

JOB DEMANDS ANALYSIS

STANDBY VESSEL WATER RESCUE BY FAST RESCUE CRAFT (FRC) CREW

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OBJECTIVES OF ANALYSIS

When a standby vessel is present, a well-equipped, well-trained, and well-practiced FRC Crew provides the best opportunity for the timely rescue of a casualty in the water. The FRC crew members can only be effective during a rescue if they are appropriately protected from the elements and other hazards, and do not become injured themselves.

On 19 October 2020, the CNSOPB's Chief Safety Officer (CSO) requested a Job Demands Analysis (JDA) with a focus on physical demands, to examine standby vessel rescue activities by Fast Rescue Craft (FRC) crew members. The purpose of this analysis is to provide a detailed description and classification of the physical requirements to remove rescue manikins from the water during a standby boat rescue, to determine offshore medical and general physical requirements for this task.

The CSO requested information concerning best ergonomic practices during FRC rescues, to ensure safety and guide employee training. Recommendations regarding the optimal total manikin weight for practice drills, to ensure fidelity of training while minimizing risk of injury to FRC crew, was also requested.

This JDA was completed on 30 November 2020, between the hours of 9:00 am and 11:30 am. Information was gathered by:

- Observing workers performing FRC rescues at Pier 9 in Halifax, NS. Photographs and video footage were taken during this observation and reviewed following the assessment.

- Examining equipment used during FRC rescues.
- Interviewing crew members following demonstration.
- Interviewing local training providers' staff responsible for delivering fast rescue craft training.
- Reviewing requirements for Marine Medical Examinations and medical requirements for seafarers in general.
- Liaising with the Chief Safety Officer and the Advisor on Health, Safety & Environment (Canada-Nova Scotia Offshore Petroleum Board).

This report was reviewed by the Chief Safety Officer and the Advisor on Health, Safety & Environment prior to its finalization.

SUMMARY

Standby vessel rescue drills by Fast Rescue Craft (FRC) crew members involve retrieving a rescue manikin from the water to simulate an actual casualty rescue. Standby vessel rescues are executed by the FRC, a rigid motorized boat, in tandem with the main standby rescue vessel. Crew members are required to locate the manikin, approach with the FRC, and then lift the manikin into the boat.

Based on writer's observations and the information gathered for this analysis, the task of **FRC rescue** requires a **heavy** physical demand as outlined by the Dictionary of Occupational Titles (Volume II, Fourth Edition, Revised 1991). The Physical Demands Strength Rating reflects the estimated overall strength requirement of the job. Definitions are provided in the Appendix on page 16. Crew members performing this task must be able to work in a variety of body positions and to use upper limb coordination and physical strength to position and lift manikins into the boat. It requires lifting up to 80 kg, shared between two crew members on an occasional basis, or a maximum lift of 40 kg for each individual crew member.

The use of a manikin during drill exercises assumes a worst-case scenario where the casualty is not able to self-assist during the rescue activity, and the weight of actual casualties will vary in the event of a live rescue. The weight of manikins used during rescue drills should be representative of an actual casualty to ensure fidelity of training, while minimizing risk to FRC crew during rescue drills. In addition to the manikin's base weight, consideration must be given to the added weight of an immersion suit if used and resultant water ingress, which increases its total weight. A variety of manikin weights may be used for practice drills and for this analysis a 45 kg manikin was used, with an additional 15 kg weight added by its immersion suit and water ingress, for a total of 60 kg lifted by two crew members.

Recommendations regarding the weight range for rescue manikins were based on the average weight of a seafarer¹ and parameters for a **heavy** physical demand, with allowance for a 5 kg variance at the upper and lower limits of those parameters. Although FRC crew may be required to lift lighter or heavier loads during an actual rescue, writer recommends keeping physical demands within a **heavy** weight range for practice drills, to ensure fidelity of training while minimizing risk of injury. See Table 1 on page 15 for recommendations regarding rescue manikin weight.

¹ CNSOPB. (2010, April 20). Safety Directive Lifesaving Equipment Arrangements [Notice]. Retrieved from https://www.cnsopb.ns.ca/sites/default/files/resource/lifesaving_equipment_safety_directive.pdf

During rescue drills, work is performed within a maximum work zone and requires reaching over the side of the FRC to grasp and position manikins and to move them into position on the boat. This job task requires excellent mobility and balance to stand, walk, crouch and kneel on the boat in varying sea states, as well as good gross handling abilities to manipulate manikins. The table on pages 8-9 outlines the overall physical demands with definitions provided in the Appendix.

All workers are required to pass a Marine Medical Examination prior to working on the main vessel. During standby boat rescue drills, they work in close cooperation with the coxswain and 2-3 additional crew members onboard the FRC. The task requires adequate vision, including spatial and depth perception to locate and maneuver manikins into position, and adequate hearing to communicate in the presence of additional noise such as the boat engine and weather.

