarding thermal, ergonomic and functional properties.

4 RESULTS / DISCUSSION

This section will present the results from the questionnaire, interviews and observations from the field tests. The performance and suitability of the two worksuits will be discussed regarding i) thermal properties, ii) personal safety, iii) ergonomic properties and iv) functional properties.

The IGSA personnel must perform a variety of tasks. Work *onshore* (including tasks like establishing camp and attachment of oil spill equipment, Image 4) and *offshore* (oil spill combatment along the shoreline and on board the boats, Image 5) represent two different work situations which place different requirements to the protective clothing used. A leading principle in IGSA is that all personnel should be familiar with and be able to carry out all tasks, so no personnel are dedicated to specific tasks.



Image 4 IGSA onshore work.



Image 5 IGSA shoreline/offshore work.

Thermal properties

The currently used worksuit has *inherent insulation*, hence it provides more thermal insulation compared to the *uninsulated* Protec and SeaWind. This can be favourable in periods of low intensity work, e.g. during waiting, boat transport and similar stationary activities. The current worksuit was observed and reported in interviews to be too warm during work in the current conditions, which induced profound sweating during work and subsequently cooling due to wet underwear in following rest periods. Thus it is unsuited for high work intensities and higher ambient temperatures. This was pointed out by the interviewed personnel.

SINTEF report no. F23963⁵ pointed out that IGSA personnel need practical work clothing that will be suitable for varying climatic conditions and changing activity levels⁶. A multi-layered clothing system was suggested, where the different layers have the following main functions: i) inner layer (moisture absorption/transport), ii) middle layer (insulation and moisture transport) and iii) outer layer (protection against external environment). This includes flexible middle layer garments to regulate the level of insulation. The suggested Protec and SeaWind suits represent outer layer worksuits in a multi-layered clothing system, where each person can regulate the thermal insulation depending on work intensity, ambient temperatures and individual preferences.

⁵ SINTEF report no. F23963, Work clothing for fishermen participating in the Goliat coastal oil spill response team, Næsgaard OP and Storholmen TCB, 2013.

⁶ Health aspects of work in extreme climates. A guide for oil and gas industry managers and supervisors. OGP Report nr. 398.

During the field test, it was observed that the personnel wearing the currently used worksuit experienced extensive sweating when performing moderate intensity work (Image 6). They frequently had to open the front zipper in order to ventilate the suit and cool down. The personnel wearing the Protec and SeaWind did not experience similar heat stress when performing the same type of work.



Image 6 Personnel wearing the currently used worksuit experienced extensive sweating when performing moderate intensity work, compared to personnel wearing the Protec and SeaWind worksuits.

In the questionnaire, the Protec was rated as warm enough, and the SeaWind was rated as chilly for the current environmental conditions (0-5 °C and 0-5 m/s wind) during the field tests (Figure 1). The participants reported that they did not experience extensive sweating, which is expected since the worksuits were reported as appropriate to chilly. However, the personnel appreciated the opportunity to zip open underarm zippers in order to improve ventilation, especially when performing high intensity work onshore. The objective of the project was to consider the suitability of the worksuit, hence complementary middle layer clothing was not available to the participants during the field test.

How warm is the clothing?

