



JOB DEMANDS ANALYSIS

Company: GVRD

Location: Wastewater Treatment Plants

Job Title: Utility Trades Helper

Classification: Regular Duty

Purpose of Activities

The purpose of the duties of the Utility Trades Helper is to carry out directed maintenance activities in the wastewater plants. This can be done alone or in assisting a trades person (e.g., mechanic or pipefitter) with repairs.

Overview

There is a wide variety of work in this job that involves routine maintenance activities like lubrication and filter changes, cleaning activities and assisting in the removal and repair of pumps, motors, engines and other equipment.

It can take place in a large plant spread across several hundred acres or in smaller ones that are in much more compact scenarios. The work involves a lot of walking and stair climbing, and can also involve heavy and awkward work.

The work varies in volume and intensity by plant with more specialization possible in the larger plants like Annacis, Lulu and Iona. All of the areas feature work around sewage at different levels of processing.

Tools and Equipment

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

- Gloves.
- Safety Hat
- Safety Boots.
- Safety Vest/coveralls.
- A wide variety of hand tools including impact tools, come-alongs, Hilti drills, wrenches.
- Electric motorized cart
- Hoses and chains
- Forklift
- J-Lift
- Radio
- Gas Detector



Usual Methods

The job varies substantially from day to day as they may be involved in smaller routine maintenance tasks or the installation or removal of pumps or engines. They spend large blocks of time doing routine lubrication of equipment, exchanging filters (some that include charcoal and require carrying heavy boxes up and down stairs. They would spend no more than 30 minutes a day engaged in seated paperwork related duties such as estimating part requirements. They are working with a variety of tools throughout the day ranging up to a 48" pipe wrench. Many of the larger tools are made from aluminum which significantly reduces their weight and improves their ease of handling considerably. However, they may have to use large, heavily leveraged tools such as a pipe wrench in very awkward positions. These positions can include extended kneeling or crouching in addition to reaching and considerable spinal flexion. Almost all of the pumps and engines are positioned at knee level from the floor. In order to work on these, the workers' are required to kneel or crouch for long periods of time.

Much of the work can also involve ladders and working with fall restraint.

They can be required to assist in lifting or guiding heavy sections of pipe or other related materials. Much of the day can be spent walking in the plant, climbing ladders and scaffolding, working around large obstructions and kneeling with large tools. Many of these tasks are accomplished with the use of a variety of rigging systems to assist in lifting and holding loads.

Administrative Issues

Typically they work an eight - hour day from Monday to Friday. Most of the work is conducted indoors (outdoors as well) and can include exposure to raw sewage and the risk of dangerous gases (such as H₂S). In some plants there can be more outdoor work that may involve exposure to inclement weather.

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 machines located close to the floor or overhead

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.

- Choose postures for carrying out duties (e.g. lifting using hips and maintaining neutral spine, creative energy saving techniques) to a limited extent.
- Planning of lifts and routes for carrying (limited).

Accommodative Considerations

1. Individual with spinal related problems may have difficulty with the crouched and stooped postures as well as with lifting activities.
2. Individuals with shoulder and neck problems may have trouble coping with the reaching and awkward maneuvering of loads at shoulder level.
3. Upper extremity problems including the hand and wrist would be difficult to accommodate because of frequent gripping and tool manipulation with force.
4. Individuals recovering from systemic illness should be carefully screened before entering this activity.
5. Individuals who do not cope well in outdoor work environments or confined spaces would have difficulty with this position.
6. Individuals who have systemic medical conditions that may place them at higher risk for sudden collapse or seizure may not be suited to a job that can leave them alone in up to a 250 acre plant.
7. There is a learning curve associated with the tasks which includes certification in confined space work and lock-out procedures.

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. There is no prolonged elevated aerobic requirements such as would be evident in an Outside Postal Worker. Many activities require high levels of force production from a variety of muscle groups to pull on wrenches, to lift and move parts or 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.

