



## JOB DEMANDS ANALYSIS

**Company:** Greater Vancouver Regional District    **Location:** All Plants

**Job Title:** WWTP – Emergency Response Team    **Classification:** Special

**Work Demand Level:** Medium to Very Heavy

### Purpose of Activities

The purpose of the duties of the Emergency Response Team (ERT) is to safeguard the people carrying out activities in hazardous circumstances and to effect a rescue if the situation makes it necessary.

### Tools and Equipment

The mechanic will use the following tools and equipment to perform their duties:

- Gloves.
- Safety Hat with headlight
- Safety Boots.
- Safety Vest.
- SCBA
- Electric cart.
- Variety of hand and power tools including impact tools and large crescent wrenches.
- Ropes
- Rigging, break bar and other climbing gear
- 2" Fire Hose
- Gas Detector

### Usual Methods

This is not a routine position, but is an extra set of duties that individuals can volunteer for. There are regular training sessions that can consist of planning sessions, practicing and learning techniques and there are actual ERT operations to effect a rescue or to set-up for a potentially high-risk activity.

The majority of the activities are essentially high angle rope rescues. There are a number of duties that an ERT member can be involved in from controlling a belay line to dragging a person out of a dangerous situation. There is considerable rope work in the job and pulling with up to 40 or 50 Kg of force. There is also packaging



activities that require working from a crouched or kneeling position for long periods of time.

### Administrative Issues

There are no set hours for this operation and the team carries out duties as required. Practice sessions take place in normal WWTP business hours. Most of the work is conducted indoors (outdoors is possible but less likely) and can include exposure to raw sewage and the risk of dangerous gases (such as H<sub>2</sub>S).

### Activity Demand Variables

These variables are tasks that must be carried out by the employee and are implicitly or explicitly required as objectives of the job.

- Work in some confined spaces.
- Walk over concrete and stairs.
- Climb up and down ladders.
- Carry out some tasks under unpredictable outdoor conditions that often include steady rainfall.
- Exposure to sewage.
- Awkward equipment located close to the floor or overhead (equipment dictates posture).
- Unpredictable circumstances
- Work at heights
- Deadlines

### Worker Decision Variables

These variables are the sub-routines and cognitive/physical decisions made by the worker in carrying out the objectives of the job.

- Some choice of postures for carrying out duties (e.g. lifting using hips and maintaining neutral spine, creative energy saving techniques).
- Planning of lifts and routes for carrying (limited).
- Limited planning of approach to job.
- Mode of transportation around site.



### **Accommodative Considerations**

1. Individual with spine related problems may have difficulty with the crouched and stooped postures as well as with lifting activities.
2. Upper extremity problems including the hand, wrist and elbow would be difficult to accommodate because of constant gripping and tool manipulation with force (especially in awkward postures).
3. Individuals with knee problems may be aggravated by kneeling and crouching.
4. Shoulder injuries may also be aggravated by the heavy rope use and elevated arm postures inherent in the job.
5. Individuals recovering from systemic illness should be carefully screened before entering this activity.
6. Individuals with a history or risk factors for heart disease could be at increased risk in this job.
7. Individuals with some respiratory conditions may have difficulty with the SCBA equipment.
8. Individuals who do not cope well in outdoor work environments or confined spaces would have difficulty with this position.
9. Individuals unable to function in fluid and threatening circumstances would not be well-suited to this position.
10. There is a learning curve associated with the tasks that includes formal training.

Prepared By: Greg Hart, Kinesiologist

June 1, 2001



## Summary of Stresses

### Metabolic Stresses

These stresses can be highly variable with the majority of power being supplied through the aerobic energy system in reasonably fit individuals. Duties such as walking, sitting, crouching and kneeling would predominantly draw energy from this system. More concentrated activity like stair climbing (which can be common) will challenge the aerobic system more. Many activities require high levels of force production from a variety of muscle groups to drag bodies, to lift and to climb ladders. The power for these requirements would be primarily derived from the anaerobic metabolism and can be drawn upon frequently through the day for brief (usually less than 45 seconds) periods of time. In emergency situations it is likely that the energy systems could be taxed at a maximum level. The maximum energy demand could be in the order of 15 METs (47 ml/kg/min).

### Structural Stresses

There are a number of high risk exposures to the physical structures of the body in this job. Some are related to movement and some are related to postures.

#### Spine

There is obvious exposure to most of the spine, but more specifically to the lumbar and thoracic regions. This exposure can come from several different possibilities. The first is high anterior disc compression from flexed postures that can include supporting high loads great distances from the body in awkward locations. The second possibility is that of prolonged strain on the spinal ligaments from working in a kneeling position. This increases instability of the structures over time. A third possibility is a sudden shearing force when lifting or moving a heavy object. The last aspect is rotating motions which can occur in combination with the previous factors. This exposes the facet joints of the spine to damage as well as weakening the disc fibre integrity. If proper lifting technique is observed when lifting is required in comfortable spaces, the risk to the spine will be minimal even if the loads are high.