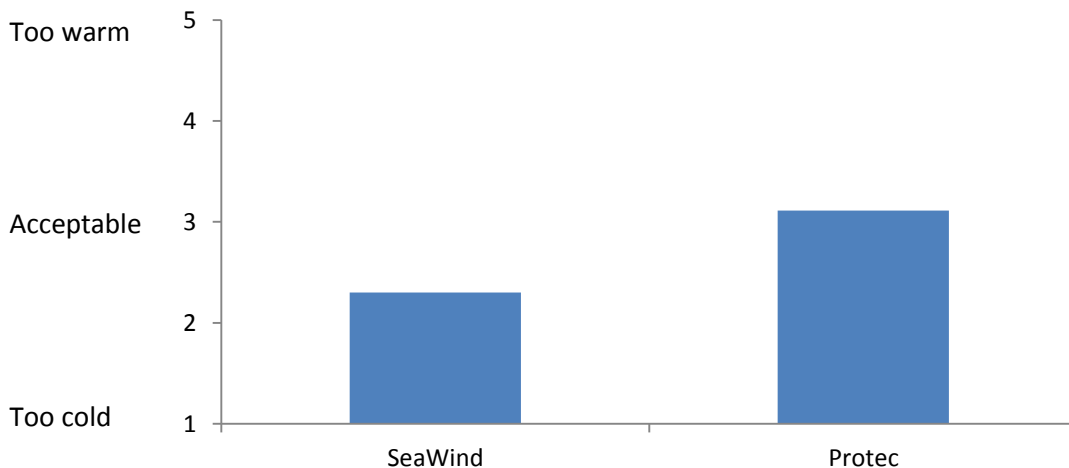


Figure 1 How warm is the clothing?

Personal safety

The work of the IGSA personnel involves much moving around both in and between the different boats of the task force, and between the boats and shore (Image 7). The personnel usually operate close to the shoreline and in the proximity of each other, but can in periods operate in open waters e.g. during transport

to action areas. There is a considerable risk of falling overboard during work, and this involves a safety risk especially in the cold waters in which IGSA operate. The worksuit should preferably provide buoyancy and protection against rapid cooling in case of immersion. All three suits should be used together with a lifejacket to ensure adequate buoyancy.



Image 7 There is a considerable risk of falling overboard during work.



Image 8 Immersion suit will keep personnel dry and reduce the risk of cold shock, hypothermia and drowning if immersed.

The currently used worksuit has inherent buoyancy properties (50 N), and insulation to prevent rapid cooling if immersed. The Protec suit has no inherent insulation, but should rather be used with complementary middle layer garments to provide insulation. None of these worksuits will keep the wearer dry if immersed.

The SeaWind will be beneficial in man-overboard situations. It is an immersion suit, with thermal performance that fulfils the requirements of IMO SOLAS for one hour immersion suit without internal buoyancy⁷. If the suit is fully closed when immersed, which it should be during high risk work offshore and close to the shoreline, it will keep personnel dry and reduce the risk of cold shock, hypothermia and drowning (Image 8). If recovered out of the water within a short period of time, the person will be fully functional and can carry on with the oil spill combatment work. A prerequisite is that the personnel are fitted with immersion suits of the correct size, to ensure watertight cuffs and neck seals. In a similar scenario with the current worksuit or the Protec, the person would become wet and cold and minimum need a rewarming period on land. This scenario would furthermore occupy at least two to three persons which must abandon the oil spill combatment work, in order to ensure the health and safety of the cooled person. Optimal performance of the IGSA personnel is important in oil spill preparedness operations.

Ergonomic properties

The tasks performed by the IGSA personnel involve much bending, kneeling and moving around, and unrestricted freedom of movement is important in order to carry out the tasks efficiently and effortlessly. Both work suits were reported as comfortable to work with (Figure 2), and freedom of movement and comfort was in the questionnaire rated as good for both suits. The Protec and SeaWind suits are lighter and offer more freedom of movement compared to the currently used worksuit.

⁷ International Life-Saving Appliances Code, Resolution MSC. 48(66), International Maritime Organization.

How comfortable is the suit?

