RECOMMENDED GUIDELINES FOR DEPLOYMENT OF RFID ON THE NORWEGIAN CONTINENTAL SHELF

- Personnel (HSE) -

THE NORWEGIAN OIL INDUSTRY ASSOCIATION (OLF)
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1 Introduction
This guideline for deployment of Radio Frequency Identification (RFID) on the Norwegian Continental Shelf (NCS) addresses the main needs and requirements of the offshore industry for operational information in the area of locating and tracking the personnel in case of emergency situations.

2 Domain

2.1 Personnel locating/tracking (HSE)
This part of the guideline addresses the area of personnel HSE. A personnel tracking (PT) system should, in the event of an emergency, be able to determine the current and past locations and identities of all personnel wearing a RFID tag for the purpose of tracking (no surveillance). The system can also offer a real time access control management to ensure the right people in the right place when an incident occurs. A PT system is an offshore emergency preparedness system, not a personnel surveillance system.

3 Business objectives
A platform operating in an offshore environment typically employs hundreds of people. Some operators have platforms that are connected via bridges which creates a centre that can hold up to 1000 persons. Tracking of the personnel is critical, in order that they can be located in an emergency situation. The use of RFID technology can increase efficiencies for the safety and security of rig personnel.

Personnel tracking system implies each person to be equipped with a tag, strategically located readers and communication with the backend systems. The RFID devices are used to track the personnel while monitoring their movement within the platforms. By use of RFID tags it is possible to monitor the location of tags around the facility.
- **Triangulation** - By having the tag close to a reader or by comparing the strength of signal picked up by different readers in the facility, and triangulating this to work out the location of the tag. The degree of accuracy is proportional with the number of readers. Narrow zones to cover the whole platform require a lot of readers and have to be taken into considerations.

![Information flow diagram](image)

- Track personnel in defined zones on offshore platforms and centers: Each person shall wear a personal RFID tag that uniquely identifies him or her. Extended versions of the personnel tracking (PT) system may also include environmental sensors (e.g. temperature, gas detection etc.).

- During normal conditions a personnel tracking (PT) system shall be used to:
  - Allocate a tag to a person; the person is picked from the personnel on board application (e.g. DaWinci).
  - Regularly test/verify that the personnel tracking system and the personnel on board (POB) application (e.g. DaWinci) are synchronized.
  - De-allocates personnel from the tag.
  - Update the personnel on board application (e.g. DaWinci) if passing a gate means change of location.

- During an emergency situation or a drill the demand from the authorities is to ensure full control over all personnel within 25 minutes after an emergency (or drill) situation has occurred. The PT system shall be used to:
  - Automatic muster personnel at muster stations or in muster zones, (lifeboats, bridges, indoor and outdoor muster stations, and emergency personnel meeting points).
  - Manual muster of personnel.
  - Search for missing personnel.

### 3.1 Safety

The RFID equipment shall comply with the exposure limits specified in the following documents:
- EN 50364 “Limitation of human exposure to electromagnetic fields from devices operating in the frequency range 0 Hz to 10 GHz, used in Electronic Article Surveillance (EAS), Radio Frequency Identification (RFID) and similar applications” issued by European Committee for
- Electrotechnical Standardization (CENELEC)
- ANSI/IEEE C95.1 “IEEE Standard for Safety Levels with respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz” issued by American National Standards Institute (ANSI) / Institute of Electrical and Electronics Engineers (IEEE)
- “Guidelines for Limiting Exposure to Time-Varying Electric, Magnetic, and Electromagnetic Fields (up to 300 GHz)” issued by International Commission on Non-Ionizing Radiation Protection (ICNIRIP)

3.2 Quality
It is an absolute necessity that the system can be operated if parts of the system is out (one or more portals can be out but the rest should be active). Enhanced safety and security can be achieved when the operator have real time access to correct localization of all personnel on board. This is of vital importance for the decision makers in any critical situation and contributes to correctness and minimizing of human errors. It is highly important that the right people in any location get the necessary critical information in an emergency situation. Regularly tests of the system to verify technical functionality are necessary. Improved personnel utilization and identifying needs during emergency drills is also of vital importance concerning the quality of safety and security issues.