#### Shoulder and Upper Extremity

The shoulder joint has to contend with repeated movements of pulling on ropes and reaching above shoulder level to make attachments. This produces considerable work for the rotator cuff musculature..



The muscles of the forearm and wrist are required to produce frequent and often constant moderate to maximal grip forces. This combined with the often pronated or deviated position of the joint can lead to carpal tunnel stress and tendinitis even previous to that. The elbows would be at particularly high risk of developing epicondylitis from the constant mechanical strain on the muscles and tendons that originate there.

### Knee and Ankle

The knee absorbs considerable compressive stress in kneeling and crouching postures. Kneeling can place high loads against the patella (kneecap) when it is unsupported and the knee joint is 'open'. Crouching loads the ligaments in the joint past the critical stress limits of the connective tissue and can contribute to increased joint laxity over time. Anterior knee pain and the development of patello-femoral syndrome are likely in these individuals. Arthritic changes can also be expected in most workers.

The ankle joint is required to stabilize the body in balanced positions on ladders and pipes and in all joint directions. It is particularly vulnerable on the lateral aspect to sudden inversion of the foot on uneven surfaces.

### **INTERVENTIONS**

Recommendations that could be implemented to increase productivity and lessen the risk of injury are listed below:

1. Continue regular training.
2. Mechanical assists should be utilized wherever possible to reduce dangerous loading in awkward spaces. Continued education in rigging techniques is vital.
3. Regular technical training should be maintained (perhaps twice in a month) to insure skill mastery. Fitness training should also be included since the loads can be very high in emergency situations.
4. Educate employees relative to creative movement technique to help limit exposures to unmanageable physiological stress.
5. Provide gloves that offer the required protection with minimal interference in sensation.



6. Knee pads should be provided to all workers to reduce heating and compression of the knee joint.
7. Active whole body conditioning would be the best protection against injury as the nature of the job places many unmanageable stresses on many structures. Ensuring that the tissue is strong and flexible and that energy delivery is efficient would be a critical recommendation. Annual assessment of fitness for this work is another possible consideration.
8. The final recommendation involves moving from the sedentary activities of sitting or standing to a labour intensive task. Time should be taken to put the muscles and joints of the torso, hip and shoulder region through a full range of motion and to increase muscle and joint temperatures. This insures adequate preparation of body structures to effectively and safely participate in the required activities.

PJDC-WWTP Emergency Response

Referral: Mike Arcand			Organization: GVRD							Title: Emergency Response Team	
Dept.: WWTP			Division: WWTP							Contact: Mike Arcand	
										Date: June 1, 2001	
PHYSICAL DEMANDS			R E Q U I R E D	S I D E	FREQUENCY*				Max. Weight (kg)	Usual Weight (kg)	COMMENTS
					Sel 1	Low 2	Mod 3	High 4			
S T R E N G T H	Lifting - Floor to Knuckle		B		X			50	20	Victim, debris, ropes, rigging gear	
	Lifting - Knuckle to Waist		B			X		50	10	Debris, end of rescue basket, tools, rope	
	Lifting - Waist to Shoulder		B			X		20	5	Rope, debris, rigging equipment and tools	
	Lifting - Over Head		D			X		10	arm+	Rope, arms, rigging equipment and tools	
	Carrying - With Handles		B		X			15	5	Cases, gear with handles, toolkits	
	Carrying - Without Handles		D			X		15	5	Rope, gear, debris < 10 metres	
	Pushing - Upper Extremity		B			X		20	10	Wrenches, doors, access hatch closed/open	
	Pushing - Hip/Leg Assist		B			X		40	20	Wrenches, basket, debris out of way	
	Pulling - Upper Extremity		B				X	20	10	Wrenches, ropes, rescue basket, climb ladder	
	Pulling - Hip/Leg Assist		B			X		40	20	Down on rope, belay, drag victim and/or debris	
	Reach - Shoulder or Above		D		X			10	arm +	Set-up gear, ladder, control rope descent	
	Reach - Sho. or Above extnd		D		X			arm +	arm+	Access awkward high locations	
	Reach - Below Shoulder		B			X		arm+	arm+	Accessing tools, access to victim and supplies	
	Reach - Bel. Shoulder extnd		B		X			10	low	Reaching around large equipment	
	Handling		B				X	max.	mod	Tools, rope, debris, hoses, basket, buckles	
E N R G	Gripping		B				X	max.	high	Tools, ropes, clothing, ladders, rescue equip.	
	Fine Finger Movements		B			X		high	low	Small parts, threading, first aid, tape, buckles	
	Aerobic (percent)					60		Heat stress, SCBA, walking, light climbing, standing, crouching			
	Anaerobic (percent)					50		Full body exertion in lifting, pull/pushing, climbing			
P O S T U R E + M O B I L I T Y	High Energy Expenditure					X		Occasional full body activity in dragging, lifting, heat demand			
	Low Energy Expenditure				X			Walking, standing, waiting, small muscle activity			
	Neck - Static Flexion						X	Attend to victim, look down ( sustained up to 10 min/time)			
	Neck - Static Neutral						X	While walking, standing			
	Neck - Static Extension				X			Can be prolonged when working with people/equip. overhead			
	Neck - Rotation		B				X	Normal movement and see around objects			
	Throwing		D		X			Ropes and small pieces of equipment (< 5 m)			
	Sitting				X			Infrequent, when planning/classroom			
	Standing						X	On concrete surfaces, perhaps grass			
	Walking					X		Over concrete, grass, metal pipes. Mostly bouts < 100m			
	Running/Jumping				X			Over obstructions, on/off ladders (< 1m), from rope descent			
	Climbing - Arms and Legs					X		Ladders and scaffolding			
	Climbing - Legs Only					X		Stairs (up to six flights) and step up onto raised areas			
	Bending/Stooping					X		Watching activity below an opening, walking under low ceiling			
	G E N	Crouching					X		Aid to victim, bundling of victim, rigging up basket/belts		
Kneeling						X		Aid to victim, bundling of victim, prolonged at times			
Crawling					X			In smoky conditions, confined spaces to find people			
Twisting					X			Working in congested areas in/out con. space			
I R R E G U L A R	Balancing						X	On ladders and pipes, on edges of opening to confined space			
	Traveling				X			Around plant on foot, in cart or truck			
	Work Alone							Always work as a team			
	Interact with Public							Very unlikely			
N	Operate Equip/Machinery					X		Manlift, hoses, Rogass, rigging, SCBA			
	Irregular/Extended Hours			X				Always possible depending on the nature of the task			
* Frequency Legend			1 = Seldom; Not Daily				2 = Low Daily Activity; < 1hr				
			3 = Moderate Demand; Repetition 1 - 3 hrs daily				4 = High Frequency Demand; Repetition > 3 hrs daily				