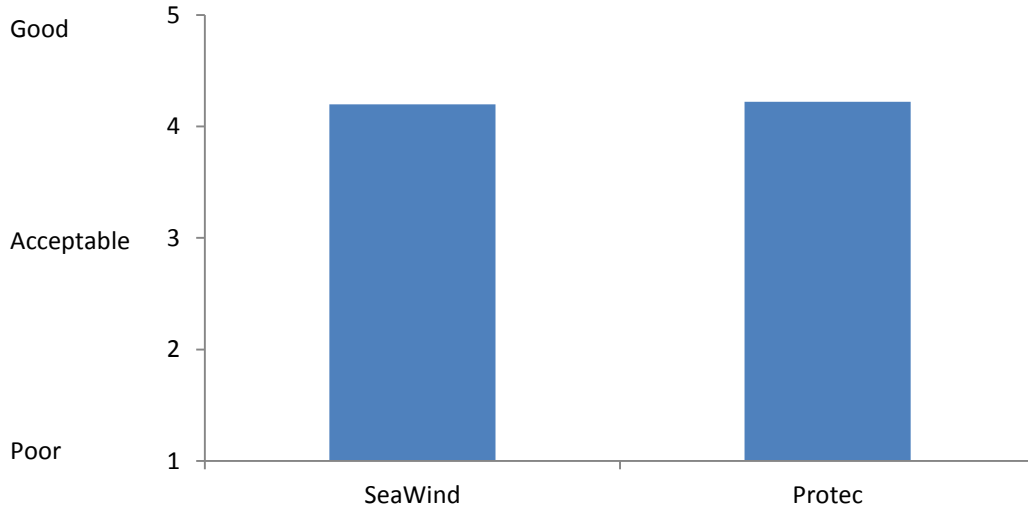


Figure 2 How comfortable is the suit?

Functional properties

In order to have the appropriate buoyancy, both the Protec and SeaWind must be used with an inflatable lifejacket when working on or near the sea. Both suits were reported to be compatible and functional with a lifejacket (Figure 3).

How does the buoyancy device fit with the suit?

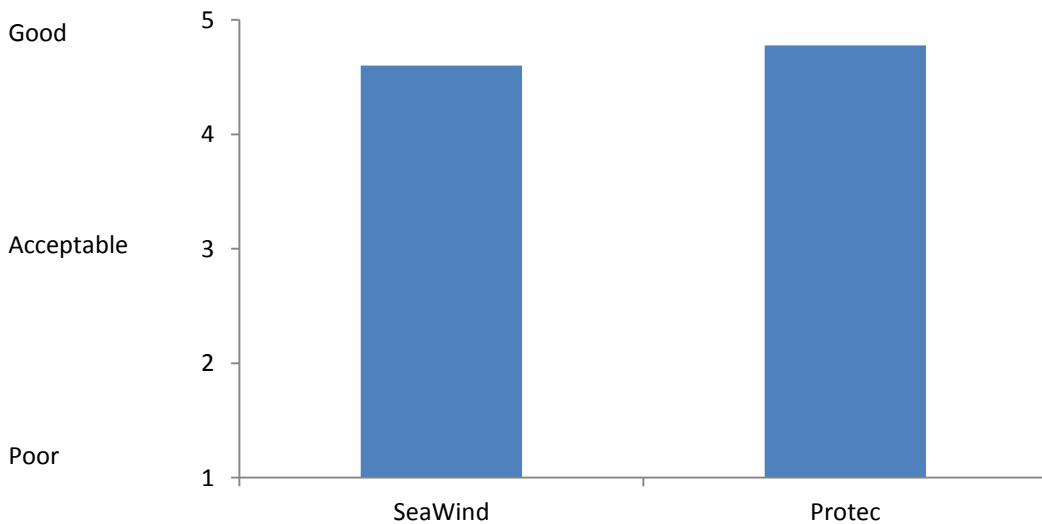


Figure 3 How does the buoyancy device fit with the suit?

The participants reported that there was a lack of functional pockets, especially on the thigh and chest, on the SeaWind suit. This issue can be negotiated with the producer of the work suit. The zippers of the SeaWind might feel slightly hard when the suit is used the first time, but this will improve with use. The SeaWind has integrated socks in order to fulfill the requirements as a dry/immersion suit. These socks were reported to be functional and well suited with the shoes used.

The personnel were pleased with the functionality of the Protec. They appreciated the opportunity of including pads for knee protection in the suit, since much work is performed while kneeling.