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 or when a wrench pops off of a bolt. 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. There is severe postural stress in carrying the charcoal filters that can weigh up to 22 kilograms. Since it is a one arm carry, the opposite side of the body is forced to compensate for the uneven loading, placing severe lateral compression on the spine and possibly interfering with normal neuromuscular spinal control if it occurs frequently enough.

Shoulder and Upper Extremity

The shoulder joint has to contend with sustained flexed and abducted postures under occasionally high load. The result is considerable joint instability with high joint



compression and ligament strain in addition to probable temporary supraspinatus impingement from time to time.

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 (more will be supplied in conjunction with the detailed ergonomics assessment currently underway at the wastewater treatment plants):

1. Every effort should be made to provide tools that are light and easy to use because of the awkward positions frequently encountered in the job. In addition care should be taken to improve grip sizes to as close to individual optimal sizes to maximize force transfer and reduce forearm flexor strain.
2. Mechanical assists should be utilized wherever possible to reduce dangerous loading in awkward spaces. Continued education in rigging techniques is vital.
3. Educate employees relative to creative movement technique to help limit exposures to unmanageable physiological stress.



4. Splitting tools across two boxes would balance the load on the spine substantially when carrying the toolbox(es). One in each hand.
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.
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.

Referral: Mike Arcand		Organization: GVRD						Title: Trades Helper		
Dept.: WWTP		Division: WWTP						Contact: Mike Arcand		
		Date: June 1, 2001								
PHYSICAL DEMANDS		R E Q 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			75	8	Tools, fittings, pumps, motors, pipe
	Lifting - Knuckle to Waist		B			X		75	10	Motors, toolkit, pipe, come-along
	Lifting - Waist to Shoulder		B			X		35	5	Fittings, rigging equipment, tools, filter boxes
	Lifting - Over Head		D			X		20	arm+	Fittings, rigging equipment, tools, filter boxes
	Carrying - With Handles		B			X		30	30	Toolbox (one arm) < 10 metres
	Carrying - Without Handles		D		X			18	5	Hoses, parts, boxes up to 4 flights of stairs
	Pushing - Upper Extremity		B			X		55	20	Wrenches and tools, chains on rigging
	Pushing - Hip/Leg Assist		B			X		50	40	Wrenches, motors (some suspended)
	Pulling - Upper Extremity		B			X		55	20	Wrenches, parts, come-along, equip. doors
	Pulling - Hip/Leg Assist		B			X		50	40	Chain on come-along or on wrenches
	Reach - Shoulder or Above		D		X			arm +	arm +	Overhead repairs/installations, place filters
	Reach - Sho. or Above extnd		D		X			arm +	arm+	Sustained in awkward locations
	Reach - Below Shoulder		B				X	35	arm+	Accessing tools, around fittings, place filters
	Reach - Bel. Shoulder extnd		B			X		35	low	Reaching around large equipment
Handling		B				X	max.	mod	Tools, parts, pipe, hoses, boxes, radio, motors	
Gripping		B				X	max.	high	Tools, boxes, radio, parts, filters, grease gun	
Fine Finger Movements		B			X		high	low	Small bolts/nuts, cleaning +adjustment, keys	
E N R G	Aerobic (percent)						70			Walking, light climbing, standing, low level tool work
	Anaerobic (percent)					30				Full body exertion in lifting, pull/pushing, climbing
	High Energy Expenditure				X					During full body, high exertion activity (eg. climbing, lift/carry)
	Low Energy Expenditure						X			Walking, standing, travelling
P O S T U R E + M O B I L I T Y	Neck - Static Flexion					X				Some repair tasks (sustained up to 10 min/time)
	Neck - Static Neutral						X			While walking, standing
	Neck - Static Extension				X					Can be prolonged when working overhead
	Neck - Rotation		B				X			Normal movement and see around objects
	Throwing		D		X					Chains or cables over pipes for rigging (< 5 m)
	Sitting				X					Travel by cart/bike, on break or computer (brief), possible in boat
	Standing						X			On concrete surfaces, some metal grating, gravel, uneven grass
	Walking						X			Almost always over concrete, grass, metal grates
	Running/Jumping				X					Over obstructions, on/off ladders (< 1m)
	Climbing - Arms and Legs				X					Ladders and scaffolding (up to 20 metres)
	Climbing - Legs Only						X			Stairs (up to 4 stories) and step up onto raised areas
	Bending/Stooping					X				Near floor level tasks w/restricted space, lean into engines, etc
	Crouching				X					Many tasks are close to ground level
	Kneeling				X					Tasks at ground level, very prolonged at times
G E N E R A L	Crawling			X						Into and out of confined spaces, access awkward spots
	Twisting				X					Working around some awkward equip., in/out confined space
	Balancing				X					On ladders, at openings, on platforms, sometimes with load
	Traveling					X				Around plant in cart, bike, on foot
	Work Alone					X				Dependent on job, but often possible
	Interact with Public			X						Rare except on tours or driving off-site
	Operate Equip/Machinery						X			Valves, motors, forklift, cart, J-lift, crane, rigging, SCBA
Irregular/Extended Hours									Monday to Friday 0630 to 1500	