3.3 Efficiency
Primary, real time monitoring of personnel on board give fast and accurate access to the necessary information needed in an emergency situation and make it easier to ensure full control over the situation. Time is critical and lives may be saved. Secondary, the use of RFID technology for personnel tracking will lead to improved staff utilization, accountability, and enhanced operational efficiency e.g. reduced time consumption during mandatory emergency drills.

3.4 Protection of privacy
In the personnel tracking domain it is important to pay attention to the protection of privacy. The Data Inspectorate in Norway is an independent administrative body under the Ministry of Government Administration and Reform and is the regulatory authority concerning enforcement of the Personal Data Act. The purpose of this Act is to protect persons from violation of their right to privacy through the processing of personal data. The Act shall help to ensure that personal data are processed in accordance with fundamental respect for the right to privacy, including the need to protect personal integrity and private life and ensure that personal data are of adequate quality. The Data Inspectorate also deal with applications for licences, verify statutes and regulations, identify risks to protection of privacy, provide advice and guidance, keep a public record of granted licences, and participate in international co-operation. The Norwegian Personal Data Act reflects all the fundamental and unalterable principles of personal information protection in the EU directives.

National legislative acts, regulations and guidelines:
The Norwegian Ministry of Government Administration and Reform. FOR-2000-12-15 No.1265: Personal Data Regulations. Regulations on the processing of personal data, (Personopplysningsforskriften).


International legislative acts, regulations and guidelines:

- The EU directive 95/46/EC on the protection of individuals with regard to processing of personal data and on the free movement of such data, (Personverndirektivet).
- The EU directive 2002/58/EC on privacy and electronic communications. Concerning the processing of personal data and the protection of privacy in the electronic communication sector, (Kommunikasjonsdirektivet).
- The EU directive 2006/24/EC on the retention of data generated or processed in connection with the provision of public available electronic communications services or of public communications networks and amending Directive 2002/58/EC, (Datalagringssdirektivet).
- The OECD guidelines on protection of privacy and transborder flows of personal data.

Concerning domain of personnel tracking and the protection of privacy the following information is recommend to be easily available for all the users:

- Name and address on the responsible RFID application operator.
- The object of the RFID employment.
- Data processed and stored, (the localization aspect and personalized information in particular).
- Prevailing data storage regulations.
- Whether the data can be accessed or transmitted to a third party.
- Information signs at the relevant locations.
- Contact person for further information.

4 Cost and benefits

The hardware costs of a personnel tracking system are usually relatively small compared to the installation costs. In terms of installation costs, it is important to be aware of the different methods of connecting the systems. If the system is able to integrate into an existing data network then the installation costs are lower than having a new infrastructure. Although because of the nature of the personnel tracking system requirements it may be necessary to implement a new separate system.

Provided correct implementation, no tangible disadvantageous is identified, but the corporate investments and operating costs will be admissible. On the other hand, several tangible benefits are expected:

- Increase the overall safety and security offshore.
- Real time headcount of all personnel on board.
- Faster (real time) and more correct localization of all personnel on board.
- Real time information about the nearest emergency exit.
- Ensure full control over all personnel on board in an emergency situation, including automatic mustering of personnel.
- Extended tags versions, including sensors may also detect health damaging environmental factors and automatically send this information to the database.
- Enhanced efficiency of time-consuming mandatory emergency drills.

Additional benefits beyond the emergency aspects may be:

- Enhanced operational efficiency.
• Improved staff utilization and accountability.
• Increase the efficiency of offshore contingency planning.
• Facilitating resource sharing and cost reduction with respect to personnel movements.
• Facilitate company specific requirements regarding work periods and training requirements.
• Hands free access control.
• Access control to restricted areas. Not only for security reasons, but can also lead to reduced number of lifeboats needed in this area.

It is required for each RFID application deployment to use cost metrics to evaluate the implementation cost and to present different solutions to limit installation costs, since the costs vary dramatically depending on the accuracy required from the location system.

5 Antenna, tags and sensors
The antennas, tags (transponders) and sensors must be suitable for use offshore and confirming to all applicable Norwegian regulations for offshore electrical and radio transmission devices. The vendor must also provide documentation that the equipment can be carried on board a helicopter during travel.