In order to preserve the properties of the work suits, it is important that they are washed and maintained according to instructions. In order to keep the waterproof properties of the Protec, it should be re-impregnated according to recommendations of the producer. The zippers of the SeaWind should be lubricated after use, to ensure they will run smoothly the next time the suit should be used.

Ranking

The participants were finally asked to rank the currently used suit, and the Protec and SeaWind from one to three, where one was the best. The SeaWind was ranked the best, followed by the Protec and on third place the currently used worksuit (Figure 4). It should be taken into consideration that the participants only tested one of the new suits, and their ranking was therefore based on observations and comments from other participants.

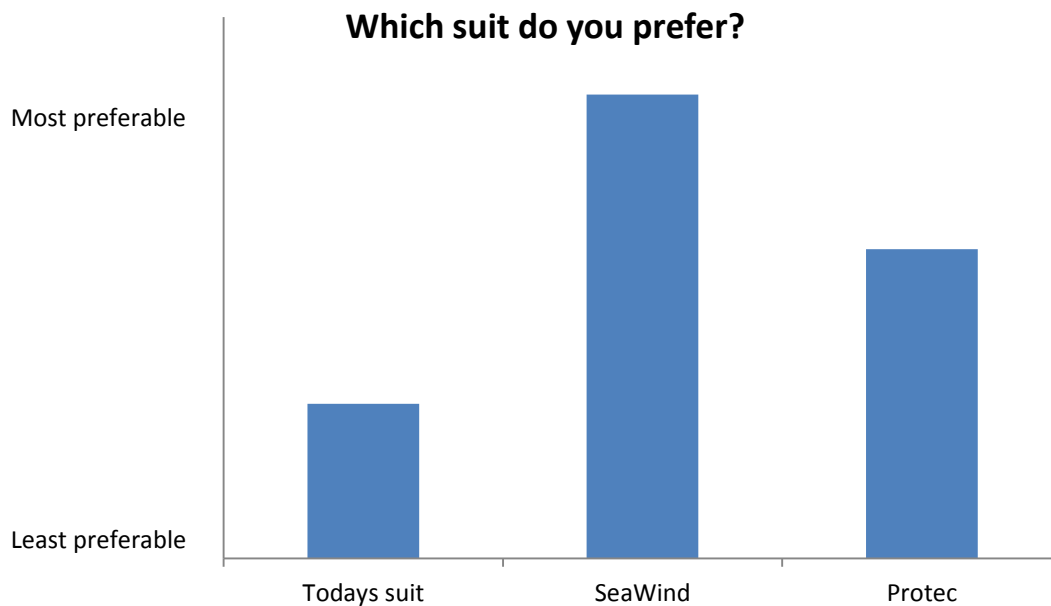


Figure 4 Which suit do you prefer?

5 CONCLUSION

The IGSA personnel must perform a variety of tasks. Work *onshore* and *offshore* represent two different work situations, which place different requirements to the protective clothing to be used. The work involves much moving around both in and between the different boats, and between the boats and shore. There is a considerable risk of falling overboard during work, and this involves a safety risk especially in the cold waters in which IGSA operate.

Based on the activities in the project, it is concluded that both the SeaWind and the Protec suit are suitable for the overall work and total range of tasks of the IGSA personnel. Both worksuits must be complemented with underwear and middle layer garments for adjustment of thermal protection and comfort. The SeaWind and Protec were preferred compared to the existing Regatta worksuit, and both will likely improve overall thermal comfort, performance and safety.

An important consideration is whether the personnel should be provided with one worksuit which is adequately suitable for all tasks, or be provided with two worksuits which are particularly suitable for each of the two different work situations (onshore and offshore/shoreline). Both worksuits are light and provide freedom of movement. The SeaWind is the most suitable for the offshore/shoreline work situation, because of the immersion properties and the positive implications on personal safety. The Protec is the most suitable for the onshore work situation, because of its flexibility and functional solutions. A leading principle in IGSA is that all personnel should be familiar with and be able to carry out all tasks, so currently no personnel are dedicated to specific tasks.

