<table>
<tr><td colspan="2">Sunshine Coast Regional District</td><td colspan="2">Confined Space Identification and Hazard Assessment</td><td colspan="2">Ammonia Condenser</td></tr>
<tr><td colspan="2">Owner: Sunshine Coast Regional District</td><td colspan="2">Location: Gibsons and Area Community Centre</td><td colspan="2">Assessed by: Neil McManus, CIH, ROH, CSP
NorthWest OH&S
Tel: 604-980-8512
Date: 2010-02-26</td></tr>
<tr><td>underground working?</td><td>enclosed or partially enclosed?</td><td>designed/ intended for continuous human occupancy?</td><td>limited or restricted entry or exit?</td><td>large enough and configured for entry to perform work?</td><td>Confined Space?

Yes
▲</td></tr>
<tr><td>No</td><td>Yes</td><td>No</td><td>Yes</td><td>Yes</td><td>» All entries bold?</td></tr>
<tr><td colspan="2" rowspan="3">Description: horizontal steel, irregularly-shaped, enclosed structure. This structure forms the discharge plenum of the centrifugal fans that discharge upward through piping to cool ammonia gas used for refrigeration.</td><td colspan="2">Access/Egress: hatches measuring about 0.5 m in diameter located in the end walls of the structure. These hatches are about out 2 m above the base of the structure.</td><td colspan="2">Contents: water, contents unlikely due to the upflow of air produced by the fans. Accumulation of debris and water is possible during shutdown conditions</td></tr>
<tr><td colspan="2">Adjacent Spaces: not applicable</td><td colspan="2">Equipment: three centrifugal fans</td></tr>
<tr><td colspan="2">Function/Use: evens the distribution of air discharged by the fans to improve heat transfer from the ammonia piping</td><td colspan="2">Process: not applicable</td></tr>
<tr><td colspan="2">External Surroundings: roof of the building</td><td colspan="2">Downgrading Conditions: noise, potential for leakage of ammonia</td><td colspan="2">Potential Impact on Work Activity: impaired communication, possible hearing loss, overexposure to ammonia</td></tr>
</table>

Notes:
· entry into this space is not expected to occur. Inspection and cleaning can occur from outside the hatches using long-handled tools without the need for entry.
· exposure to ammonia, while ever possible due to its presence in piping under pressure, is highly unlikely to occur. The presence of ammonia in air is an indication of failure of containment.

<table>
<tr><td colspan="2">Sunshine Coast Regional District</td><td colspan="2">Confined Space Identification and Hazard Assessment</td><td colspan="2">Ammonia Condenser Sump Tank</td></tr>
<tr><td colspan="2">Owner: Sunshine Coast Regional District</td><td colspan="2">Location: Gibsons and Area Community Centre</td><td colspan="2">Assessed by: Neil McManus, CIH, ROH, CSP
NorthWest OH&S
Tel: 604-980-8512
Date: 2010-02-26</td></tr>
<tr><td>underground working?</td><td>enclosed or partially enclosed?</td><td>designed/ intended for continuous human occupancy?</td><td>limited or restricted entry or exit?</td><td>large enough and configured for entry to perform work?</td><td>Confined Space?

Yes
▲</td></tr>
<tr><td>No</td><td>Yes</td><td>No</td><td>Yes</td><td>Yes</td><td>» All entries bold?</td></tr>
<tr><td colspan="2" rowspan="3">Description: vertical plastic tank about 1.8 m high by 1.2 m diameter.</td><td colspan="2">Access/Egress: hatch measuring about 0.5 m in diameter located on the top of the structure. This hatch is about 1.8 m above the base of the structure.</td><td colspan="2">Contents: treated condenser water</td></tr>
<tr><td colspan="2">Adjacent Spaces: ammonia refrigeration room</td><td colspan="2">Equipment: piping and effluent pump</td></tr>
<tr><td colspan="2">Function/Use: collects and stores water returning from ammonia condenser to be pumped back to ammonia condenser</td><td colspan="2">Process: not applicable</td></tr>
<tr><td colspan="2">External Surroundings: ammonia refrigeration room and related equipment</td><td colspan="2">Downgrading Conditions: noise, potential for leakage of ammonia in refrigeration room</td><td colspan="2">Potential Impact on Work Activity: impaired communication, possible hearing loss, overexposure to ammonia</td></tr>
</table>

Notes:
· entry into this space is not expected to occur. Inspection and cleaning can occur from outside the hatch using long-handled tools without the need for entry.
· exposure to ammonia, while ever possible due to its presence in piping under pressure, is highly unlikely to occur. The presence of ammonia in air is an indication of failure of containment.

<table>
<tr><td colspan="2">Sunshine Coast Regional District</td><td colspan="2">Confined Space Identification and Hazard Assessment</td><td colspan="2">Snow Melt Pit</td></tr>
<tr><td colspan="2">Owner: Sunshine Coast Regional District</td><td colspan="2">Location: Gibsons and Area Community Centre</td><td colspan="2">Assessed by: Neil Mc:Manus, CIH, ROH.CSP
NorthWest OH&S
Tel: 604-980-8512
Date: 2010-02-26</td></tr>
<tr><td>underground working?</td><td>enclosed or partially enclosed?</td><td>designed/ intended for continuous human occupancy?</td><td>limited or restricted entry or exit?</td><td>large enough and configured for entry to perform work?</td><td>Confined Space?

Yea
&</td></tr>
<tr><td>No</td><td>Yes</td><td>No</td><td>Yes</td><td>Yes</td><td>» All entries bold?</td></tr>
<tr><td colspan="2" rowspan="3">Description: open-topped, sub floor, cast-in-place, vertically-oriented, concrete structure measuring about 2.5 m by 3.5 m by 4.3 m deep. The structure contains an overflow for melted water to drain to thesewer.</td><td colspan="2">Access/Egress: ladder required</td><td colspan="2">Contents: ice, water, paint and sludge from scrapings</td></tr>
<tr><td colspan="2">Adfaeent Spaces: arena</td><td colspan="2">Equipment: heater coils located at along one of the long walls. The heater coils circulate glycol solution containing waste heat from the refrigeration process. The space also contains a submersible pump that connects to spray piping located along the outer long wall of thebuilding.</td></tr>
<tr><td colspan="2">Function/Use: contains ice and water from ice melting prior to drainage to the sewer system.</td><td colspan="2">Process: not applicable</td></tr>
<tr><td colspan="2">External Surroundings: interior of the building</td><td colspan="2">Downgrading Factors: exhaust from mobile equipment</td><td colspan="2">Potential Impact on Work Activity: overexposure to exhaust gases</td></tr>
</table>

Hazard Assessment - Undisturbed/Operational Space

This hazard assessment considers conditions to be encountered in the space under undisturbed conditions. This represents a benchmark prior to implementing control measures.

• **Abnospheric Hazards**

Oxygen Deficiency No

In use, this space is almost completely tun of water..Entry for the purpose of performing work cannot occur.

Oxygen Enrichment No

Bio/Chemical No

In use, this space is almost completely full of water..Entry for the purpose of performing work cannot occur.

Fire/Explosion No

• **Micro/Biological** No

In use, this space Is almost completely full of water. Growth of microorganisms is not likely on dry surfaces of concrete.

• **Ingestion/Skin & Eye Contact Hazard** No

• **Physical Agents**

Noise/Vibration No

Heat/Cold Stress No

Non/Ionizing Radiation No

Laser No

• **Personal Confinement** No

In use, this space is almost completely full of water..Entry for the purpose of performing work cannot occur.

• **Bio/Mechanical Hazard** No

• **Hydraulic/PneumatlcNacuum Hazard** No

• **Process Hazard** No

• **Safety Hazards**

Rundown **Possible**

Work occurring where rundown can occur necessitates traffic control measures. Barriers, tape and signage will be used to alert operators to the work area.

Structural **Hazard** No

Engulfment/Immersion **Yes**

In operation, this space is of water. This depth is sufficient fo drown standing individuals. A prone individual can drown in 15 cm of water.

Entanglement No

Electrical/Electrostatic No

Fall No

In use, this space is almost completely full of water. Entry for the purpose of performing work cannot occur.

Slip/Trip No

VlslbIlIty/LIght level **PossIble**

The space has no lighting. Light level is not likely to an issue during work performed in the space owing to illumination provided by building lighting. Considerable light enters the space through the access/egress opening.

Explosive/Implosive No

Hot/Cold Surfaces No

Hazard Assessment - Undisturbed Space

Hazardous Condition	**Real or Potential Consequence**		
	Low	**Moderate**	High
• atmospheric hazards			
oxygen deficiency	**NA**		
oxygen enrichment	**NA**		
bio/chemical	**NA**		
fire/explosion	**NA**		
• micro/biological	**NA**		
• ingestion/skin & eye contact	**NA**		
• physical agents			
noise/Vibration	**NA**		
heat/cold stress	**NA**		
non/ionizing radiation	**NA**		
laser	**NA**		
• personal confinement	**NA**		
• bio/mechanical**hazard**	**NA**		
• hydraulic/pneumatic/vacuum **hazard**	**NA**		
• process hazard	**NA**		
• **safety hazards**			
rundown	x		
structural	NA		
engulfment/immersion			x
entanglement	NA		
electricaVelectrostatic	NA		
fall	NA		
slip/trip	NA		
visibility/light level	x		
explosive/implosive	NA		
hot/cold surfaces	NA		

In this table, toxic substance, oxygen deficiency, oxygen enrichment andflammable or combustible atmosphere derive their meaning from Exposure limits and standards contained in the Occupational Health and Safety Regulation. **NA** means not applicable.

Action Required
- Remove the water from the spaoe prior to entry.
- Provide temporary lighting for work occurring inthe space.