Depending on the business solution active, passive or semi-passive RFID tags can be used, if the required EX/ATEX certificate is available. If the demand is to track personnel as they move between zones the suggested solution is to set up directional portals that detects a tag when passing. This solution may require a semi-passive or active RFID tag. Personnel are directed through a portal set up by fixed antennas near by the reader and may include field activation of the passive or active mode. If the demand is to track personnel as they muster, a passive RFID-tag could be used. This requires the personnel to hold the tag close to the antenna because the reading distance is short. Tags including sensors require some kind of energy storage i.e. a semi-passive or active tag is necessary.

5.1 Frequency
The transmitting frequencies and the power levels used by the RFID tags and readers should respect the values approved by the Norwegian Post and Telecommunication Authority for use on the Norwegian continental shelf. RFID uses the ISM frequency bands, intended for low power short range communication.

For the RFID equipment intended to transmit a type approval is required. The approval procedure depends on several factors, such as the frequency band of operation and the emitted power level. Once the type approval is granted the operator may use the equipment freely if operation is in a license-exempt frequency band, or may apply for a license to transmit if in a non-exempt band.

For the active, passive or semi-passive RFID tags reference should be made to the relevant ISO/IEC air interface standards or protocol specifications. The relevant ISO/IEC standards are listed in appendix of the RFID technology part of the guidelines.

For specific applications the following three crops of technologies are recommended to be used
• Dedicated RTLS active RFID systems
• WLAN based systems
• Ultra Wide Band (UWB) system

These have very different deployment characteristics and need very different infrastructure.
Transmission and power:
- Transmitting power: Limitations as required by the implemented standard and less than 3mW.
- Transmit/read range: Up to 100m in free air that depends on the application. The actual read range is influenced by the transmitted power, reader sensitivity, antenna-type, tag-type and orientation.
- Repetition rate/ping rate: Transmit a pre-programmed data string in regular intervals, e.g. 0.5-60 seconds in 0.5 seconds steps.
- Certifications: CE EN 300 220-1,3, ETSI EN 301 489-1,3.

For compliance is required to refer to ETSI standards (see the appendix in the RFID technology part of the guidelines).

5.2 EX/ATEX
Ignition protection in explosive atmosphere is required. EX proof is an absolute demand for the field equipment (antennas, tags, sensors etc.). These may be solved by certify each elements or by mounting the equipments in a cabinet that has the needed certification and have everything certified as a whole unit. If the antenna is active or semi-passive, it is required that necessary EX/ATEX certification is present. If the antenna is passive, no EX/ATEX certification is needed, but note that the antenna shall be EX/ATEX certified as part of the whole unit.

The tags must have the minimum certifications:
- EX/ATEX certification: Zone 0 or alternatively be certified as Intrinsically Safe (IS) - (to be decided by the operators on case by case basis).
- Gas group certification: IIC.
- Temperature certification: T6 (-40°C to +85°C).

Other field equipment:
- EX/ATEX certification: Zone 1 or alternatively be certified as Intrinsically Safe (IS) or alternatively (to be decided by the operators on case by case basis).

5.3 Environment
These equipments will be worn in harsh environment, including temperature changes, humidity, wet, strong winds and jets of water, salt, ice, aggressive gases and liquids, physical strain like sharp hits, heavy impact, shock, metal constructions and frequency interference. Harsh environment exposed equipment should work properly both during and after the exposure and be materially unaffected by these external environment factors. Important parameters and specifications are:

Only RFID tags:
- Storage/washing temperature: Up to 100°C.
- Water proof (withstand washing)
- Material: Non-allergic and sound hygienic.
- Shock: Multiple drops to concrete from 1.5m.
- The active tags must be certified to carry on board the helicopter when they are activated.

All field equipment:
- Operating temperature: From -40°C to +85°C.
- Relative humidity: Up to 100% RH and be non-condensing.
- Material: Water proof (IP), all used material both external and internal shall be corrosion consistent, fire resistant, low smoke and halogen free.
- Wind speeds: Withstand wind speeds at 25m/s with gusts up to 45m/s.
• Vibration: Up to 3G, 20 sine wave cycles, 5Hz to 150Hz, (DIN IEC 68-2-6/ 5G), noise 5Hz to 1000Hz, 30min., (DIN IEC 68-2-64).


The selection of the tag will consider the read range requirements, the material for which the tag is applied. The material properties used in oil and gas industry have a tendency to alter the resonant tag antenna properties (e.g., potentially detuning the antenna, resulting in a frequency shift and hence lowering performance), that could require the use of tags with a relatively flat frequency response and broad bandwidth.