Specific ergonomic considerations include use of proper back mechanics while lifting, performing stretching exercises prior to rescue drills, performing drills in good weather with low surf, switching positions during lifting, and using a rescue frame, such as a Dacon Rescue Frame, when possible, to minimize extended reaching. Detailed guidelines are outlined on page 12. Training recommendations include education on proper back mechanics while lifting, with recommendations outlined on page 13.

Crew members must demonstrate the ability to perform all of the physical skills and meet the medical requirements outlined in this assessment in order to safely and competently perform the essential duties of an FRC team member.



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Occupational Therapist

Job Task: Removal of rescue manikins from the water by Fast Rescue Craft (FRC) crew members.

Task Description: There are two basic drill scenarios, the first which involves FRC crew members practicing removing a rescue manikin from the water on a weekly basis. These rescue drills help to prepare for an actual rescue event. A rescue hook is used to position the manikin into a Dacon Rescue Frame that is positioned alongside the FRC, with the manikin's head facing the stern. Two crew members then use the rescue frame to lift the manikin onto the edge of the boat. The manikin is then shifted toward the bow, rolled into the boat, and repositioned as needed on the FRC deck.

A mass causality drill for standby vessel certification is also performed every 3 years, which involves rescuing 21 manikins or more, depending on the certified capacity, within 75 minutes. These drills are necessary to ensure the standby vessels and crew members are properly prepared for an actual rescue event.

Work Schedule: Crew members typically work 28-day rotations (28 days on board/28 days off). While in port, they work 12-hour shifts, followed by 12 hours off. While at sea, crew members work 6-hour shifts, followed by 6 hours off. Rescue drills to practice removing manikins from the water are performed at least once biweekly, however some operators may require weekly drills.

Break Schedule: No breaks are taken during rescue drills. Given the nature of the work, break times are not standardized but there is normally a coffee break on each shift.

(Net Time Worked): 12 hours in a 24-hour period.

Overtime Worked: Overtime is only approved under special circumstances.

Staff Complement: The number of crew members on each vessel varies. During rescue drills one crew member (the coxswain) drives the boat and 2-3 crew members retrieve the manikin from the water. This typically includes one deckhand and the third engineer. The team on the FRC during this assessment was composed of 2 crew members and one coxswain.

Education or Skill Required:

Crew members take a Fast Rescue Craft training course which meets the requirements set out in the International Maritime Organization's Standard for Training, Certification and Watchkeeping (STCW) and are provided with a Certificate of Proficiency in Fast Rescue Boats. They are required to maintain certification every 5 years, which can be achieved by demonstrating continued proficiency through onboard training and drills, and refresher training is available to aid recertification if needed.

Additional training considerations: Typically, a person must be at least 16 years of age and hold a training certificate in Proficiency in Survival Craft and Rescue Boats other than Fast Rescue Boats. Crew members must be qualified to work on the main vessel, which requires passing a Transport Canada Marine Medical Examination by a qualified Marine Medical Examiner. A summary of medical requirements includes:

- Being able-bodied, agile, and able to cope with the ship's movements, which may fluctuate depending on weather and sea conditions.

- Demonstration of sufficient balance, mobility, speed of movement and physical effort to mobilize throughout the ship while carrying heavy tools or equipment, and ability to climb the ship's mast (up to 9 meters above deck).
- No limitations of movement in the upper and lower limb joints greater than 30 percent.
- Able to lift and carry a weight of 22 kg.
- Uncorrected vision of at least 6/60 in each eye and corrected or uncorrected distant vision of at least 6/12 in each eye, and corrected or uncorrected near vision of N5 print size at a distance of 30 cm to 50 cm.
- Ability to see objects in a normal range of periphery and demonstrate normal depth perception.
- Sufficient colour vision, depending upon occupation on board.
- Hearing that is conversationally adequate in both ears: ability to hear conversational voice communication at a distance of 3 meters and a soft-whispered voice at a distance of 2 meters (hearing aids may be worn).