Hazard Assessment- Work Tasks In **the Snow Melt Pit**

This hazard assessment considers conditions to be encountered in the space during work activity. Work activity includes inspection, cleaning, and minor mechanical work. Minor mechanical work includes drilling into the concrete and use of epoxies andcementitious grouts for concrete repair. This hazard assessment considers hazardous conditions created by the work activity in context with those remaining following implementationof control measures.

- **Hot Work** — No

- **Atmospheric Hazards**

Oxygen Deficiency — No

In use, this space is almost completely full of water..Entry for the purpose of performing work cannot occur.

On emptying, this space becomes a large container and is ventilated passively. Passive ventilation requires inflow and outflow of air. Air movement through structures, such as this, occurs because of a difference in temperature. This is possible in the present circumstance due to the presence of cold water and ice.

Oxygen depletion can also occur through absorption by the walls of the concrete if left undisturbed for a prolonged period. Organic debris can support growth of microorganisms, such as fungi and bacteria adapted to coldconditions. The key factor that affects air quality in these spaces is water. Water is essential for corrosion of metals and for thegrowth of microorganisms. The process of rusting involves chemical reaction of atmospheric oxygen with metal surfaces. The process continues deeper into the metal long after initial rusting of the surface. Microorganisms require oxygen for aerobic growth. Oxygen depletion through theaction of microorganisms or oxidation of metals requires considerable time and quiescent conditions.

Development of quiescent conditions and the risk of oxygen deficiency are governed primarily by water flow and exhalation of gases that dilute and displace the atmosphere, and the potential for thecontents of the space to experience aerobic digestion andgrowth of mould. This is likely only where the loading of organic material Is high, ascould occur here over the passage of time, the temperature of the liquid is suitable for growth of microorganisms, and flow is low or stagnant. None of the preceding factors is predictable in a particular circumstance to the extent needed to guarantee that an oxygen-deficient condition cannot or will not develop. One statement that is reasonable in these circumstances is that following removal of the water, conditions created by ventilation using portable equipment andascertained through atmospheric testing and very conservative setting of the alarm level of theoxygen sensor, in the absence of other measures, will not change during occupancy.

Continuous atmospheric testing and continuous mechanical ventilation, will occur during this **work.** The set point for the oxygen sensor is 20.5%. This prevents occurrence of a legally oxygen-deficient atmosphere (19.5%).

Oxygen Enrichment — No

Bio/Chemical — **Possible**

In use, this space is almost completely full of water..Entry for the purpose of performing work cannot occur.

On emptying, this space becomes a large container and is ventilated passively. Passive ventilation requires inflow and outflow of **air.** Air movement through structures, such as this, occurs because of a difference in temperature. This is possible in the present circumstance due to the presence of cold water and ice.

A biofilm resulting from colonization by microorganisms adapted to cold temperatures forms over the passage of time on interior surfaces. Organic debris can support growth of microorganisms, such as fungi and bacteria adapted to cold conditions. The key factor that affects air quality in these spaces is water. Water is essential for the growth of microorganisms. Microorganisms require oxygen for aerobic growth. The products of aerobic respiration include primarily carbon dioxide. Oxygen depletion through the action of microorganismsrequires considerable time and quiescent conditions. Anaerobic growth can occur in sludges in some circumstances. The products of anaerobic respiration include hydrogen sulphide and mercaptans (substituted hydrogen sulphide), methane and possibly ammonia and amines.

Development of quiescent conditions andthe risk of atmospheric contamination are governed primarily by water flow and exhalation of gases, and the potential for the contents of the space to experience aerobic and anaerobic digestion and growth of mould. This is likely only where the loading of organic material is high, as could occur here over the passage of time, the temperature of the liquid is suitable for growth of microorganisms,and flowis low or stagnant. None of the

preceding factors is predictable in a particular circumstance to the extent needed to guarantee that an atmospheric hazard cannot or will not develop. One statement that is reasonable in these circumstances is that following removal of the water, conditions created by ventilation using portable equipment and ascertained through atmospheric testing and conservative setting of the alarm level of sensors in the monitoring instrument, in the absence of other measures, will not change during occupancy.

Exhaust from vehicles and mobile equipment could enter the space under some conditions when used near access openings. Conditions of inversion or cool or cold weather and the cold temperatures that exist in the building can trap exhaust in the building and the space. Exhaust from gasoline engines contains carbon monoxide, carbon dioxide, unburned fuel vapour and particulates. Exhaust from diesel engines contains nitric oxide (NO), nitrogen dioxide ($N0_2$), unburned fuel vapour and particulates.

Pouring of concentrated solution of sodium hypochlorite into residual liquid remaining in the space could generate chloramines and depending on pH chlorine gas during the process of dilution.

Concrete dust produced during drilling contains quartz, a crystalline form of silica.. WorkSafeBC requires exposure to crystalline silica to be maintained as low as reasonably achievable. This can occur through use of ventilated tools containing dust collectors or use of wet methods.

Concrete, grout products, cement, and brick contain quartz, a form of crystalline silica. Chipping and drilling can create airborne dust and exposure to silica. Crystalline silica in the respirable size range causes silicosis and possibly lung cancer Quartz in the respirable form is an ALARA substance to which WorkSafeBC requires exposure to be maintained as low as reasonably achievable. Dust suppression using wet methods and dust collection are required. Refer to the Material Safety Data Sheet for further information.

Epoxy products contain solvents. Small quantities are used. Refer to the Material Safety Data Sheet for further information.

Continuous atmospheric testing, and mechanical ventilation will occur during this work.

Fire/Explosion No

• **Micro/Biological** **Possible**

In use, this space is almost completely full of water. Growth of microorganisms is not likely on dry surfaces of concrete.

On emptying, this space becomes a large container and is ventilated passively. Passive ventilation requires inflow and outflow of air. Air movement through structures, such as this, occurs because of a difference in temperature. This is possible in the present circumstance due to the presence of cold water and ice.

A biofilm resulting from colonization by microorganisms adapted to cold temperatures forms over the passage of time on interior surfaces. Organic debris can support growth of microorganisms, such as fungi and bacteria. Microbiological activity results In formation of spores and cysts. Spores can cause allergic reactions and respiratory distress in sensitized individuals. The space may also contain insects and spiders. Development of these conditions is governed by the extent of enclosure of the space, the presence of extraneous contents that can undergo aerobic decay and the period of quiescence between openings.

Powerwashing, disturbance during freeing of debris from walls and manipulation of piping could release spores and droplets containing microorganisms into the air.

• **Ingestion/Skin& Eye Contact Hazard** **Possible**

Concrete patching products and grouts are skin and severe eye irritants and are capable of causing chemical burns to the cornea. Refer to the Material Safety Data Sheet for these products further information.

Epoxy products are allergic sensitizers. Sensitization can occur through skin contact. Epoxy resin systems often are packaged in tubes with built-in mixing chambers. These minimize potential for skin contact. Refer to the Material Safety Data Sheet for these products for further information

• **Physical Agents**

NoIseNIbratIon **Possible**

Noise from portable electric tools and explosive-actuated tools could exceed regulatory limits. Noise levels in spaces containing reflective walls are considerably higher than those outdoors.

Heat/Cold Stress Possible

The temperature in the pit is likely to be as low or lower than the temperature in the other parts of the building. During a hot summer day, this temperature provides a respite from the heat. During the winter, this temperature and the accompanying high humidity could provoke cold stress in individuals performing sedentary work for long periods and not dressed in appropriately winter clothing. This situation is considerably less onerous than that experienced by workers who are working outdoors in rainy conditions just above freezing.

Non/Ionizing Radiation — No

Laser — No

• Personal Confinement — Yes
Access/egress is restricted to the ladder and the entry point. Headroom Is not an issue in this space due to the low ceiling.

• **Bio/Mechanical Hazard** — No

• **Hydraullc/Pneumatic;lVacuum Hazard** — **Yes**
Pressures involved in powerwashing (up to 5000 lb{1112) pose aninjection hazard. Fluid injected into the tissues in this manner follows an unpredictable path. This path can damage tissues under the skin. This kind of injury requires prompt attention from an experienced medical practitioner, as there is a risk of gangrene and loss of the limb. The risk of gangrene is related to the delay in receiving proper medical attention.

Vacuuming using high vacuum equipment poses a suction hazard. Some vacuum systems operate at -27 inches of mercury vacuum (-90 kPa). Systems creating high vacuum are capable of causing severe traumatic injury.

• **Process Hazard** — No

• **Safety Hazards**

Rundown — **Possible**
Work occurring where rundown can occur necessitates traffic control measures. Barriers, tape and signage will be used to alert operators to the work area.

Structural **Hazard** — No

Engulfment/Immersion — No
In operation, this space is of water. This depthis sufficient fo drown standing indMduals. A prone individual can**drown** in 15 cm of water. Removal of the water will occur prior to entry into the pit. Inflow depends completely ori the dumping of ice into the pit.

Entanglement — **No**

ElectrlcaVElectrostatlc — **Possible**
Faulty, deteriorated or inappropriate wiring in lights and other electrical equipment brought into the space poses an electrocution risk.

Fall — No
In use, this space is almost completely full of water. Entry for the purpose of performing work cannot occur. When emptied, the distance from the top to the bottom of the space exceeds that *tot* which fall protection is required. Irregular surfaces in the contact zone could increase the severity of fall-related injury. FaR protection will be used during entry into this structure.

Slip/Trip — No

VlslbIllty/LIght **level** — No
The space has no lighting. Light level is not likely to be an issue during work performed in the space owing to illumination provided by building lighting. Considerable light enters the space through the access/egress opening. Supplementary lighting will be provided during this **work.** Lighting is adequate when one can read this document unaided.