Properties of the tagged materials and packaging can impact tag performance. It’s important to verify the general characteristics of the material under consideration. Aqueous products, liquid detergents, can be very challenging due to the physical properties of water, which absorbs the available RF energy. Metals and metallized/foil-lined packaging are as well important to be tested. Spacers are generally used to isolate the tag from most products containing metal. Carbon or graphite-impregnated plastics, which are typically used for the black colouring, can seriously impede the tag performance.

Platform personnel have restrictions from wearing watches, necklaces or anything else that could get tangled in the equipment. Wearing a tag must allow unimpeded movements of personnel. The tags must be designed with flexible straps or bands for comfortable wear around the neck wrist etc. Straps intended for neckwear or wrist shall be designed to break before injury may occur. The design shall be based on a hygienic solution (e.g. water and sound hygienic) such that cleaning and replacement of straps or bands can be readily performed. The tags and the straps need to be cleaned after each time a person has been using it. Using a dishwasher for this purpose has proven to be an effective solution, and causes a temperature towards 100°C which the tags and the straps must be able to bear without any damage. Close connected to the tags the following items could be a part of the delivery:
• A rack used for storage of tags in the reception area when tags are handed over to arriving personnel.
• A device for activation of tags and connected a person to a tag.
• A label printer.
• A device located in the reception or sky lobby used by personnel to drop their tags when they leave. The box must include tools with functionality to:
  • Transfer a person to the interim/transportation zone.
  • Detach a tag from a person.
  • Deactivate the tag.

5.4 ID numbering

One of the most important premises for information sharing, tracking and localization is unique identification. Every personalized tag must be associated with a unique identifier. Important aspects of the ID numbering are that it is well defined, valid, robust, reliable, and usable. The unique ID issue for Oil and Gas industry is presented in an own part of the guidelines.

RFID Tags for the purpose of personnel tracking should have the same standard as or be compatible with all other tags used in the Oil industry on the Norwegian continental shelf, e.g. follow a global numbering standard or built upon a global standard superstructure to ensure compatibility.
• Programmability: The user data is programmable / reprogrammable, but the unique ID is fixed for a standard user.
- Programming and activation: Wireless activation / reprogrammable by proximity device over a distance of maximum 5cm.
- Memory capacity: User definable (between 9 bytes and up to 4 kbytes).

5.5 Semantics
Semantics in this context means that the tags and sensors must play together internally and with the readers externally. The tags must be able to communicate with the intended readers, i.e. not only the frequency must be concurrent, but also the data format must be recognizable. The implemented ID numbering tag standard for use in the area of personnel tracking will imply specific standardized meanings which will be the basis for use and communication.

5.6 Security
The body of each tag shall be physically marked with a permanent visible unique identification number. Current label could be removed or damaged. For radio frequency purposes the tag can contain an ID number only, or additional information related to the personnel. By using the tag as a marker ID only and the possible additional information in a database, the information accessibility may increases and the security challenges are reduced. Some relevant issues are listed below:
- Destroyed identity.
- Changed, stolen or other unauthorized allocation of identity.
- Unauthorized reading of identity.

The oil operators using RFID personnel tracking will require that every person working offshore will always wear the tag for the duration of his/her offshore stay. For the active RFID tags the battery powered sources are required to have the capability to operate satisfactory for a minimum of 4 years, without replacement or recharging. For active RFID tags it is required the following:
- Certification: CE (EN 300 220-1,-3, ETSI EN 301 489-1,-3).
- Power source: Non-replaceable, built-in batteries, moulded, EX tags.
- Battery life: Minimum 4 years @ 2 second intervals for beacon type tags.
- Battery life: Minimum 5 years for transponder type tags.
- Low battery indication is required to be included in the tag.

6 Antenna and readers
At least three different types of readers including antennas will be used:
- **Directional portals** - A directional portal is able to detect the direction of travel and is used to set the border between two zones and to detect persons entering or leaving the lifeboats.
- **Non directional portals** - A muster station is a non directional portal, where the personnel are mustered as they arrive and can be defined within a zone.
- **Handheld readers** - Compatible handheld readers used for backup.

Portal designs may vary between different suppliers. Common for the portals is that they require equipment that enables reading and interim storing of a detected RFID tag.