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3 = Moderate Demand; Repetition 1 - 3 hrs daily 4 = High Frequency Demand; Repetition > 3 hrs daily  
The following shading denotes a HIGH RISK TASK: Modifications should be considered

**REQD** is marked with an X if the particular demand or category is relevant to the purpose of the job.

**SIDE** refers to the side or limb required to execute a task. If it is marked **E**, it indicates either side, the most common choice is listed first. **D** refers to dominant and **B** to both sides.

PJDC-WWTP Emergency Response

Referral:		Organization:				Title: see 1st page header		
Dept.:		Division:				Contact:		
						Date:		
PHYSICAL DEMANDS	REQD	SIDE	FREQUENCY*				COMMENTS	
			Sel.	Low	Mod.	High		
			1	2	3	4		
PERCEPTION	Hearing - Conversations		B				X	Communicating with co-workers via radio/in person
	Hearing - Other Sounds		B				X	Pumps, motors, alarms etc
	Vision - Far						X	Most tasks
	Vision - Near				X			Small, detailed adjustments
	Vision - Colour							
	Vision - Depth						X	Judging distance, often in poorly lit areas
	Perception - Spatial						X	Moving around objects, maneuver loads on rope
	Perception - Form				X			Differentiate subtleties in victim appearance
	Feeling (Tactile)						X	Manual examination of victim(s)
	Reading				X			Instructions, signs
WORK	Writing			X				Minor reporting
	Speech						X	Communicating with co-workers
	Inside Work						X	Buildings, tunnels, underground, classroom
	Outside Work						X	Moving between buildings, outdoor rescue
	Hot Conditions >25 deg. C					X		Depending on the part of the plant, time of year
	Cold Conditions <10 deg.C			X				Outside work during winter
	Humid			X				Occasionally
	Dust				X			Outside work in windy conditions
	Vapor Fumes					X		Exhaust, sewage (H2S,Meth.) + related
	Hazardous Machines					X		Pumps, motors, crane, fans, mechanical skimmers etc.
ENVIRONMENT	Proximity to Moving Object					X		Forklift, manlift, crane truck, carts
	Noise					X		Varies to above 110Db (protection required)
	Electrical Hazard				X			Should be neutralized in all rescues
	Sharp Tools				X			Cutting tools, exposed metal and fragments
	Radiant/Thermal Energy						X	Motors, pipes, pumps
	Slippery Conditions					X		Working in wet areas, near leaks etc.
	Vibration and Related				X			Hose, impact tools, hammer
	Chemical Irritants					X		Cleaners
	Organic Substances						X	Victim(s) vomit, raw/partially processed sewage
	Medical Waste				X			Used gauze, gloves, etc.
PERSONAL	Blood Products					X		Bleeding victim(s)
	Congested Worksite					X		Many confined areas - training req'd
	Lighting - Direct						X	Overhead incandescent, daylight, headlamp
	Lighting - Indirect						X	Reflected light
	Consequences of Error						X	Diminish chance of rescue, put self or others in peril
	Competence Challenge						X	New techniques/rescues to learn, emergency improvisation
	Autonomy				X			Decision-making latitude shifts with situation
	Relatedness						X	Significant team work required, must trust co-workers

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For detailed descriptions of each of the different categories, please refer to the reference guide or inquire with Human Effort at 1-888-4EFFORT