Explosive/Implosive — No

Hot/Cold **surfaces** — No

Hazard Assessment - Work Tasks In **the Snow Melt Pit**

Hazardous Condition	**Real or Potentlal Consequence**		
	Low	**Moderate**	High
• hot work	NA		
• atmospheric hazards			
oxygen deficiency	NA		
oxygen enrichment	NA		
bio/chemical		**x**	
we/explosion	**NA**		
• micro/biological	**x**		
• ingestion/skin & eye contact		X	
• physical agents			

noise/vibration		x	
heal/cold stress	x		
non/ionizing radiation	NA		
laser	NA		
• personal confinement		X	
• bio/mechanicalhazard	NA		
• hydraulic/pneumatic/vacuumhazard			X
• process hazard	NA		
• safety hazards			
rundown	x		
structural	NA		
engulfment/immersion	NA		
entanglement	NA		
electrical		x	
fall	NA		
slip/trip	NA		
visibility/light level	NA		
explosive/implosive	NA		
hot/cold surfaces	NA		

In this table, toxic substance, oxygen deficiency, oxygen enrichment and flammable or combustible atmosphere derive the:r meaning from Exposure Limits and standards contained in the Occupational Health and Safety Regulation. **NA** means not applicable.

Action Required

• Refer to accompanying procedure.

Sunshine Coast Regional District	**First Aid Assessment**	**Snow Melt Pit**
Owner: Sunshine Coast Regional District	**Work Location:** Gibsons and Area Community Center 700 Park Road, Gibsons, BC	**Assessed by:** Neil McManus, CIH, ROH, CSP NorthWest OH&S **Tel:** 604-980-8512 **Date:** 2010-02-26
Project: inspection, cleaning, concrete repair	**Number of Workers:** 2 to 3	
Work Activity:	**Probable Incident/Accident:**	**Probable Injury:**
· lifting and moving tools, equipment, supplies	· slip, trip, fall, overexertion, fall from ladder	· broken bones, soft tissue injury
· powerwashing	· slip, trip, overexertion, suction injury involving vacuum system, foreign object in the eye	· soft tissue injury, muscle strain, back injury, broken bones, corneal scratch
· concrete drilling	· dust and material in the eye, skin contact with hot surface, overexposure to noise	· soft tissue injury, muscle strain, back injury, temporary hearing loss
· grout patching	· material in the eye or on the skin	· chemical burn in the eye, eye injury, skin burn
· epoxy handling and application	· material in the eye or on the skin	· chemical burn in the eye, eye injury, skin irritation
Workplace Hazard Rating: moderate risk (This rating applies to all accidents occurring in the industry and not to the specifics of this situation.)	**Types of Work Activity/Accidents:** typical of industry; refer to hazard assessment	**Types of Injury:** typical of industry; some types require hospital treatment
Rating Modification Factors: none anticipated	**FAA Required**: one, Level 1 minimum	**FAA Selected**: one, available on site
Site Access Issues: not applicable	**Nearest Hospital:** St. Mary's Hospital, Sechelt (all emergencies)	**Alternate Hospital:** Gibsons Medical Clinic
	Route to Hospital: Left out of parking lot onto Park RD. Park RD to HYW 101 (Gibsons Way). Right onto HYW 101 (Gibsons Way). Follow HYW 101 approximately 20 km to St Mary's Hospital.	**Route to Clinic:** Left out of parking lot onto Park RD. Park RD to HYW 101 (Gibsons Way). Left onto HYW 101 (Gibsons Way). Follow HYW 101 (Gibsons Way) approximately 1.5 km to Gibsons Medical Clinic located at 821 Gibsons Way.
External Emergency Response: FIRE and AMBULANCE through 911 service	**Estimated Distance:** 20 km	**Estimated Distance:** 2 km
	Estimated Travel Time: 18 min	**Estimated Travel Time:** 5 min
Transportation: BC Ambulance Service, company vehicle, taxi, industrial ambulance; varies with location	**Transportation Issues:** winter weather	**Transportation Issues:** winter weather
Implementation		
Name: Ken Robinson	**Title:** Facilities Operation Supervisor	**Date:** 2010-02-26

Comments:
· Refer to the overall OH&S program.
· provide a wall map indicating the address and route to the Hospital and nearest alternate medical services and emergency telephone numbers.
· ensure that alternate medical services are equipped and amenable to providing assistance.

Sunshine Coast Regional District	**Confined Space Procedure**	**Snow Melt Pit**
Permit Required: No At time of entry, atmosphere is expected to be low hazard and not to exceed moderate hazard during work activity. The space does not contain equipment requiring lockout or isolation, or pose an immersion or engulfment hazard.	**Pgm Admin:** Ken Robinson **Tel:** 604-885-6822 **Cell/Pgr:** 604-989-1185 **Site Contact:** Dean Totten **Tel:** 604-885-6800 Ext: 6618 **Cell/Pgr:** 604-741-8510	**Prepared by:** N. McManus, CIH, ROH, CSP NorthWest OH&S **Tel:** 604-980-8512 **Date:** 2010-02-26

Equipment Required	**Co-ordination of Work Activities**
· two-way radio, cellular telephone · operating vehicles and fuel-powered equipment · secondary barricades, barrier tape, warning signs	· prior to starting work, invite the Fire Department to inspect the space for possible rescue issues, and to review the hazard assessment and preparatory measures included in this document Contractors: · upon arriving at the worksite, check in with the Assistant Supervisor, Maintenance and Operations, to determine the status of equipment and operations in the surroundings where this work is to occur and to establish reliability of communication · the Assistant Supervisor, Maintenance and Operations, or First Aid Attendant can act as standby for contractor personnel provided that this is pre-arranged and that the duties of the standby are known and followed · work is not to start unless the standby is prearranged · establish the reliability of radio or cellular communication. Reliable communication may not exist in some areas. · keep operating vehicles and fuel-powered portable equipment at least 10 m downwind from the entry to the space and intake of ventilating equipment to prevent entry of exhaust gases. · as needed to keep bystanders away from the area while work is occurring, erect secondary barriers

Equipment Required	**Isolation & Lockout**
·not applicable	·not applicable

Equipment Required	**Cleaning, Purging, Venting or Inerting**
· to be determined, ft^3/min, free air delivery	· locate the intake of the fan in an area of clean respirable air and use as a supply unit · direct flow from the duct into the space

Equipment Required	**Verification & Testing**
· to be determined, containing sensors for oxygen, flammable/combustibles, hydrogen sulphide, carbon monoxide · calibration kit · additional instrument containing sensor for nitrogen dioxide (Note: Monitoring for nitrogen dioxide is required where exposure to diesel exhaust can occur. If one can smell diesel, one must monitor it.)	· calibrate the instrument at the beginning of the workshift or immediately before use according to manufacturer's instructions. Persons calibrating and operating the instrument must have appropriate training. Keep records of calibration and testing. · measure conditions at the access opening to the space, and progressively downward · enter and work only if the following conditions are met: **Entry** **Work Activity/Alarm Setting** **oxygen:** 20.9% 20.5 % **flammable/combustibles:** 0% 0% **carbon monoxide:** 0 ppm 0 ppm **hydrogen sulphide:** 0 ppm 0 ppm **nitrogen dioxide:** 0 ppm 0 ppm · one entrant must wear the instrument at all times while in the space. · test each section prior to entry; note the acceptable criteria stated above · vacate the space in the event that the alarm sounds. For oxygen set the alarm at 20.5%; for other gases, set the alarm at the TLV level. If an alarm sounds, the standby shall order the entrants to vacate the space immediately. · at the end of the workshift record all data provided by the instrument (peak, TWA, STEL, occurrence of alarms)

Equipment Required	**Ventilation**

· to be determined, ft^3/min, free air delivery	· locate the intake of the fan in an area of clean respirable air and use as a supply unit · direct flow from the duct into the space
Equipment Required	**Personal Protective Equipment & Other Precautions**
· hard hat, safety glasses + sideshields, hearing protection (muffs or plugs) when noise sources are present, work area clothing, rubbersafety boots, waterproof gloves. Powerwashing requires additional protection: faceshield. industrial raingear, heavy duty waterproof gloves	· all workers require personal protective equipment, as specified. Personal protective equipment shall comply with requirements of the respective certifying and testing agencies, CSA (Canadian Standards Association) and ANSI (American National Standards Institute).
· respiratory protection: half-facepiece respirator containing organic vapour cartridges + HEPA filters	· in view of the information available, respiratory protection is required where dust generation can occur and where exposure to mist from ppwerwashing can occur. Provision of clean respirable air to the work area from an uncontaminated source, in the absence of sources of contamination, is believed sufficient to protect against overexposure to other air contaminants. In the event that this strategy does not provide sufficient protection, this situation requires re-evaluation.
· GFCIs · work area lighting	· all electrical circuits involving portable electrical equipment require Ground Fault Circuit Interrupters (GFCIs) · portable lighting is required during work occurring in areas lacking installed lighting; inspect electrical cords prior to the start of work; do not use if damaged. Light level is satisfactory if this document is readable in the work area.
Equipment Required	**Personal Hygiene and Decontamination**
· soap and water	· thoroughly wash hands, face and all exposed surfaces of skin prior to eating, drinking, or smoking
· portable eyewash, ANSI-compliant eyewash	· portable eyewash must be immediately available for use during work that creates a known eye hazard · continue flushing the eye after extrication using the ANSI-compliant eyewash; seek medical attention
Equipment Required	**Lifelines, Harnesses & Lifting Equipment**
· harness: dorsal D-ring	· required to assist in extrication; continuous connection to lifelines not required due to potential for entanglement
· fall restraint device: winch (Make model)	· fall restraint device is required during ascent and descent of ladder where free fall distance can exceed 3 m (10 feet) · this will prevent fall into the wastewater
· retrieval system: davit arm (Make model) positioned at the side of the space	· retrieval device required for entry and for lifting injured victim from the space
Equipment Required	**Standby Person**
· telephone, two-way radio	· standby must be accessible to the telephone and two-way radio at all times. · standby must have training in monitoring duties and initiating emergency response. · standby must communicate periodically and reliably with entrants in the space · standby must not enter the space
Equipment Required	**Rescue**

· cellular telephone, two-way radio	· rescue personnel must have training in first aid and CPR · to activate the emergency response, entrant or standby calls on the two-way radio, stating the exact location and the nature of the problem and requests assistance from the First Aid Attendant · the First Aid Attendant proceeds to the location, assesses the situation, and as appropriate, calls 911 on the telephone, states exact location, and asks for assistance from FIRE and AMBULANCE · rescue person assesses condition of the victim and determines whether serious injury has occurred, and whether serious injury has occurred to the head, neck or back. If serious injury has not occurred and does not involve the head, neck or back, the victim may be assisted to the access opening, as appropriate. If the preceding conditions cannot be met, the victim is to be packaged for transport.