* 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

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.

Referral:		Organization:		Title: see 1st page header				
Dept.:		Division:		Contact:				
PHYSICAL DEMANDS		R E Q D	S I D E	FREQUENCY*				COMMENTS
				Sel. 1	Low 2	Mod. 3	High 4	
P E R C E P T I O N	Hearing - Conversations		B				X	Communicating with co-workers
	Hearing - Other Sounds		B				X	Pumps, motors, alarms etc (noticing unusual sounds)
	Vision - Far						X	Most tasks
	Vision - Near					X		Small, detailed adjustments
	Vision - Colour					X		Pipes, motor wiring are colour coded
	Vision - Depth					X		Judging distance, often in poorly lit areas, for driving
	Perception - Spatial					X		Need to understand relative object position
	Perception - Form					X		Discern between fittings and tools with small differences
	Feeling (Tactile)					X		Grip adjustment through gloves
	Reading				X			Work orders, signs
N	Writing				X			Minor notations for lockout and reporting
	Speech					X		Communicating with co-workers via radio/in-person
W O R K E N V I R O N M E N T	Inside Work						X	Buildings, tunnels, underground
	Outside Work				X			Moving between buildings, outside repairs
	Hot Conditions >25 deg. C					X		Depending on the part of the plant, varies
	Cold Conditions <10 deg.C			X				Outside work during winter
	Humid			X				Usually, marine climate, water intensive operation
	Dust				X			Plant is very clean, just in some confined areas
	Vapor Fumes					X		Exhaust, sewage (H2S,Methane)
	Hazardous Machines					X		Pumps, motors, crane, fans, mechanical skimmers etc.
	Proximity to Moving Object				X			Forklift, overhead crane, carts, bikes, vehicles outside
	Noise				X			Varies to above 110Db (protection req'd)
	Electrical Hazard					X		Considerable amount of high voltage equipment (lock outs)
	Sharp Tools/Items				X			Cutting tools, exposed metal + fragments, sharps on screens
	Radiant/Thermal Energy						X	Motors, pipes, pumps, welding equip., sun energy outside
	Slippery Conditions					X		Working in wet areas, near leaks, while hosing equipment etc.
	Vibration and Related				X			Hose, hammer, jarring to the body while riding in cart/bicycle
	Chemical Irritants					X		Cleaners, chlorine, SO2
	Organic Substances						X	Raw or partially processed sewage and associated bacteria
	Medical Waste			X				Possible at headworks
	Blood Products			X				Unlikely, although technically possible
	Congested Worksite					X		Many confined areas - training req'd
T	Lighting - Direct						X	Overhead incandescent, daylight
	Lighting - Indirect						X	Reflected light
	Lighting - Adjustable				X			Portable lighting
	Lighting - Fluorescent					X		Some fixtures in different work areas
	Lighting - Incandescent						X	Overhead
	Lighting - Shadows etc.						X	Everywhere due to obstructions

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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