Applicants undergo a chest X-ray, dental examination, urinalysis, and possibly an electrocardiogram.²

Training generally requires a minimum of 23 hours, which includes a combination of lecture and practical training with skill demonstration (in pool or open water). Training typically includes the following components:

1. Review of written information concerning winter and ice navigation, the International Life-Saving Appliance Code and the International Aeronautical and Maritime Search and Rescue Manual.
2. Visual or audio-visual presentations on types of fast rescue boats, hypothermia, cold shock, launching, handling, and recovering a fast rescue craft in rough weather.
3. Review of safety and first aid equipment, including the standby rescue boat and its operating components.
4. Launching and recovery, which requires demonstration of competency and includes safety precautions, launching and recovery in rough seas, and drills in launching and recovery.
5. Maneuvering of FRC, which requires demonstration of competency and includes maneuvering at slow and fast speeds, boat handling in adverse weather, towing, pacing, and transfer.
6. Righting a capsized fast rescue boat, which requires demonstration of competency.
7. Search patterns and rescue, which requires demonstration of competency and includes initial information and action, search patterns, rescuing survivors, casualty care, helicopter operation, and drills in search and rescue.
8. Maintenance and emergency repairs, which includes describing maintenance tasks and repairs.
9. Evaluation, which includes questions covering course content and practical assessment demonstrated during the course (includes at least one towing drill, one pacing/transfer drill, and one search and rescue drill).

Practice rescue drills are performed as required on a weekly or biweekly basis. A "toolbox talk" is performed prior to rescue drills, which includes a review of the rescue task to be performed that day.

² Transport Canada (2007) Medical Examination of Seafarers Physician Guide. Retrieved from https://www.budaihajoorvosicentrum.hu/wp-content/uploads/2018/04/can_med_guide_2013.pdf

Production Rate or Workload: Crew members generally rescue one or more manikins during rescue drills. The actual weight of the rescue manikin varies depending on the manikin and is increased if an immersion suit is used. Based on information provided by the CSO, the Advisor on Health, Safety & Environment, as well as the crew present for this assessment, it is estimated that the use of an immersion suit with resultant water ingress increases the total weight of the manikin by 15 kg. The observed manikin weight for this assessment was 45 kg, adding weight for the immersion suit and water ingress for a total of 60 kg.

During a mass rescue drill, the number of casualties to be rescued within the expected 75-minute timeframe is 10% of the certified survivor capacity of the vessel. The vessel assessed for this report has a certified survivor capacity of 300 casualties. This means crew members are expected to rescue 30 casualties within 75 minutes. This equates to 1 rescue every 2.5 minutes during the mass rescue drill for the subject vessel.

The pace of rescue activities is affected by several factors including the weight of the casualty, distance between casualties in the water, and environmental conditions such as precipitation, wind, and surf conditions on the water during the rescue.

SPECIFIC TASK DUTIES

Essential Functions

The essential functions of a task include all steps required to complete that task; in this case, the steps required to remove manikins from the water by FRC crew members during a rescue drill. Prior to the rescue drill, crew members don an anti-exposure suit and other PPE such as head protection and gloves and position themselves in the FRC. Crew members are required to locate the manikin, approach with the FRC, and then lift the manikin into the boat.

The task of performing a standby vessel water rescue by FRC crew includes the following essential functions:

1. The crew identifies the location of the manikin. The coxswain approaches and positions the boat alongside the manikin, prior to retrieval. The Dacon Rescue Frame is rolled out alongside the FRC by the 2 additional crew members.
2. The crew member closest to the bow of the boat uses a hook, in combination with leaning and reaching over the side of the FRC, to grasp the manikin and position its head toward the stern of the boat. This crew member then uses the hook or their hands to move the manikin onto the frame, with the second crew member reaching and grasping the upper part of the manikin to assist in positioning it onto the frame, parallel to the boat.
3. The 2 crew members then perform a series of 3 lifts with the frame, by grasping its rungs with both hands palms down, counting to 3, and then leaning back to pull the frame upward to lift the manikin from the water. After each lift, the crew members reach forward to grasp lower rungs of the frame, while observing the second crew member to ensure they are reaching for rungs at the same horizontal point along the frame. The frame folds outward and away from the FRC, while the crew are performing each lift.
4. Once the manikin is positioned on the edge of the FRC, the 2 crew members grasp the torso and feet respectively and slide the manikin approximately 2 feet toward to bow of the boat, before rolling it into the boat. The crew member at the bow pulls most of the weight, while grasping the manikin's feet.

5. The 2 crew members then bend and lift the manikin by the torso and feet and shift it toward the middle of the FRC craft. Once the manikin is positioned clear of the edge of the boat, they are ready to proceed to their next manikin retrieval if necessary.

It was observed that 2 FRC crew placed the manikin into the water, prior to the rescue drill, by lifting its feet and torso and then swinging it over the edge of the FRC. Writer was informed that this is not always standard practice and that other methods may be used to place manikins in the water, such as deploying them from the main vessel. As such, this task was not included as an essential function of the FRC rescue task. Ergonomic considerations if the manikin is deployed by FRC crew are discussed on page 12 of this analysis.

Although not observed by writer, it is understood that other methods may be used to lift manikins into the FRC during practice drills and actual rescues. The same ergonomic principles, outlined on pages 12-13, should be applied during any lifting activity, to minimize risk of injury to crew.