Sunshine Coast Regional District		**Confined Space Identification and Hazard Assessment**		**Pump Stations – Aquatic Centres**	
Owner: Sunshine Coast Regional District		**Location:** Gibsons and District Aquatic Facility, Sechelt Aquatic Centre		**Assessed by:** Neil McManus, CIH, ROH, CSP NorthWest OH&S **Tel:** 604-980-8512 **Date:** 2012-03-14	
underground working?	enclosed or partially enclosed?	designed/ in-tended for continuous human occupancy?	limited or re-stricted entry or exit?	large enough and configured for entry to perform work?	**Confined Space?** **Yes** ▲
No	**Yes**	**No**	**Yes**	**Yes**	← All entries **bold**?
Description: prefabricated, in-floor concrete structures • Gibsons and District Aquatic Facility: 1.5 m in diameter by 3.5 m deep. • Sechelt Aquatic Centre: 1.5 m in diameter by 1.5 m deep.		**Access/Egress:** manhole measuring about 0.6 m in diameter; built-in ladder for internal access.		**Contents:** groundwater; tidewater possible; mould possible on wetted and dry surfaces	
		Adjacent Spaces: • Gibsons and District Aquatic Facility: not applicable • Sechelt Aquatic Centre: Pump Room located in the basement		**Equipment:** • Gibsons and District Aquatic Facility: one submersible pump, level sensing equipment, valves • Sechelt Aquatic Centre: two submersible pumps, level-sensing equipment, valves	
		Function/Use: • Gibsons and District Aquatic Facility and Sechelt Aquatic Centre: collect flow from perimeter drainage and groundwater for pumping to the storm sewer • Sechelt Aquatic Centre: collect from water sources in the basement for pumping to the sanitary sewer, not believed to handle wastewater from sanitary sources, such as toilets		**Process:** not applicable	
External Surroundings: • Gibsons and District Aquatic Centre: outdoor location beside the building • Sechelt Aquatic Centre: indoor location in the Pump Room		**Downgrading Conditions:** equipment noise		**Potential Impact on Work Activity:** interference with communication, possible overexposure	

Notes:
- Isolation of inflow during work activity is not possible.
- Gases accompanying water inflow and entry can be present.
- Service work will entail entry for removal of the pumps and level-detection equipment.
- Electrical lockout and isolation of this equipment is required prior to entry.

- **Atmospheric Hazards**

Oxygen Deficiency **Possible**

Oxygen deficiency can develop in these structures, but only through a limited number of mechanisms that may or may not apply in the specifics of this situation. These mechanisms include oxidation of metal surfaces, aging of reactive surfaces through oxidation, respiration by microorganisms, off-gassing of large quantities of vapour or gases from surfaces and vapours from liquids that displace and/or dilute the existing atmosphere, and adsorption by reactive surfaces.

Partial filling and emptying of these structures acts like a piston in a cylinder to expel and to entrain air through the vents. The likelihood of oxygen deficiency is reduced because of the movement of air into and out of the space in response to fluctuation in the level of water.

A biofilm resulting from colonization by microorganisms forms over the passage of time, given the quantity of debris and fine organic material present on interior surfaces in the space. Microbiological activity involving the biofilm could contribute to creating an oxygen-deficient atmosphere. This situation is unlikely given the action of the level control system.

Rusting of steel surfaces also can deplete oxygen. This situation is likely to pose risk only when the space remains undisturbed for a long period of time with minimal airflow.

Humidification of the airspace above the water due to the high temperature (28 °C), humidity and mist also create growth conditions. Water vapour evaporating from the surface of the liquid water reduces the concentration of oxygen in the airspace. At 20 °C, the partial pressure of water vapour (100% Relative Humidity) is about 18 mm Hg (millimetres of mercury). At this pressure, for a total atmospheric pressure of 760 mm Hg, the combined pressure of oxygen and nitrogen would be 742 mm Hg. The pressure of oxygen, which is 20.9% of the total would be about 155 mm Hg. This corresponds to a composition of 20.4 % relative to the norm of 20.9 % at normal atmospheric conditions. The legally oxygen-deficient concentration is 19.5 % at normal atmospheric conditions. At 28 °C, the partial pressure of water vapour (100% Relative Humidity) is about 28 mm Hg. At this pressure, the combined pressure of oxygen and nitrogen would be 732 mm Hg. The pressure of oxygen would be about 153 mm Hg. This corresponds to a composition of 20.1 % relative to the norm of 20.9 % at normal atmospheric conditions.

Development of these conditions and the risk of oxygen deficiency is governed by the extent of enclosure of the space, and the period of quiescence between openings. None of the preceding factors is predictable in a particular circumstance to the extent needed to guarantee that an oxygen-deficient condition cannot or will not develop. One statement that is reasonable in these circumstances is that the *status quo,* as created by conditions and ascertained through testing, in the absence of other measures is unlikely to change during occupancy.

Oxygen Enrichment No

Bio/Chemical **Possible**

A biofilm resulting from colonization by microorganisms forms over the passage of time, given accumulation of debris on interior surfaces in the space. Temperature and humidification of the airspace above the water also create growth conditions. Growth of microorganisms could lead to production of carbon dioxide (aerobic conditions).

Partial filling and emptying of these structures through action of the level control system acts like a piston in a cylinder to expel and to entrain air through the vents. The likelihood of accumulation of hazardous levels of contaminants is reduced because of the movement of air into and out of the space in response to fluctuation in the level of water.

Pool waters contain low concentrations of hypochlorous acid, hypochlorite ion, and various levels of calcium and sodium ions, and chloride and sulphate and carbonate and bicarbonate ions. If present in the flow, these waters may off-gas chloramines and nitrogen trichloride (the source of the ‘swimming pool odour’). Quantities should reflect the level of exposure of users of the pool.

Development of these conditions is governed by the extent of enclosure of the space, the presence of extraneous contents that can undergo aerobic and possibly anaerobic decay and the period of quiescence between openings. None of the preceding factors is predictable in a particular circumstance to the extent needed to guarantee that production and accumulation of these gases cannot or will not occur. One statement that is reasonable in these circumstances is that the *status quo,* as created by conditions and ascertained through testing, in the absence of other measures is unlikely to change during occupancy.

Fire/Explosion No

• Micro/Biological **Possible**

A biofilm resulting from colonization by microorganisms forms over the passage of time, given accumulation of debris on interior surfaces in the space. Temperature and humidification of the airspace above the water also create growth conditions. Growth of microorganisms could lead to production of spores and cysts. Spores and cysts can cause allergic respiratory symptoms in sensitized individuals. The space also can contain insects and spiders.

• Ingestion/Skin & Eye Contact Hazard **Possible**

A biofilm resulting from colonization by microorganisms forms over the passage of time, given accumulation of debris on interior surfaces in the space. Temperature and humidification of the airspace above the water also create growth conditions. Contact with surfaces containing growth of microorganisms can cause rashes in sensitized individuals. These spaces also can contain sharps, usually in the form of discarded hypodermic syringes and needles. Hypodermic syringes and needles are potential sources of exposure to HIV and hepatitis viruses. HIV can survive a week outside the body, and hepatitis viruses, up to three months.

• Physical Agents

Noise/Vibration No

Heat/Cold Stress No

Non/Ionizing Radiation No

Laser No

• **Personal Confinement** **Yes**

Access/egress requires vertical climb by ladder. Interior is large compared to availability of access. Headroom is an issue in the spaces at the Sechelt Aquatic Centre.

• **Bio/Mechanical Hazard** No

• **Hydraulic/Pneumatic/Vacuum Hazard** No

• **Process Hazard** No

• **Safety Hazards**

Rundown/Strikedown No

Structural Hazard **Possible**

Deterioration of the structure and rungs of in-place ladders may occur. Failure of a rung or a bracket can lead to fall during descent or ascent of an in-place ladder. This situation can develop only after prolonged exposure to conditions that are corrosive to metal and concrete. Structural integrity requires confirmation by the Owner. This reflects longevity projected in designs of these structures.

Engulfment/Immersion **Yes**

In operation, the spaces are partly full of water. Drowning of a prone individual can occur in 15 cm of water.

Entanglement No

Electrical/Electrostatic No

Fall **Yes**

Distance from top of the space to the floor through the access hatch in the structure at the Gibsons and District Aquatic Facility is sufficient to cause serious fall-related injury and exceeds the distance for which fall protection is required.

Slip/Trip **Yes**

Floor of the space may be slippery from growth of microorganisms.

Visibility/Light level **Yes**

Interior of the space has no lighting.