A portal design may require the equipment to be mounted in or connected to a cabinet. Depending on the requirements from the operator the portals can be set up with:
- One cabinet can contain:
  - Reader, (including antenna).
  - Hub (for processing and storing of data).
  - Switch.
  - Media converter.
- Heater plate.
- Power supply.
- Battery charger.
- Fuses.
- Power switch.
- UPS power.
- Battery backup power.
- Gas detector, (local for this portal).

Other Portal designs may utilize an ATEX certified self contained reader unit that can be mounted adjacent to the portal antenna.

6.1 Frequency

RFID uses ISM frequency bands, intended for low power short range communication. The reading frequency must be in accordance with the relevant specifications and standards given in chapter Error! Reference source not found. RFID uses the ISM frequency bands and multi frequency readers may be necessary.

For RFID readers, surrounding environment will impact the antenna performance, as the antenna serves to focus and direct the RF energy. Different types, including circularly polarized antennas, linearly polarized antennas, and close coupled antennas can be used. Proper description of the type of the antenna is required. Readers with adjustable RF power levels could be considered and possibly specified.

- Operating frequency: The receiver must be tag compatible
- Read/transmit range: Up to 100m in free air that depends on the application. The actual read range is influenced by the transmitted power, reader sensitivity, antenna-type, tag-type and orientation. The reader could include a received signal strength indication by use of adjustable RSSI filtering (e.g. according to the IEEE 802.11 protocol).
- Number of antennas: Minimum two, depending on the application (multi frequency options).
- Antenna connection: Appropriate for the area classification, for example, SMA.
- Read memory/buffer: EEPROM, up to 400 tags. Extension possibility for 2000 tags.
- Programmable: Program updates via host computer interface.
- Host interface: Examples are: 2-wire serial, RS 422, Daisy chain.
- Baud rate: Suitable for application, for example 115kBaud.
- Certifications: CE (EN 300 220-1, -3; ETSI EN 301 489-1, -3), FCC Part 15 (US), Industry Canada.

6.2 EX/ATEX

Ignition protection in explosive atmosphere is required. In most applications there is an absolute demand for EX/ATEX certification of the antennas, readers and belonging equipment. These may be solved by certify each elements or by mounting the equipments in a cabinet that has the needed certification and have everything certified as a whole unit/portal.

- EX/ATEX certification:
  - Zone 0 or Intrinsically Safe for handheld readers.
  - Zone 0, 1 or 2 for the directional portals and the non directional portals (muster stations) depending on the localization.
- Gas group certification: IIC; gas detector, trip level 60% LEL (only EX Zone2).
- Temperature certification:
  - T6 for handheld readers.
  - T4 for the directional portals and the non directional portals (muster stations).
6.3 Environment
Most of these equipments will be placed (portals) or worn (handheld) in a harsh environment, including temperature changes, humidity, wet, strong winds and jets of water, salt, ice, aggressive gases and liquids, physical strain like sharp hits, heavy impact, shock, metal constructions and frequency interference. Harsh environment exposed equipment should work properly both during and after the exposure. Depending on the particular application and placement, important parameters are:

- Operating temperature:
  - From -40°C to +85°C, (temperature class T6).
  - From -40°C to +135°C, (temperature class T4).
- Relative humidity: Up to 100% RH and be non-condensing.
- Material: All used material both external and internal shall be corrosion consistent, fire resistant, low smoke and halogen free.
- Wind speeds: Withstand wind speeds at 25m/s with gusts up to 45m/s.
- Shock: For handheld readers up to 50G, (DIN IEC 68-2-27) and multiple drops to concrete from 1.5m.
- Vibration: Up to 3G, 20 sine wave cycles, 5Hz to 150Hz, (DIN IEC 68-2-6/ 5G), noise 5Hz to 1000Hz, 30min., (DIN IEC 68-2-64).

Portals with equipment certified only for zone 2 must be delivered with a gas detector that shuts down the equipment when gas detected, the trip level must be set at 60% LEL (lower explosive limit).

6.4 Semantics
Semantics in this context has two aspects, the compatibility between the readers and tags (ref. chapter Error! Reference source not found.), and the compatibility between the readers and the middleware, (data capturing application). The definition of middleware can vary and the application may be partly integrated in the reader.