OVERALL PHYSICAL DEMANDS

Activities Rated by Physical Demand						
Activity	Job Demand Level					Comments
	S	L	M	H	VH	
Lift High	X					
Lift Mid				X		Crew members lean over the edge of the FRC to position the manikin on the frame. They then lift up to 80 kg, divided between them, using the frame to assist to bring the manikin to the edge of the FRC. The crew member positioned closest to the stern lifts more weight than their counterpart when pulling up the frame, as the manikin's torso is positioned on this end.
Lift Low				X		
Lift Full	X					
Carry				X		The crew member pulling the feet of the manikin on the bow side carries more weight than their counterpart when shifting the manikin along the edge of the FRC. Once it is rolled into the boat, the crew member toward the stern lifts more weight when moving the manikin toward the centre, upper bow of the boat. The crew member on the bow side pulls on the manikin's feet to assist when moving it into position.
Push/pull				X		
Activities Rated by Frequency and Duration						
Activity	Job Demand Level				Comments	
	C	F	O	N		
Sitting				X		
Standing	X				Crew members stand throughout the duration of the rescue drill.	
Walk		X			The crew members walk 3-4 steps at a time on the FRC deck during rescue drills. This area is a firm surface but may require additional care in icy/slippery conditions.	
Climb				X		
Balance	X				Crew members must adjust for movements of the FRC during rescues, including sudden changes due to surf conditions and adjustments in the boat's position while driving between casualties and maneuvering for manikin retrieval.	
Stoop		X			Crew members bend at the waist with arms fully extended and may also kneel or crouch, while positioning the manikin into the frame at the side of the FRC, moving it into the boat, and positioning it on the FRC deck.	
Kneel		X				
Crouch		X				
Crawl				X		
Reach		X			Crew members' arms are fully extended while reaching and bringing the manikin into position on the frame, when lifting the frame with the manikin in place, and moving and positioning the manikin toward the bow of the boat.	
Handling		X			Handling and use of finger strength and feeling is required to grasp the manikin and place it into position on the frame, when pulling the frame up, and repositioning the manikin on the edge of the FRC and once in the boat. This movement may require additional force, as the crew members are required to wear thick gloves with their anti-exposure suits. Rubber texture on these gloves improves grip during these activities.	
Fingering		X				
Feeling		X				

Cont.

Activities Rated by Frequency and Duration					
Activity	Job Demand Level				Comments
	C	F	O	N	
Eye/ Hand/ Foot		X			Crew members must work together to ensure a coordinated approach when lifting manikins on the frame and moving them within the FRC, while considering additional environmental factors such as surf conditions and weather.
Other/ Awkward Positions			X		Crew members may bend and twist into awkward positions while positioning the manikin in the frame and moving the manikin on the FRC deck.

PERCEPTUAL DEMANDS

Talking: In person verbal communication is required to communicate with the coxswain and other crew members.

Vision: Both near and far vision is required for the crew members to complete rescue drills. Good depth perception is required to align manikins and ensure they are properly positioned on the frame and when reaching forward to grasp rungs of the frame, in synch with the second crew member. The ability to identify and distinguish colors and variances in colour is required to identify the location of manikins in the water.

Adequate field of vision involves observing an area that can be seen up and down or to the right or left while eyes are fixed on a given point. This skill is required when locating manikins in the water and is particularly important for the coxswain when locating manikins or casualties for retrieval.

Hearing: Crew members require sufficient hearing for verbal communication with other crew members during rescue activities. This is important during the process of locating manikins or casualties in the water, as the crew members need to communicate and prepare as they approach for a retrieval. During the lifting process, crew members must effectively communicate with each other to ensure lifting occurs in a synchronized fashion, as lapses in communication may result in one crew member lifting individually, thus supporting more weight than their counterpart, which increases risk of injury.

The crew members' ability to communicate may be affected by environmental factors, such as wind and surf conditions, as well as the anti-exposure suit hood, which covers their ears.

Tactile Sensation: Tactile sensation is required as crew members may work in low light conditions, using their hands to assist with positioning manikins.

Smell/Taste: Performing rescue drills or retrieval of casualties does not require smell or taste sensations.

Aptitudes: Based on observations during this physical demands analysis, performing manikin retrievals or rescue activities on the FRC requires an average general learning ability; verbal, visual, hearing and spatial perception abilities, including depth perception.

WORK AREA

General Description: Work is performed in an outdoor environment, which may vary according to weather and surf conditions. Work is performed on the FRC, which is a smaller, motorized, rigid boat, that is lowered from the main vessel.

Work Surfaces: Crew members perform rescues while standing on the FRC craft, which is a vessel composed of hard rubber surfaces.