Explosive/Implosive No

Hot/Cold Surfaces No

Hazard Assessment - Undisturbed/Operational Space

Hazardous Condition	**Real or Potential Consequence**		
	Low	**Moderate**	**High**
	*	*	*
• atmospheric hazards			
oxygen deficiency	x		
oxygen enrichment	NA		
bio/chemical	x		
fire/explosion	NA		
• micro/biological		x	
• ingestion/skin & eye contact		x	
• physical agents			
noise/vibration	NA		
heat/cold stress	NA		
non/ionizing radiation	NA		
laser	NA		
• personal confinement		x	
• bio/mechanical hazard	NA		
• hydraulic/pneumatic/vacuum hazard	NA		
• process hazard	NA		
• safety hazards			
rundown/strikedown	NA		
structural		x	
engulfment/immersion			x
entanglement	NA		
electrical/electrostatic	NA		
fall		x	
slip/trip		x	

visibility/light level		x
explosive/implosive	NA	
hot/cold surfaces	NA	

In this table, toxic substance, oxygen deficiency, oxygen enrichment and flammable or combustible atmosphere derive their meaning from Exposure Limits and standards contained in the Occupational Health and Safety Regulation. **NA** means not applicable.

Action Required
• Pump accumulated water from the space prior to entry and work.
• Ventilate the interior of the space prior to entry.
• The Owner is to implement a procedure to deactivate, de-energize, isolate and lock out sources of water that can enter the structure.

Hazard Assessment — Work Tasks in the Pump Stations – Aquatic Centres
This hazard assessment refers to entry for the purpose of performing work tasks in the sumps in the Sechelt Aquatic Centre and the Gibsons and District Aquatic Facility. These include water- and powerwashing interior surfaces, and piping and concrete repair. Piping repair can involve use of adhesives. Concrete repair involves chipping and use of epoxy products and cementitious grouts. Setting of concrete anchors involves drilling and use of epoxy products. This hazard assessment considers hazardous conditions posed by the work activity in context with those remaining in the space following preparatory activity.

• **Hot Work** No

• **Atmospheric Hazards**

Oxygen Deficiency No

Oxygen deficiency can develop in these structures, but only through a limited number of mechanisms that may or may not apply in the specifics of this situation. These mechanisms include oxidation of metal surfaces, aging of reactive surfaces through oxidation, respiration by microorganisms, off-gassing of large quantities of vapour or gases from surfaces and vapours from liquids that displace and/or dilute the existing atmosphere, and adsorption by reactive surfaces.

Partial filling and emptying of these structures acts like a piston in a cylinder to expel and to entrain air through the vents. The likelihood of oxygen deficiency is reduced because of the movement of air into and out of the space in response to fluctuation in the level of water.

A biofilm resulting from colonization by microorganisms forms over the passage of time, given the quantity of debris and fine organic material present on interior surfaces in the space. Microbiological activity involving the biofilm could contribute to creating an oxygen-deficient atmosphere. This situation is unlikely given the action of the level control system.

Rusting of steel surfaces also can deplete oxygen. This situation is likely to pose risk only when the space remains undisturbed for a long period of time with minimal airflow.

Humidification of the airspace above the water due to the high temperature (28 °C), humidity and mist also create growth conditions. Water vapour evaporating from the surface of the liquid water reduces the concentration of oxygen in the airspace. At 20 °C, the partial pressure of water vapour (100% Relative Humidity) is about 18 mm Hg (millimetres of mercury). At this pressure, for a total atmospheric pressure of 760 mm Hg, the combined pressure of oxygen and nitrogen would be 742 mm Hg. The pressure of oxygen, which is 20.9% of the total would be about 155 mm Hg. This corresponds to a composition of 20.4 % relative to the norm of 20.9 % at normal atmospheric conditions. The legally oxygen-deficient concentration is 19.5 % at normal atmospheric conditions. At 28 °C, the partial pressure of water vapour (100% Relative Humidity) is about 28 mm Hg. At this pressure, the combined pressure of oxygen and nitrogen would be 732 mm Hg. The pressure of oxygen would be about 153 mm Hg. This corresponds to a composition of 20.1 % relative to the norm of 20.9 % at normal atmospheric conditions.

Development of these conditions and the risk of oxygen deficiency is governed by the extent of enclosure of the space, and the period of quiescence between openings. None of the preceding factors is predictable in a particular circumstance to the extent needed to guarantee that an oxygen-deficient condition cannot or will not develop. One statement that is reasonable in these circumstances is that the *status quo,* as created by conditions and ascertained through testing, in the absence of other measures is unlikely to change during occupancy.

Continuous mechanical ventilation and continuous atmospheric testing will occur during this work. The alarm set point for the oxygen sensor is 20.5% not the legal limit of 19.5%. This will ensure that an oxygen-deficient atmosphere cannot develop.

Oxygen Enrichment No

Bio/Chemical **Possible**

A biofilm resulting from colonization by microorganisms forms over the passage of time, given accumulation of debris on interior surfaces in the space. Temperature and humidification of the airspace above the water also create growth conditions. Growth of microorganisms could lead to production of carbon dioxide (aerobic conditions).

Partial filling and emptying of these structures through action of the level control system acts like a piston in a cylinder to expel and

to entrain air through the vents. The likelihood of accumulation of hazardous levels of contaminants is reduced because of the movement of air into and out of the space in response to fluctuation in the level of water.

Pool waters contain low concentrations of hypochlorous acid, hypochlorite ion, and various levels of calcium and sodium ions, and chloride and sulphate and carbonate and bicarbonate ions. If present in the flow, these waters may off-gas chloramines and nitrogen trichloride (the source of the 'swimming pool odour'). Quantities should reflect the level of exposure of users of the pool.

Development of these conditions is governed by the extent of enclosure of the space, the presence of extraneous contents that can undergo aerobic and possibly anaerobic decay and the period of quiescence between openings. None of the preceding factors is predictable in a particular circumstance to the extent needed to guarantee that production and accumulation of these gases cannot or will not occur. One statement that is reasonable in these circumstances is that the *status quo,* as created by conditions and ascertained through testing, in the absence of other measures is unlikely to change during occupancy.

Exhaust from vehicles and mobile equipment can enter the work space under conditions related to cold weather or inappropriate placement of equipment, and can cause needless exposure. This is especially probable where the geometry of structures prevents dispersion. Exhaust from gasoline engines contains carbon monoxide (CO), carbon dioxide (CO_2), unburned fuel vapour and particulates. Exhaust from vehicles is less of a problem at this time due to use of catalytic converters in the exhaust system. Small engines used in generator sets, pumps, powerwashers, and other small portable units are major sources of exposure to exhaust, especially where the geometry of structures prevents dispersion.

Exhaust from diesel engines contains nitric oxide (NO), nitrogen dioxide (NO_2), unburned fuel vapour and particulates. Exhaust from the diesel engine of trucks is often directed horizontally at ground level. In cool or cold weather, vertically directed exhaust will cool rapidly and stratify in a layer just above the top of the truck. Descent to ground level is possible. In confining geometries, accumulation could pose a serious exposure risk.

Combustion gases discharged from propane-fuelled air heaters used in cold weather conditions are sources of carbon dioxide and possibly carbon monoxide. Under cool or cold conditions, these gases do not disperse and can be entrained into the air provided by portable ventilation systems.

Abrasive blasting to remove coatings is a source of exposure to dust from the coating and from the blast medium. Refer to the Material Safety Data Sheets for both products for further information. WorkSafeBC lists respirable quartz as an ALARA substance to which exposure is to be kept as low as reasonably achievable below the exposure limit. This involves use of wet methods and dust collection.

Abrasive blasting using dry ice (solid carbon dioxide) is a source of exposure to carbon dioxide gas. Such applications require careful scrutiny by an individual well qualified and experienced in the practice of occupational hygiene.

Dry drilling, chipping or coring of concrete can evolve quartz (a form of crystalline silica) in respirable form. WorkSafeBC lists respirable quartz as an ALARA substance to which exposure is to be kept as low as reasonably achievable below the exposure limit. This involves use of wet methods and dust collection.

Concrete, grout products, cement, and brick contain quartz, a form of crystalline silica. Chipping and drilling can create airborne dust and exposure to silica. These tasks are short in duration relative to the length of the work day. Quartz in the respirable form is an ALARA substance to which WorkSafeBC requires exposure to be maintained as low as reasonably achievable below the exposure limit. Dust suppression using wet methods and dust collection are required. Refer to the Material Safety Data Sheet for further information.

Adhesives and cleaners used with the plastic piping contain methylethylketone (MEK) and/or toluene and/or cyclohexanone, and tetrahydrofuran. The vapours of these solvents provide excellent warning properties. The products are used very briefly and in very small quantity. As much of the work as possible occurs outside the space. Overexposure under normal circumstances of use is highly unlikely when the space undergoes continuous mechanical ventilation. Refer to the Material Safety Data Sheet for these products for further information.

Epoxies are sources of exposure to solvent vapour, and vapour from unreacted components. Refer to the Material Safety Data Sheets for these products for further information. Crack filling involving large quantities of epoxy could generate sufficient vapour to pose an exposure risk.

Continuous mechanical ventilation and continuous atmospheric testing will occur during this work.

Fire/Explosion No

• Micro/Biological **Possible**

A biofilm resulting from colonization by microorganisms forms over the passage of time, given accumulation of debris on interior surfaces in the space. Temperature and humidification of the airspace above the water also create growth conditions. Growth of microorganisms could lead to production of spores and cysts. Spores and cysts can cause allergic respiratory symptoms in sensitized individuals. The space also can contain insects and spiders.

Break-up of the biofilm by powerwashing creates airborne droplets containing viable microorganisms. These could include bacteria, yeasts, amoeba, and *Cryptosporidium*, among others. Inhalation of airborne spores and cysts and viable microorganisms could cause disease and allergic respiratory reactions in sensitized individuals.

Continuous mechanical ventilation will occur during this work. Turbulence created by the ventilation system could aerosolize spores contained in the structure.