Based on these considerations, SINTEF recommends that the IGSA personnel are provided with both suits. If personnel are dedicated to different specific tasks onshore/offshore, all personnel might not need to be provided with both worksuits.

Both worksuits should also be used together with a lifejacket.

A QUESTIONNAIRE

Spørreskjema

Arbeidsbekledning for IGSA

Dato: _____

Fornavn: _____ Høyde: _____ Vekt: _____

Sett kryss under den drakten du evaluerer:

Hansen Protection



Univern ProTec



Under- og mellombekledning (sett strek under det du brukte under drakten)

Underbekledning:	T-skjorte	Ulltrøye	Ull-longs
Mellombekledning:	Genser/treningsjakke	Fleece	Ullgenser

Kommentar _____

Passform og påkledning (sett ring rundt tallet du mener passer):

1. Hvordan synes du passformen på denne drakten er?

1	2	3	4	5
Veldig romstor		Sånn passe		For tetsittende

2. Hvordan er lengden på beina?

1	2	3	4	5
For kort		Akseptabel		For lang

3. Hvordan er lengden på armene?

1	2	3	4	5
For kort		Akseptabel		For lang

4. Hvordan er det å ta drakten av/på?

1	2	3	4	5
Vanskelig		Akseptabel		Enkelt

Kommentar _____

5. Hvordan er det å åpne og lukke drakten (knepping, glidelåser, etc)?

1	2	3	4	5
Vanskelig		Akseptabel		Enkelt

Kommentar _____

6. Hvordan er det å åpne og lukke drakten med hansker?

1	2	3	4	5
Vanskelig		Akseptabel		Enkelt

7. Hvor godt passer hetten sammen med hjelmen?

1	2	3	4	5
Dårlig		Akseptabel		Bra

Kommentar? _____

8. Hvor godt passer ermene og hanskene sammen?

1	2	3	4	5
Dårlig		Akseptabel		Bra

Kommentar? _____

9. Hvor godt passer sko/støvler og drakten sammen?

1	2	3	4	5
Dårlig		Akseptabel		Bra

Kommentar? _____

10. Hvor godt passer drakten sammen med redningsvesten?

1	2	3	4	5
Dårlig		Akseptabel		Bra

Kommentar? _____

Komfort:

11. Hvor komfortabel er drakten?

1	2	3	4	5
Dårlig		Akseptabel		Bra

12. Hvordan er bevegelsesfriheten i drakten?

1	2	3	4	5
Dårlig		Akseptabel		Bra

13. Hvordan er det å løfte beina?

1	2	3	4	5
Vanskelig		Akseptabel		Enkelt

14. Hvordan er det å løfte armene?

1	2	3	4	5
Vanskelig		Akseptabel		Enkelt

15. Hvis det er noen begrensninger i bevegelsesfriheten, kan du nevne disse?

16. Hva synes du om vekten på drakten?

1	2	3	4	5
Tung		Akseptabel		Lett

17. Hvor varm er bekleddingen?

1	2	3	4	5
For kald		Sånn passe		For varm

18. Blir du svett i bekleddingen?

1	2	3	4	5
Veldig svett		Litt svett		Ikke svett

19. Hvordan fungerer luftemulighetene i drakten (feks. glidelås under armene)?

1	2	3	4	5
Dårlig		Akseptabel		Bra

20. Er det nok med lommer på bekleddingen? (sett ring rundt svar) Ja / Nei

21. Er lommene store nok? Ja / Nei

22. Er lommene lett tilgjengelig? Ja / Nei

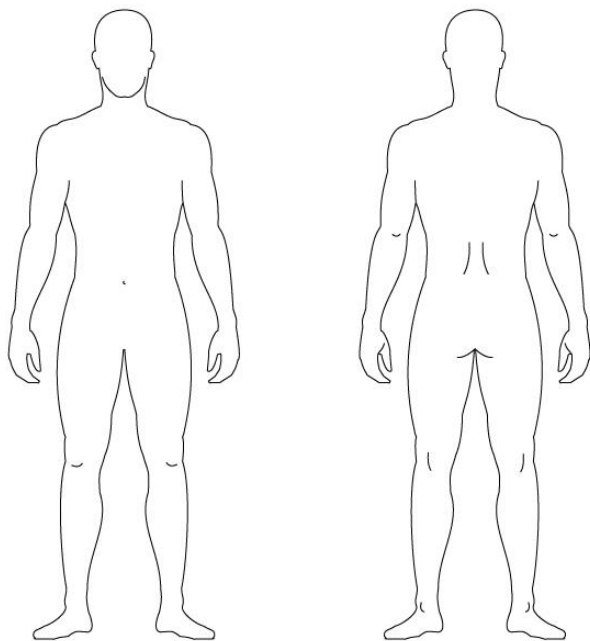
Kommentar? _____

Vanntetthet:

23. Oppstod problemer med vanninntrenging?

1	2	3	4	5
Ekstrem lekkasje		Litt lekkasje		Ingen lekkasje

24. Hvis drakten lekker, hvor trenger vannet inn? Bruk tegningen under til å markere lekkasjeområdene.
Kommenter gjerne hva som forårsaket vanninntrenging



Kommentar? _____

25. Vennligst list opp eventuelle kommentarer som du synes er viktig med tanke på evalueringen av drakten, spesielt for områder som ikke er nevnt i de tidligere spørsmålene.

26. Hvilken drakt synes du er best (ranger fra 1 til 3, hvor 1 er best og 3 er dårligst)

Dagens drakt	
Hansen Protection	
Univern Protec	

B SEMI-STRUCTURED INTERVIEW GUIDE

INTERVJU – FELTTEST IGSA

Passform og påkledning:

1. Hvordan er passformen på drakten?
2. Hvordan er lengden på beina?
3. Hvordan er lengden på armene?
4. Hvordan er det å ta bekledningen av/på?
5. Hvordan er det å åpne og lukke bekledningen (knepping, glidelåser, etc)?
6. Hvordan er det å åpne og lukke bekledningen med hansker?
7. Hvor godt passer drakten sammen med hjelmen? Behov for hette?
8. Hvor godt passer ermene og hanskene sammen? Best med/uten mansjetter?
9. Hvor godt passer sko/støvler og bekledning sammen? Greit ifm påkledning?
10. Hvor godt passer bekledningen sammen med redningsvesten?

Komfort:

11. Hvor komfortabel er drakten?

Noen arbeidsoppgaver som var vanskelig å gjennomføre i noen av draktene? Hvilke/hvorfor?

Noen av draktene som var ubehagelige å arbeide i? Hvilke/hvorfor? (arb.drakt vs. tørrdrakt)

Behov for knebeskyttelse?

12. Hvordan er bevegelsesfriheten i bekledningen?

13. Hvordan er det å løfte beina?

14. Hvordan er det å løfte armene?

15. Noen begrensninger i bevegelsesfriheten?

16. Hva synes du om vekten på bekledningen?

17. Hvor varm er bekledningen?

18. Blir du svett i bekledningen?

Mulig å ta på/av plagg underveis?

19. Hvordan fungerer luftemulighetene i bekledningen (feks. glidelås under armene)?

Egnet for ulike værforhold? (kaldt/varmt, regn, vind)

Egnet for varierende arbeidsintensitet? (passiv, hardt arbeid)

Funksjonelle løsninger:

20. Er det nok med lommer på bekledningen?

Hvordan fungerer disse? (størrelse, tilgjengelighet)

Vanntetthet:

21. Greit å holde vannet ute?

Annet:

Draktene ved en MOB-situasjon? (tørrdrakt vs. arb.drakt)

Noen av MOB-draktene som hadde mangler eller upraktiske løsninger? Hvilke/hvorfor?

Hvilken av draktene er mest hensiktsmessig for bruk til IGSA?

Har du forslag til evt ytterligere forbedringer av draktene?



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