Floor Surfaces: Hard rubber surface that may be affected by environmental factors such as water, snow and ice.

Seating Used: N/A – Crew members do not normally sit while performing tasks on the FRC.

Physical Accessibility: Crew members are required to adapt to various conditions while performing rescues on the FRC, which may include stepping over manikins or casualties on the boat and maintaining balance in rough seas while the FRC is in motion, and during retrieval of manikins or casualties. The area at the front of the FRC where rescues are performed may become congested after rescuing more than one casualty, which limits the space available to perform subsequent rescues and may require additional lifting and repositioning of manikins during the course of rescue drills, or of casualties in the event of an actual rescue. FRCs vary in passenger capacity, typically between 6 and 15 persons including FRC crew. This limits the number of casualties that can be rescued at one time. The capacity of the FRC observed in the study was noted to be 6-7 individuals, which would include crew members and therefore limits the number of rescues to 4, before offloading casualties to the primary vessel.

Tools observed:

- Dacon Rescue Frame, which is a lightweight sling with buoys attached, used when removing manikins from the water.
- Rescue hook, which is a light reaching tool approximately 3 meters long, used to maneuver manikins or casualties in the water.

Safety Equipment observed:

- safety glasses
- hard hat
- safety shoes (steel toe boots)
- anti-exposure suit with gloves
- life jacket.

ENVIRONMENTAL CONDITIONS

The expertise of an environmental specialist is required to test actual air quality, noise levels, lighting levels, etc.

Indoor/Outdoor:	Work is performed outdoors, which may expose crew members to fluctuations in weather, as well as changes in surf conditions.
Vibration:	There may be exposure to vibration while the boat is in motion. This may be more significant at higher speeds in open waters.
Lighting:	Lighting conditions during rescue drills will vary depending on weather but are performed during daylight hours. Actual rescues may be performed during day or night, with spot lighting available to locate casualties.
Temperature:	Employees working in outdoor environments are exposed to seasonal temperature variations and may be exposed to heat >25 deg. C or cold <10 deg. C.
Moisture/Humidity:	Crew members may be exposed to moisture or humidity while on the FRC, including water that enters the boat due to surf conditions or precipitation.
Noise:	Noise levels may vary depending on environmental conditions and would also be affected by the FRC boat engine. Noise levels were not measured as part of this assessment. Crew members do not wear hearing protection as they are required to communicate during rescue activities.
Fumes/Odour/Dust:	Crew members may be exposed to fumes or odors from the boat engine. They would not be exposed to dust.
Job Hazards/Exposures:	Crew members are exposed to varying weather conditions and fluctuations in the FRC's position, depending on surf conditions. Hazards include potential for slips and falls or falling overboard.
Social Environment:	The coxswain and deckhand report to the Chief Officer, while the third engineer reports to the Chief Engineer. The Chief Officer and Chief Engineer report to the Captain. Some standby vessel crews are unionized, while others are not.

RECOMMENDATIONS FOR BEST ERGONOMIC PRACTICES AND TRAINING

Risk Factors Identified

Crew members may be exposed to varying risk factors during rescue drills or when performing actual rescue operations on the FRC. These include:

- Changes in weather conditions including temperature variations and precipitation, which can affect muscle strength and stamina.
- Potential for slip and fall due to wet and/or freezing conditions on the FRC deck.
- Rough or changing surf conditions that occur suddenly and result in shifting and rocking of the FRC while maneuvering between rescues and during retrieval of rescue manikins or casualties. This requires crew members to adapt and respond quickly to secure the rescue manikin or casualty, which may lead to awkward movements or lifting techniques that increase risk of injury.
- Leaning over the edge of the FRC and lifting away from their centre of gravity, with extended reaching to position manikins in the water, while pulling up with the Dacon Rescue Frame, and when bending to lift and position manikins once in the boat. This places additional strain on the neck, shoulders, and lower back.
- Twisting side-to-side while lifting manikins from the boat into the water and during retrieval and positioning in the boat. When pulling or pushing manikins along the edge of the FRC, crew members are unable to position themselves squarely to the manikin and must twist to the side to grasp and pull the manikin toward the bow. Twisting while lifting increases risk of neck, shoulder and back injury.