• Ingestion/Skin & Eye Contact Hazard **Possible**

A biofilm resulting from colonization by microorganisms forms over the passage of time, given accumulation of debris on interior surfaces in the space. Temperature and humidification of the airspace above the water also create growth conditions. Contact with surfaces containing growth of microorganisms can cause rashes in sensitized individuals. These spaces also can contain sharps, usually in the form of discarded hypodermic syringes and needles. Hypodermic syringes and needles are potential sources of exposure to HIV and hepatitis viruses. HIV can survive a week outside the body, and hepatitis viruses, up to three months.

Concrete patching products and grouts are skin and severe eye irritants and are capable of causing chemical burns to the cornea. Refer to the Material Safety Data Sheet for further information.

Epoxy products are allergic sensitizers. Sensitization can occur through skin contact. Epoxy resin systems often are packaged in tubes with built-in mixing chambers. These minimize potential for skin contact. Refer to the Material Safety Data Sheet for these products for further information

• Physical Agents

Noise/Vibration **Possible**

Spraying using high pressure equipment, and concrete chipping, grinding, and sawing can create high levels of noise. This is exacerbated by reflection off the surfaces of the space. Noise produced by portable electrical and pneumatic tools can exceed regulatory limits.

Heat/Cold Stress No

Non/Ionizing Radiation No

Laser No

• Personal Confinement **Yes**

Access/egress requires vertical climb by ladder. Interior is large compared to availability of access. Headroom is an issue in the spaces at the Sechelt Aquatic Centre.

• Bio/Mechanical Hazard **Possible**

Mechanical equipment used for chipping, grinding and sawing poses an injury risk from striking and entangling.

• Hydraulic/Pneumatic/Vacuum Hazard **Possible**

Powerwashing poses an injection hazard (up to 5000 lb/in^2). Fluid injected into the tissues in this manner follows an unpredictable path. This path can damage tissues under the skin. This kind of injury requires prompt attention from an experienced medical practitioner, as there is a risk of gangrene and loss of the limb. The risk of gangrene is related to the delay in receiving proper medical attention.

Vacuuming using high vacuum equipment poses a suction hazard. Some vacuum systems operate at -27 inches of mercury vacuum (-90 kPa). Systems creating high vacuum are capable of causing severe traumatic injury, including avulsion and evisceration.

• Process Hazard No

• Safety Hazards

Rundown/Strikedown No

Structural Hazard No

Deterioration of the structure and rungs of in-place ladders may occur. Failure of a rung or a bracket can lead to fall during descent or ascent of an in-place ladder. This situation can develop only after prolonged exposure to conditions that are corrosive to metal and concrete. Structural integrity requires confirmation by the Owner. This reflects longevity projected in designs of these structures. Fall protection will be used, as deemed appropriate.

Engulfment/Immersion No

In operation, these structures are partly full of water. Drowning of a prone individual can occur in 15 cm of water. Accumulated water will be pumped from the space prior to the start of work. Water flow into the pump station at the Gibsons and District Aquatic Facility requires on-going control during the work to be performed.

Entry into a space containing water of sufficient depth to cause drowning is not permitted. A fall protection/work positioning system will be used where immersion in water is possible.

Entanglement No

Electrical/Electrostatic **Possible**

Portable electrical equipment used in the space containing faulty, deteriorated or inappropriate components or wiring poses an electrocution risk.

Fall No

Distance from top of the space to the floor through the access hatch in the structure at the Gibsons and District Aquatic Facility is sufficient to cause serious fall-related injury and exceeds the distance for which fall protection is required. Fall protection will be used, as deemed appropriate.

Slip/Trip **Yes**

Floor of the space is slippery from growth of microorganisms.

Visibility/Light level No

Interior of the space has no lighting. Supplemental lighting will be used, as needed. Lighting is satisfactory when one can read this document unaided.

Explosive/Implosive No

Hot/Cold Surfaces No

Hazard Assessment — Work Tasks in The Pump Stations – Aquatic Centres

Hazardous Condition	**Real or Potential Consequence**		
	Low *	**Moderate** *	**High** *
• hot work	NA		
• atmospheric hazards			
oxygen deficiency	NA		
oxygen enrichment	NA		
bio/chemical		x	
fire/explosion	NA		
• micro/biological		x	
• ingestion/skin & eye contact		x	
• physical agents			
noise/vibration		x	
heat/cold stress	NA		
non/ionizing radiation	NA		
laser	NA		
• personal confinement		x	
• bio/mechanical hazard		x	
• hydraulic/pneumatic/vacuum hazard		x	
• process hazard	NA		
• safety hazards			
rundown/strikedown	NA		
structural	NA		
engulfment/immersion	NA		
entanglement	NA		
electrical/electrostatic		x	
fall	NA		
slip/trip		x	
visibility/light level	NA		
explosive/implosive	NA		
hot/cold surfaces	NA		

In this table, toxic substance, oxygen deficiency, oxygen enrichment and flammable or combustible atmosphere derive their meaning from Exposure Limits and standards contained in the Occupational Health and Safety Regulation. **NA** means not applicable.

Action Required

• Refer to procedure for entry and work in this space.

Sunshine Coast Regional District	**First Aid Assessment**	**Pump Stations – Aquatic Centres**
Owner: Sunshine Coast Regional District	**Work Location:** Gibsons and District Aquatic Facility, Sechelt Aquatic Centre	**Assessed by:** Neil McManus, CIH, ROH, CSP NorthWest OH&S **Tel:** 604-980-8512 **Date:** 2012-03-14
Project: inspection, powerwashing concrete repair of structures, and valve repair and replacement	**Number of Workers:** 2 to 3	
Work Activity: • lifting and moving tools, equipment, supplies • powerwashing • concrete drilling • grout patching • epoxy handling and application, adhesive handling	**Probable Incident/Accident:** • slip, trip, fall, overexertion, fall from ladder • slip, trip, overexertion, suction injury involving vacuum system, foreign object in the eye • dust and material in the eye, overexposure to noise • material in the eye or on the skin • material in the eye or on the skin	**Probable Injury:** • broken bones, soft tissue injury • soft tissue injury, muscle strain, back injury, broken bones, corneal scratch • soft tissue injury, muscle strain, back injury, temporary hearing loss • chemical burn in the eye, eye injury, skin burn • chemical burn in the eye, eye injury, skin irritation
Workplace Hazard Rating: moderate risk (This rating applies to all accidents occurring in the industry and not to the specifics of this situation.)	**Types of Work Activity/Accidents:** typical of industry; refer to hazard assessment	**Types of Injury:** typical of industry; some types require hospital treatment
Rating Modification Factors: none anticipated	**FAA Required**: one, Level 1 minimum	**FAA Selected**:
Site Access Issues:	**Nearest Hospital:** St. Mary's Hospital, Sechelt (all emergencies)	**Alternate Hospital:** Gibsons Medical Clinic; Sechelt Medical Clinic; Pender Harbour & District Health Centre
	Route to Hospital:	**Route to Hospital:**
External Emergency Response: FIRE and AMBULANCE through 911 service	**Estimated Distance:** km	**Estimated Distance:** km
	Estimated Travel Time: min	**Estimated Travel Time:** min
Transportation: BC Ambulance Service, company vehicle, taxi, industrial ambulance; airlift possibly required	**Transportation Issues:** winter weather	**Transportation Issues:**
Implementation		
Name: Ken Robinson	**Title:** Facilities Operation Supervisor	**Date:** 2012-03-14
Comments: • Refer to the overall OH&S program. • for each location, provide a map indicating the address and route to the Hospital and nearest alternate medical services and emergency telephone numbers. • ensure that alternate medical services are equipped and amenable to providing assistance.		

Sunshine Coast Regional District	**Confined Space Procedure**	**Work Tasks in the Pump Stations – Aquatic Centres**
Permit Required: Yes At time of entry the atmosphere is expected to be low hazard and not to exceed moderate hazard during work activity. Space can contain a potential immersion hazard requiring continuous pump-out. Isolation of the space from inflow is not possible due to the absence of isolation valves.	**Pgm Admin:** Ken Robinson **Tel:** 604-885-6822 **Cell/Pgr:** to be determined **Site Contact:** Allen van Velzen **Tel:** 604-885-6822 **Cell/Pgr:** 604-741-1547	**Prepared by:** N. McManus, CIH, ROH, CSP NorthWest OH&S **Date:** 2010-03-14 **Tel:** 604-980-8512
Equipment Required	**Co-ordination of Work Activities**	
• two-way radio, cellular telephone • operating vehicles and fuel-powered equipment • exhaust hose • two-way radio, cellular telephone • exhaust hose • primary barriers • secondary barricades, barrier tape, warning signs	**Note**: • perform this work only when inflow into the Pump Station is fully controlled to a low level in the space. • locate the pump externally to the space to avoid potential electrical contact with the water Contractors: • on arriving at the site, contact the Pool Operator to establish reliability of communication. Reliable communication may not exist in some areas. • keep operating vehicles and fuel-powered portable equipment at least 10 m downwind from the entry to the space and intake of ventilating equipment to prevent entry of exhaust gases. • install exhaust hose to divert flow up the side of the truck to discharge above the roof when the engine continues to operate Operators: • on arriving at the site, contact the Pool Operator to establish reliability of communication. Reliable communication may not exist in some areas. • keep operating vehicles and fuel-powered portable equipment at least 10 m downwind from the entry to the space and intake of ventilating equipment to prevent entry of exhaust gases. • install exhaust hose to divert flow up the side of the truck to discharge above the roof when the engine continues to operate • erect primary barriers around openings to the space when unoccupied to prevent falls • as needed to keep bystanders and traffic away from the area while work is occurring, erect secondary barriers • at the end of the work or the workshift, replace the manhole cover	
Equipment Required	**Isolation & Lockout**	
	.• the Owner is to prepare and implement a procedure for deactivating, de-energizing, isolating and locking out equipment and fluid circuits that could influence the safety of the entry and work	
Equipment Required	**Cleaning, Purging, Venting or Inerting**	
• to be determined, xxxx ft^3/min free air delivery • garden sprayer or hose	• install fan intake in an area of clean respirable air and utilize as a supply unit. • position outlet of duct to provide air as close as possible into the zone in which work will occur. This will ensure that the entrant breathes air from the exterior rather than the atmosphere in the space. • begin ventilating at least 5 minutes prior to initial entry to ensure that purging of the atmosphere in the work zone has occurred • keep concrete wet when chipping or drilling to suppress dust generation	
Equipment Required	**Verification & Testing**	