Technological bridging procedures will be parts of the work the Oil and Gas industry will have to do, to be able to implement the prevailing standard for information sharing, tracking and localization. DaWinci is the personnel on board application used by the operators on the Norwegian sector, and SAP is the enterprise resource planning (ERP) system used by most of the operators on the Norwegian sector.

6.5 Security
These solutions are not for surveillance of personnel. This is strictly for safety preparedness and shall primarily be used during an emergency or drill situation. It is necessary to allocate personnel to tags as they arrive or leave the actual offshore platform or center. No personified historical data should be kept for a long time and only the current location for a person is maintained. All personnel entering a reading area under the given circumstances below must be registered.

Each non-directional portal (muster station) must satisfy the detection accuracy with of 100% to detect, monitor and display in real time. Typically, a muster station would be in a room or an area where people meet for mustering. If not everybody detected they will be reported as missing personnel.

- The reading area must cover the whole muster station and all people presence must be detected.
• Each directional portal must satisfy the detection accuracy with of 100% to detect, monitor 
  and display in real time for the following scenarios:
• A group of 50 persons passing through the gate at a rate of 4 persons per second.
• A group of 10 persons passing through the gate at a rate of ten 10 persons per second.

The solution should have the possibility to monitor/analyze the detection rate over time. A robust 
solution is required with redundancy as applicable of most of the equipment like antennas and 
readers, network and network components, servers, and client PC. To ensure that the system will 
continue functioning in case of power loss, battery backup is required. However, the loss of any 
portal shall not affect the other portals from functioning.

7 Application integration

The personnel tracking system relies on all personnel wearing tags, readers distributed at 
selected locations around the hazardous environment and an adjusted data capturing system. In 
addition there will always be a data communication requirement to direct data collected to a 
central offshore controller and an offshore or onshore data collection point. To avoid confusion 
following a major emergency, it is essential that a reliable data network exists both on and off 
the installation.

Seamless integration with the personnel on board (POB) application (e.g. DaWinci) should be 
achievable. Could also be integrated with the enterprise resource planning (ERP) system e.g.
SAP, depending on business operator rules and regulations. The solution that will be 
implemented needs to interface with shore based heliports and platform administration via the 
personnel on board system.

It is preferable if the personnel controllers can view graphical displays on a computer screen that 
give an overview of the members of staff in each area in case of emergency. Even the system 
could store more than just the ID of an individual, like personnel details, full work experience, 
survival and medical certificates with expiration dates, allocated muster stations and 
photographs, this guideline refers only at the ID information and the scenario in case of 
emergency situations. All personnel information and details are stored in POB application (e.g.
DaWinci) for each person.

Integrated operations (IO) denotes the kind of operation where use is made of the opportunities 
which new and improved information technology provide by utilizing approximate real-time data 
to achieve better and quicker decisions. To achieve full benefit of integrated operations, the oil 
and gas industry needs to cooperate on data integration across disciplines and organizational 
boundaries. The semantic web, based on ISO and W3C standards facilitate this strategy. Fig. 3 
illustrates the information integration strategy based on common extensible markup language 
(XML) schemas and the semantic web. Real time data are sent from the platform to the operation 
centre and expert and knowledge data from the operation centre to the rig.
The semantic web is an infrastructure for web services. It is a web of data that provides a common framework that allows data to be shared and reused across application, enterprise, and community boundaries. It is a collaborative effort led by World Wide Web Consortium (W3C) with participation from a large number of research and industrial partners.

Ontology in the semantic web is a hierarchal data structure containing the concepts, properties, rules, and relationships used to describe and represent a specific domain. It is possible classify the terms used in a particular application, characterize possible relationships, and define possible constraints on using those relationships.

The extensible markup language (XML) is a general purpose specification for creating custom markup languages. It allows user defined mark-up elements and the purpose is to aid information systems in sharing structures data, especially via the internet. XML is an open standard and is recommended by the W3C organization.

The syntax used by the application is to allocate tags to personnel in e.g. DaWinci using a e.g. DaWinci ID. Automatic change the location of personnel:

- In e.g. DaWinci when a person changes location in the personnel tracking system.
- In the personnel tracking system when a person changes location in e.g. DaWinci.

Transfer of data between the applications shall be based on any business need the individual operator may have.

For the personnel application security requirements need the following precautionary arrangements:

- Limited PCs with the client installed.
- Restricted user access to the personnel tracking application.
- It is recommended that all communication between external applications is done through the Secure Oil Information Link (SOIL) network or company specific.