Recommendations to Address Risk Factors

The following recommendations are made to reduce risk of injury during rescue drills:

1. Ensure crew members warm up and perform stretching exercises to prepare muscles for lifting, prior to rescue drills.
2. If possible, perform rescue drills on days with temperate weather (temperatures between 10 - 25 deg. C). This keeps muscles warm and reduces risk of heat stroke or heat exhaustion.
3. If possible, perform rescues on days with calm surf. This helps to reduce risk of unsafe lifting techniques due to sudden changes in the FRC's position during drills and reduces risk of slip and fall on the deck of the boat.
4. Rescue drills should be performed when crew members are rested and alert, ideally at the beginning of their shift.
5. If lifting manikins from the FRC into the water, crew members should use a squatting technique, rather than bending at the waist. Feet should be shoulder-width apart, with elbows bent and tucked into the waist. Crew members should tighten their abdominal muscles and keep their back straight when grasping and lifting manikins onto the side of the FRC, before rolling them into the water. Avoid swinging the manikin over the edge from a standing position.
6. If rescuing more than one manikin or casualty, crew members should switch positions so that they alternate between lifting the torso and feet of the manikin. This reduces the physical demands of the task, as the crew member lifting the torso of the manikin exerts a higher physical demand due to increased weight.

Recommendations to Address Risk Factors cont.

7. To minimize reaching, the crew member at the bow should predominantly use a rescue hook to move the manikin into the rescue frame, while the second crew member assists to reach and guide the manikin into place.
8. Crew members should use a rescue frame when possible, such as a Dacon Rescue Frame, to improve grip and minimize reaching while lifting, and to divide the weight of the manikin or casualty between both crew members.
9. Crew members should communicate clearly while lifting the manikin in the frame (i.e., lift on count of 3). They should bend their knees and lean back using their body weight to assist when lifting. They should keep their back straight and tighten their abdominal muscles while lifting.
10. Once the manikin is on the edge of the FRC, the crew member closest to the bow should position as squarely to the manikin as possible when pulling the manikin toward the bow of the boat.
11. Any injuries sustained during rescue drills should be immediately reported to the appropriate supervisor.

Training

Training should include education on proper back mechanics while lifting, to be included during initial training and recertification every 5 years. Crew members should be able to identify proper back care principles and demonstrate these techniques as part of their practical evaluation. These techniques should be reinforced during training drills to minimize risk of injury and would be applicable to other tasks on the main vessel. A complete, additional training component could be devised by a physiotherapist or occupational therapist, and may include the following:

GUIDELINES FOR RESCUE DRILLS

When lifting, stand with your feet shoulder-width apart, bend your knees and keep your back straight. Keep your elbows tucked into your sides, if possible, and keep the object or rescue manikin close to your body. Straighten your legs to lift the manikin and lower in the reverse fashion. This avoids reaching forward and straining your lower back and shoulders.

Push instead of pulling when moving manikins or casualties, when possible.

Have a plan when working with fellow crew members and maintain consistent communication to prevent any quick, jerky movements, which can cause strain on the body and lead to unsafe lifting techniques.

Avoid twisting motions while lifting. Keep your shoulders, hips and feet in-line and take small steps to turn and pivot your whole body.

GENERAL GUIDELINES

Consider alternate options to minimize strain when lifting heavy objects:

- Have a fellow crew member assist to lift (such as a box or equipment)
- Unpack boxes and carry contents individually
- Carry smaller loads at a time

- Use a dolly for heavier loads
- Carry parts of larger equipment individually, if possible.

Carry objects at waist height, close to the body. Any reaching or lifting away from your body will increase stress on your lower back and shoulders.

Push objects along the floor, instead of pulling.

When possible, pick up heavier items from a higher surface.

Offshore Medical and General Physical Requirements

In addition to the existing medical requirements, the following recommendations are made concerning crew members performing standby boat rescue activities:

- Crew members should fit comfortably into protective clothing and lifesaving equipment and fall within the maximum weight capacity for such equipment.³
- With respect to physical requirements, crew members should be deemed fit for heavy lifting (up to 45 kg)⁴ and demonstrate sufficient endurance to complete strenuous tasks, which may involve consideration of additional health concerns such as high blood pressure; heart and other vascular disease; diabetes; obesity; and musculoskeletal damage, particularly in weight bearing areas such as the hips, knees and lower back.

It is acknowledged that actual rescues may require **very heavy** lifting; however, recommendations for physical requirements have been made to ensure adequate strength for the upper range of **heavy** lifting, as recommended for training purposes. This helps to ensure fidelity of training, while minimizing risk of injury to FRC crew.

³ Handbook for seafarer medical examiners. (n.d.). Retrieved from: <http://handbook.maritimemedicine.com/>

⁴ This is considered the upper weight limit for heavy lifting, according to the Dictionary of Occupational Titles (Volume II, Fourth Edition, Revised 1991). See Definitions in the Appendix on page 16.

Recommended Weight Range for Rescue Manikins During FRC Drills

As outlined in the CNSOPB’s Safety Directive “Lifesaving Equipment Arrangements” (File No. 20,100.13)⁵, the CSO has issued a notice that requires a value of 100 kg per seafarer, which includes a nominal weight for a survival suit. This recommendation is supported by a study completed in 2004, which shows that the mean base weight of a seafarer is 90 kg.⁶ The weight of a rescue manikin is meant to represent an actual casualty; therefore, a value of 100 kg was used when making a recommendation regarding the appropriate weight of a rescue manikin for FRC practice drills.