• atmosphere testing instrument (Biosystems PhD Lite and Draeger XAM 2000) containing sensors for oxygen, flammable/combustibles, carbon monoxide, hydrogen sulphide • calibration kit • additional instrument containing sensor for nitrogen dioxide when diesel engines are operating. (If one can smell diesel exhaust, one must monitor the exhaust gases.)	• calibrate or bump test the instrument at the beginning of the workshift or immediately before use, per the manufacturer's instructions. Persons calibrating and operating the instrument must have appropriate training. Keep records of calibration and testing. • measure conditions at the top, middle and bottom of the space through which access/egress, and extrication will occur in the event of an emergency or accident by lowering the sampling line. Remember that there is a delay in response as air is pumped into the instrument. • record these readings and readings obtained periodically during work activity • where use of portable equipment powered by small engines is occurring, monitor the surroundings to ensure that exposure is not happening
	• entry and work in the space without respiratory protection for gases can occur only if the following conditions are met: **Entry** — **Work Activity/Alarm Settings** **oxygen:** 20.9 or 21.0% — 20.5 % or greater **flammable/combustibles:** 0 % of LEL — 5 % of LEL or less **carbon monoxide:** 0 ppm — 25 ppm or less **nitrogen dioxide:** 0 ppm — 1.0 ppm or less **hydrogen sulphide:** 0 ppm — 10 ppm or less
	• if these conditions are not met prior to entry, continue ventilating the space for 5 minutes and retest. If these conditions cannot be met, the situation requires reevaluation.
	• the entrant must wear the instrument at all times while in the space, and must vacate in the event that the alarm sounds. If an alarm sounds, the standby shall order the entrant(s) to vacate the space immediately. • at the end of the workshift record all data provided by the instrument (peak, TWA, STEL, occurrence of alarms)
Equipment Required	**Ventilation**
• to be determined, xxxx ft^3/min free air delivery ft^3/min free air delivery	• locate the intake to the supply fan upwind from operating engines and other sources of contamination. Direct exhaust flows away from air intakes. • position the end of supply duct as close as possible to the work zone and support, as necessary, to direct flow from directly above the worker.
Equipment Required	**Personal Protective Equipment & Other Precautions**
• hard hat, safety glasses + side-shields, hearing protection (muffs or plugs) when noise sources are present, work area clothing, safety boots, protective gloves. Powerwashing requires additional protection (faceshield, industrial raingear, rubber safety boots, waterproof gloves).	• all persons working in the space require personal protective equipment, as specified. Personal protective equipment shall comply with requirements of the respective certifying and testing agencies, CSA (Canadian Standards Association) and ANSI (American National Standards Institute).
• NIOSH-approved half-facepiece respirator containing HEPA filters and acid gas/organic vapour cartridges	• in view of the information available, persons working in the space should wear respiratory protection as a precaution against potential exposure to bacteria and viruses and spores from moulds and odours. Respiratory protection is required during operations that can generate concrete and cement dust. Wet methods greatly reduce the potential for dust generation. Provision of clean respirable air in the work zone by the supply system and atmospheric monitoring are believed sufficient to protect against overexposure to other contaminants. In the event that this strategy does not provide sufficient protection, the situation requires reevaluation.
• GFCIs	•all electrical circuits require Ground Fault Circuit Interrupters (GFCIs)
• sharps kit	• use tongs to handle sharps for disposal in the protected container
Equipment Required	**Personal Hygiene and Decontamination**
• personal eyewash, ANSI-compliant eyewash station	• a personal eyewash bottle must be available in the event of a splash into the face to flush the eyes immediately following contact with irritating substances • flush the eyes for 15 to 20 minutes using the ANSI-compliant unit • seek medical attention

• household bleach (1:20 dilution)	• utilize bleach solution (or similar disinfectant product) for cleaning following exposure to biofilms as part of the initial clean-up. Sewer workers must clean hands, face and exposed skin prior to eating, drinking or smoking.
• soap and water	• thoroughly wash hands, face and all exposed surfaces of skin prior to eating, drinking, or smoking
Equipment Required	**Lifelines, Harnesses & Lifting Equipment**
• harness (dorsal D-ring)	• all persons entering and working in the space where vertical extrication may occur require a harness, if feasible. Connection to the winch is required when standing water is present and to permit extrication. • inspect all equipment for damage before use. Remove damaged equipment from service.
• fall restraint device: winch (Make model)	• fall restraint is required where work occurs on the top of structures lacking fall prevention in the form of railings or other devices where fall can occur • fall restraint device is required during ascent and descent of ladder where free fall distance can exceed 3 m (10 feet)
• retrieval system: tripod or davit arm (Make model) positioned at manhole above the entry ladder	• retrieval device required for entry and for lifting injured victim from the space
Equipment Required	**Standby Person**
• two-way radio, cellular telephone	• standby person must remain near the access when equipment noise causes difficulty in communication. The standby can assist the entrant with equipment and supplies. The standby must be able to extricate the worker vertically in the event of an emergency or an accident. Standby must have training in monitoring duties, initiating emergency response, operation of retrieval equipment and removal of injured victims using this equipment. • standby must not enter the space
Equipment Required	**Rescue**
• two-way radio, cellular telephone, air horn	• rescue personnel must have training in first aid and CPR • to activate the emergency response, standby person sounds three long blasts on the air horn, as appropriate or contacts the Lifeguards on the two-way radio, indicates the occurrence of the accident and asks the Lifeguard to call 911 to request assistance from FIRE and AMBULANCE and states the exact location and the nature of the problem. • the Lifeguard contacts the Assistant Supervisor, Maintenance and Operations, to inform about the situation • if the instrument in the space is not alarming, and no other hazardous condition has arisen, the rescue person may enter the space to assist the victim; otherwise, use the winch to remove the victim. The standby must not enter the space. • rescue person assesses condition of the victim and determines whether serious injury has occurred and whether serious injury has occurred to the head, neck or back. If serious injury has not occurred and does not involve the head, neck or back, the victim may be assisted to the access and removed from the space. If the preceding conditions cannot be met, the victim is to be packaged for transport.

Sunshine Coast Regional District		**Confined Space Identification and Hazard Assessment**		**AHU #1 Sechelt Aquatic Centre**	
Owner: Sunshine Coast Regional District		**Location:** Sechelt Aquatic Centre		**Assessed by:** Neil McManus, CIH, ROH, CSP NorthWest OH&S **Tel:** 604-980-8512 **Date:** 2011-01-31	
underground working?	enclosed or partially enclosed?	designed/ intended for continuous human occupancy?	limited or restricted entry or exit?	large enough and configured for entry to perform work?	**Confined Space?** No ▲
No	**Yes**	Yes	No	**Yes**	» All entries **bold**?
Description: enclosed structure constructed from galvanized steel. These structure has both horizontally and vertically oriented components. Ducts are rectangular strengthened metal structures. Much of the duct is large enough for entry and work along its length. Generally the duct is suspended from the ceiling in inaccessible locations whose access requires the use of specialized work-positioning equipment. Vertical and horizontal orientations are present		**Access/Egress:** doors mounted in the wall of the structure. These doors have differing sizes; the largest measure about 0.6 m by 1.5 m. Ducts have inspection hatches measuring about 0.4 m by 0.6 m located at various heights above the floor. Access also can occur at airhandling equipment.		**Contents:** dust possible on surfaces following long-term operation, especially if filtration is faulty or ineffective	
		Adjacent Spaces: not applicable		**Equipment:** fan, motorized dampers	
		Function/Use: filter, heat and cool, and guide and move air through the ventilation system		**Process:** not applicable	
External Surroundings: mechanical rooms in the building		**Downgrading Conditions:** noise		**Potential Impact on Work Activity:** impaired communication, possible hearing loss	

Notes:
· since the original assessment in February 2010, the Sunshine Coast Regional District has installed lighting and emergency shutdown devices inside the duct at the access doors of AHU #1.These features remove the greatest concern about work in this structure in the event of an unexpected start-up of this equipment.
· the entrant is protected against contact with moving parts of the fan and moving parts of dampers are unable to cause harm.
· these modifications remove concerns that require treatment as a confined space
· lockout considerations will apply to this work. (Be aware of the exemption for exclusive control where this applies.)
· working alone considerations apply to this work.
· fall protection is required in parts of the structure where vertical sections are present.