The personnel application requires integration with following business processes:

- Personnel on board logistics.
- Personnel on board control.
• Mustering solutions.

The application is integrated with the enterprise resource planning (ERP) system and the inter operator personnel on board (POB) application e.g. DaWinci used by the operators on the Norwegian continental shelf.

Handing out personal tags to personnel going offshore and collecting the tags going onshore can be done on the heliports. Personnel tracking solutions should enable a common system for combined ID/Personnel tracing tag for personnel offshore.
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<tr>
<td>Programmable</td>
<td>Wireless activation/reprogrammable by proximity device (max. 5cm).</td>
<td>Program updates via host computer interface.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Air interface and related properties:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>General annotations</td>
<td>Recommended:</td>
<td>The handheld readers are for backup purposes only.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standard/Protocol/Frequency</td>
<td>Global standard/ISM frequency band, (&lt;135kHz, 13.56MHz, 433MHz, 860-960MHz or 2.45GHz).</td>
<td>Tag compatible.</td>
<td>&lt;135kHz (ISO 11784/5, 14223, ISO/IEC 18000-2, RuBee/IEEE P1902.1); 13.56MHz (ISO 14443, 15693, ISO/IEC18000-3); 433MHz (ISO/IEC 18000-7), 860-960MHz (ISO/IEC 18000-6, EPC Class1/Gen2); 2.45GHz (ISO/IEC 18000-4).</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transmission Power</td>
<td>Depending on energy from reader.</td>
<td>Depending on frequency band and application.</td>
<td>Depending on frequency band, application and human exposure limits (passive tag applications).</td>
<td>ETSI standards (EN 300220, EN 300 330, EN 300 440).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Read range</td>
<td>See Readers.</td>
<td>See Readers.</td>
<td>Up to TBD m. Up to 100m. Up to 100m.</td>
<td>Distance in free air.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Detection accuracy</td>
<td>See Readers.</td>
<td>See Readers.</td>
<td>100%</td>
<td>The presence of metal and electromagnetic interference must be considered.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Power:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power source</td>
<td>No battery, induced by the reader.</td>
<td>Rechargeable battery.</td>
<td>10V-30V DC (offshore).</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Battery indicator and backup.</td>
<td>-</td>
<td>Low battery indication.</td>
<td>Low battery indication.</td>
<td>Backup battery required, 30min. operation/5 years. Low battery indication.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Environmental properties, incl. ignition protection in explosive atmosphere:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EX/ATEX.</td>
<td>EX Zone 0.</td>
<td>EX Zone 0, 1 or 2 (depending on the localization of the portal).</td>
<td>Onshore readers do not need EX/ATEX certification normally.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gas certification/detector</td>
<td>Certification group IIC.</td>
<td>Certification group IIC. Gas detector, trip level 60% LEL (only EX Zone 2).</td>
<td>Onshore readers do not need Gas certification or detectors normally.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operating temperature</td>
<td>-40°C to +85°C.</td>
<td>See Tags.</td>
<td>See Tags.</td>
<td>Class T6 (85°C); Class T4 (135°C); Depending on the localization.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Humidity</td>
<td>100% RH and be non-condensing.</td>
<td>See Tags.</td>
<td>See Tags.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Material</td>
<td>Corrosion and fire resistant, low smoke, halogen free, withstands aggressive gases/liquids and physical strain, and non-allergic.</td>
<td>Corrosion resistant, fire resistant, low smoke and halogen free, withstands aggressive gases/liquids and physical strain.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Storage/ washing</td>
<td>Temperatures up to 100°C and sound hygienic.</td>
<td></td>
<td>IP ?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shock</td>
<td>Up to 5G, multiple drops 1.5m.</td>
<td>See Tags.</td>
<td>See Tags.</td>
<td>DIN IEC 68-2-27.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vibration</td>
<td>-</td>
<td>-</td>
<td>Up to 3G, 20 sine cycles, 5Hz-150Hz.</td>
<td>DIN IEC 68-2-6; DIN IEC 68-2-64.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note! All prevailing regulations given by the authoritative body within the application must be followed, (Petroleum Safety Authority Norway, Norwegian Post and Telecommunication Authority, The Data Inspectorate in Norway, and Norwegian Radiation Protection Authority etc.).