The weight of a rescue manikin is further increased by the immersion suit, if worn, and resultant ingress water once it is deployed. If applicable, this additional weight must be considered when calculating the optimal weight of a rescue manikin for FRC drills.

Lifting manikins for training is performed **occasionally** (0-33% of the workday; see Appendix). The ideal weight of the manikin must be sufficient to ensure representative training, while minimizing risk to FRC crew. Assuming the weight of the manikin is shared between **two** FRC crew members, the following weight range for manikins is recommended:

Table 1:

Recommendations for Rescue Manikin Weight (2 FRC crew)⁷		
Total Manikin Weight	Lower weight limit: 36 kg	Upper weight limit: 80 kg

The total weight of the manikin must be inclusive of any accessories placed on the manikin, such as an immersion suit or life jacket, as well as weight added due to water ingress into the immersion suit and accessories post-deployment, as these will increase the total rescue weight. An estimated 15 kg of additional weight is added by an immersion suit and resultant water ingress once the manikin is deployed. The total weight of the manikin after these factors are considered should be between 36 kg – 80 kg when lifted from the water.

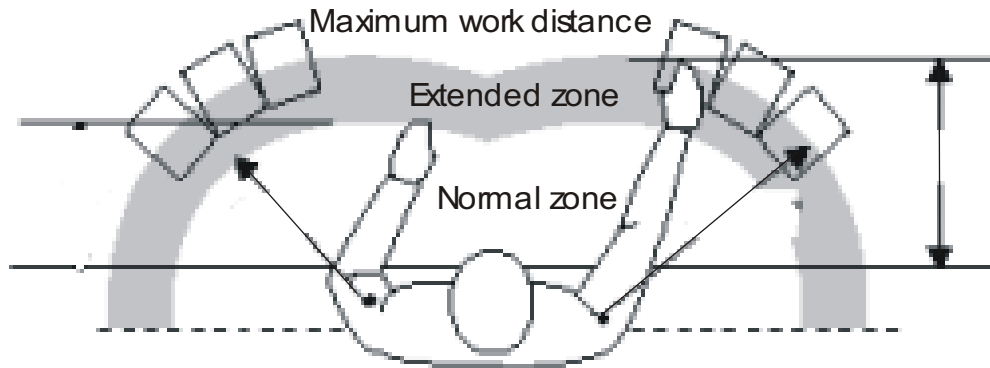
Based on this criterion, a 60 kg manikin (inclusive of manikin, accessories, and estimated water ingress) may be considered as having a nominal target weight, as it falls within the recommended range; however, any manikin that falls within the range of these target weight limits would be considered appropriate for representative training, while keeping requirements within a **heavy** physical demand category. Lifting any manikin heavier than the upper weight limit, as noted in Table 1, would be classified as **very heavy** lifting and increases risk of injury to FRC crew members during training exercises. Using a manikin less than the lower weight range recommended may reduce the value of the training, as it may not be representative of an actual casualty in the event of a live rescue event.

⁵ CNSOPB. (2010, April 20). Safety Directive Lifesaving Equipment Arrangements [Notice]. Retrieved from https://www.cnsopb.ns.ca/sites/default/files/resource/lifesaving_equipment_safety_directive.pdf

⁶ Brooks et al. (2004): Technical Report to Transport Canada on Research Studies to Investigate the Impact of Immersion Suit Use in an Emergency Situation.

⁷ Values were calculated using the upper and lower limits of the heavy lifting category according to the Dictionary of Occupational Titles (Volume II, Fourth Edition, Revised 1991), minus 5 kg from the upper and lower limits to account for variances in weight. An additional 15 kg should be added to account for the weight of the immersion suit and water ingress, if applicable. Total weights were divided among two FRC crew members, assuming both members participate when lifting the manikin. Recommendations for lifting by an individual crew member would reduce the values in Table 1 by half.

Appendix: Definitions



Horizontal Work Surface

Normal zone – trunk to fingertips with arms resting at 90 degrees by side

Extended zone – trunk to fingertips with shoulder flexed to 90 degrees

Maximum work distance – beyond extended zone

Activity Frequency - Dictionary of Occupational Titles Volume II, Fourth Edition, Revised 1991		Lifting Activity Height Definitions
Constant (C)	67 – 100% of the workday	High – above shoulder
Frequent (F)	34 – 66% of the workday	Mid – knuckle to shoulder
Occasional (O)	0 – 33% of the workday	Low – floor to knuckle
Not Present (N)	Activity is not performed	Full – full vertical work plane

PDC - Dictionary of Occupational Titles - Volume II, Fourth Edition, Revised 1991			
Physical Demand Level	OCCASIONAL 0-33% of the workday	FREQUENT 34-66% of the workday	CONSTANT 67-100% of the workday
Sedentary (S)	1 - 10 lbs.	Negligible	Negligible
Light (L)	11 - 20 lbs.	1 - 10 lbs.	Negligible
Medium (M)	21 - 50 lbs.	11 - 25 lbs.	1 - 10 lbs.
Heavy (H)	51 - 100 lbs.	26 - 50 lbs.	11 - 20 lbs.
Very Heavy (VH)	Over 100 lbs.	Over 50 lbs.	Over 20 lbs.

IV. PHYSICAL DEMANDS - STRENGTH RATING (Strength)

The Physical Demands Strength Rating reflects the estimated overall strength requirement of the job, expressed in terms of the letter corresponding to the particular strength rating. It represents the strength requirements which are considered to be important for average, successful work performance.

The strength rating is expressed by one of five terms: Sedentary, Light, Medium, Heavy, and Very Heavy. In order to determine the overall rating, an evaluation is made of the worker's involvement in the following activities:

a. Standing, Walking, Sitting

Standing - Remaining on one's feet in an upright position at a work station with-out moving about.

Walking - Moving about on foot.

Sitting - Remaining in a seated position.

b. Lifting, Carrying, Pushing, Pulling

Lifting - Raising or lowering an object from one level to another (includes upward pulling).

Carrying - Transporting an object, usually holding it in the hands or arms, or on the shoulder.

Pushing - Exerting force upon an object so that the object moves away from the force (includes slapping, striking, kicking, and treadle actions).

Pulling - Exerting force upon an object so that the object moves toward the force (includes jerking).

Lifting, pushing, and pulling are evaluated in terms of both intensity and duration. Consideration is given to the weight handled, position of the worker's body, and the aid given by helpers or mechanical equipment. Carrying most often is evaluated in terms of duration, weight carried, and distance carried.

Estimating the Strength factor rating for an occupation requires the exercise of care on the part of occupational analysts in evaluating the force and physical effort a worker must exert. For instance, if the worker is in a crouching position, it may be much more difficult to push an object than if pushed at waist height. Also, if the worker is required to lift and carry continuously or push and pull objects over long distances, the worker may exert as much physical effort as is required to similarly move objects twice as heavy, but less frequently and/or over shorter distances.

c. Controls

Controls entail the use of one or both arms or hands (hand/arm) and/or one or both feet or legs (foot/leg) to move controls on machinery or equipment. Controls include but are not limited to buttons, knobs, pedals, levers, and cranks.

Following are descriptions of the five terms in which the Strength Factor is expressed:

S-Sedentary Work - Exerting up to 10 pounds of force occasionally (Occasionally: activity or condition exists up to 1/3 of the time) and/or a negligible amount of force frequently (Frequently: activity or condition exists from 1/3 to 2/3 of the time) to lift, carry, push, pull, or otherwise move objects, including the human body. Sedentary work involves sitting most of the time but may involve walking or standing for brief periods of time. Jobs are sedentary if walking and standing are required only occasionally, and all other sedentary criteria are met.

L-Light Work - Exerting up to 20 pounds of force occasionally, and/or up to 10 pounds of force frequently, and/or a negligible amount of force constantly (Constantly: activity or condition exists 2/3 or more of the time) to move objects. Physical demand requirements are in excess of those for Sedentary Work. Even though the weight lifted may be only a negligible amount, a job should be rated Light Work: (1) when it requires walking or standing to a significant degree; or (2) when it requires sitting most of the time but entails pushing and/or pulling of arm or leg controls; and/or (3) when the job requires working at a production rate pace entailing the constant pushing and/or pulling of materials even though the weight of those materials is negligible. NOTE: The constant stress and strain of maintaining a production rate pace, especially in an industrial setting, can be and is physically demanding of a worker even though the amount of force exerted is negligible.

M-Medium Work - Exerting 20 to 50 pounds of force occasionally, and/or 10 to 25 pounds of force frequently, and/or greater than negligible up to 10 pounds of force constantly to move objects. Physical Demand requirements are in excess of those for Light Work.

H-Heavy Work - Exerting 50 to 100 pounds of force occasionally, and/or 25 to 50 pounds of force frequently, and/or 10 to 20 pounds of force constantly to move objects. Physical Demand requirements are in excess of those for Medium Work.

V-Very Heavy Work - Exerting in excess of 100 pounds of force occasionally, and/or in excess of 50 pounds of force frequently, and/or in excess of 20 pounds of force constantly to move objects. Physical Demand requirements are in excess of those for Heavy Work.