Sunshine Coast Regional District		**Confined Space Identification and Hazard Assessment**		**Airhandling Units and Related Structures**	
Owner: Sunshine Coast Regional District		**Location:** Sechelt Aquatic Centre		**Assessed by:** Neil McManus, CIH, ROH, CSP NorthWest OH&S **Tel:** 604-980-8512 **Date:** 2010-02-10	
underground working?	enclosed or partially enclosed?	designed/ intended for continuous human occupancy?	limited or restricted entry or exit?	large enough and configured for entry to perform work?	**Confined Space?** **Yes** ▲
No	**Yes**	**No**	**Yes**	**Yes**	» All entries **bold**?
Description: enclosed structures of varying size constructed from galvanized steel. These structures can have both horizontally and vertically oriented components. Ducts are rectangular strengthened metal structures. Much of the duct is large enough for entry and work along its length. Generally the duct is suspended from the ceiling in inaccessible locations whose access requires the use of specialized work-positioning equipment. Vertical and horizontal orientations are present		**Access/Egress:** doors mounted in the wall of the structure. These doors have differing sizes; the largest measure about 0.6 m by 1.5 m. Ducts have inspection hatches measuring about 0.4 m by 0.6 m located at various heights above the floor. Access also can occur at airhandling equipment.		**Contents:** dust possible on surfaces following long-term operation, especially if filtration is faulty or ineffective	
		Adjacent Spaces: not applicable		**Equipment:** fan, motorized dampers	
		Function/Use: filter, heat and cool, and guide and move air through the ventilation system		**Process:** not applicable	
External Surroundings: mechanical rooms in the building		**Downgrading Conditions:** noise		**Potential Impact on Work Activity:** impaired communication, possible hearing loss	

Hazard Assessment — Undisturbed/Operational Space

This hazard assessment considers conditions to be encountered in the space under operational and shutdown conditions. This represents a benchmark prior to implementing control measures.

· Atmospheric Hazards

Oxygen Deficiency No

These spaces are actively ventilated components of ventilation systems. As a result, during operational conditions, interior surfaces experience considerable and prolonged contact with excess oxygen in the flowing air compared to what occurs under normal conditions. The only time in the history of a ventilation that this is not the case is during shutdown, usually performed to enable maintenance on the system.

The key factor that affects air quality in these spaces is water. Water is essential for the growth of microorganisms and for corrosion of metals. Oxygen depletion can occur through oxidation of the zinc in the galvanizing on the surfaces of the ducts and rusting of the underlying steel when left undisturbed for a prolonged period. The process of rusting involves chemical reaction of atmospheric oxygen with metal surfaces. The process continues deeper into the metal long after

initial rusting of the surface.

Some parts of airhandling equipment can contain wetted surfaces, as for example the bottom of the condensate pan and in some cases, insulation that has experienced condensation from air in the system or wetting from external sources. Wetted surfaces in ventilation systems provide the conditions for growth of microorganisms. Microorganisms consume oxygen during respiration. Microorganisms require oxygen for aerobic growth. Oxygen depletion through the action of microorganisms or oxidation of metals requires considerable time and quiescent conditions.

A ventilation system is an enclosed system that contains open ends. Development of quiescent conditions and the risk of oxygen deficiency are likely only under highly unusual circumstances. None of the preceding factors is predictable in a particular circumstance to the extent needed to guarantee that an oxygen-deficient condition cannot or will not develop. One statement that is reasonable in these circumstances is that conditions created by ventilation either through operation of the installed fan or use of a portable ventilation system and confirmed through atmospheric testing and very conservative setting of the alarm level of the oxygen sensor, in the absence of other measures, will not change during occupancy.

Oxygen Enrichment No

Bio/Chemical **Possible**

These spaces are actively ventilated components of ventilation systems. As a result, during operational conditions, interior surfaces experience considerable and prolonged contact with contaminants in the flowing air compared to what occurs under normal conditions. As well, volatile substances incorporated into materials of construction are entrained more efficiently into the rapidly moving air than would occur under normal circumstances. The only time in the history of a ventilation that this is not the case is during shutdown, usually performed to enable maintenance on the system.

Volatile materials vaporize at the surface of materials. Under quiescent conditions vaporization and condensation occur simultaneously until an equilibrium occurs. Equilibrium is highly unlikely to develop in a ventilation system even during quiescent conditions. While long stretches of the system are enclosed, the ends are open to the atmosphere.

The other factor that affects air quality in these structures is water. Water is essential for the growth of microorganisms. A biofilm resulting from colonization by microorganisms forms over the passage of time on wetted interior surfaces. Organic debris can support growth of microorganisms, such as fungi and bacteria. The products of aerobic respiration include primarily carbon dioxide.

Accumulation of contamination through the action of microorganisms requires considerable time and quiescent conditions. Anaerobic growth can occur in sludges in some circumstances. The products of anaerobic respiration include hydrogen sulphide and mercaptans (substituted hydrogen sulphide), methane and possibly ammonia and amines.

Development of quiescent conditions and the risk of atmospheric contamination are likely to occur only under highly unusual circumstances. None of the preceding factors is predictable in a particular circumstance to the extent needed to guarantee that an atmospheric hazard cannot or will not develop. One statement that is reasonable in these circumstances is that conditions created by ventilation either through operation of the installed fan or use of a portable ventilation system and confirmed through atmospheric testing and conservative setting of the alarm level of sensors, in the absence of other measures, will not change during occupancy.

Exhaust from vehicles and mobile equipment can enter the space under conditions of careless placement near air intakes. Conditions of inversion or cool or cold weather and the cold temperatures that exist in the building can trap exhaust in the building. Exhaust from gasoline engines contains carbon monoxide, carbon dioxide, unburned fuel vapour and particulates. Exhaust from diesel engines contains nitric oxide (NO), nitrogen dioxide (NO_2), unburned fuel vapour and particulates.

Fire/Explosion No

· Micro/Biological **Possible**

A biofilm resulting from colonization by microorganisms forms over the passage of time on damp or wet interior surfaces. Bacteria and fungi grow on damp or wetted surfaces. Organic debris can support growth of microorganisms, such as fungi and bacteria. Microbiological activity results in formation of spores and cysts. Spores can cause allergic reactions and respiratory distress in sensitized individuals. In operation, movement of air at high velocity removes spores from surfaces. Slow movement of air can lead to deposition. Entrapment of spores occurs in filters. Under quiescent conditions, aerosolization of spores becomes subject to active disturbance of the structure. The space may also contain insects and spiders.

· Ingestion/Skin & Eye Contact Hazard No

· Physical Agents

Noise/Vibration **Possible**

This equipment produces some noise, mainly at low frequencies. Within the structure the noise may impede communication and cause hearing loss. This equipment often contains sound insulation intended to minimize noise transmission in the air being processed and transported and distributed This sound insulation also can prevent transmission of calls for help from inside the equipment during operation.

Heat/Cold Stress No

Non/Ionizing Radiation No

Laser No

· Personal Confinement **Yes**

Access/egress is restricted to the entry door and the entry point. Headroom is an issue in some of these spaces. Piping may restrict movement.

· Bio/Mechanical Hazard **Yes**

The interior of these structures normally is accessible during operation through access doors. Movement by motorized dampers poses a risk of traumatic injury. Openings into the fan casing may be unguarded. Movement of the impeller can cause serious traumatic injury, including death. The motor that drives the fan is unguarded. The enclosure of the airhandling equipment serves as the guard. Movement of the motor and belts and pulleys during occupancy can cause severe traumatic injury, including death.

· Hydraulic/Pneumatic/Vacuum Hazard No

· Process Hazard No

· Safety Hazards

Rundown No

Structural Hazard No

Engulfment/Immersion No

Entanglement **Possible**

Entanglement of lifelines and restricted movement in the space can occur in internal structures.

Electrical/Electrostatic No

Fall **Yes**

Vertically oriented structures requiring ladder access or horizontally oriented structures accessed by ladder pose fall risk. Irregular surfaces in the contact zone could increase the severity of fall-related injury

Slip/Trip **Possible**

Interior metal surfaces are slippery especially when wet. Protrusions pose trip hazards.

Visibility/Light level **Possible**

The space has no lighting. Light level is not likely to be an issue during work performed in the space near access openings owing to illumination provided by building lighting. Considerable light enters the space through access/egress openings.

Explosive/Implosive **Yes**

Gaining access to the interior of these structures during operation requires overcoming the static pressure exerted on them by the fan. Upstream from the fan, the door opens outward, and suction acts inward. Downstream from the fan the door opens inward and static pressure acts outward. A person injured while working inside the structure during operation must overcome these forces fo open the access door and to exit fo gain assistance. This is not always possible.

Hot/Cold Surfaces No

Hazard Assessment — Undisturbed/Operational Space

Hazardous Condition	**Real or Potential Consequence**		
	Low	**Moderate**	**High**
· atmospheric hazards			
oxygen deficiency	x		
oxygen enrichment	NA		
bio/chemical	x		
fire/explosion	NA		
· micro/biological	x		
· ingestion/skin & eye contact	NA		
· physical agents			
noise/vibration		x	
heat/cold stress	NA		
non/ionizing radiation	NA		
laser	NA		
· personal confinement		x	
· bio/mechanical hazard	x		
· hydraulic/pneumatic/vacuum hazard	NA		
· process hazard	NA		
· safety hazards			
rundown	NA		
structural	NA		
engulfment/immersion	NA		
entanglement	x		
electrical/electrostatic	NA		
fall		x	
slip/trip	x		
visibility/light level	x		
explosive/implosive		x	
hot/cold surfaces	NA		

In this table, toxic substance, oxygen deficiency, oxygen enrichment and flammable or combustible atmosphere derive their meaning from Exposure Limits and standards contained in the Occupational Health and Safety Regulation. **NA** means not applicable.

Action Required

· Provide temporary lighting for work occurring in the space.

· Operate the installed fan to ventilate the system prior to occupancy.

Hazard Assessment — Work Tasks in Airhandling Units and Related Structures

This hazard assessment considers conditions to be encountered in the space during work activity. Work activity includes inspection, cleaning, changing filters, and minor mechanical work. Minor mechanical work includes servicing the motor that drives the fan and lubricating bearings. This hazard assessment considers hazardous conditions created by the work activity in context with those remaining following implementation of control measures.

· Hot Work No

· Atmospheric Hazards

Oxygen Deficiency No

These spaces are actively ventilated components of ventilation systems. As a result, during operational conditions, interior surfaces experience considerable and prolonged contact with excess oxygen in the flowing air compared to what occurs under normal conditions. The only time in the history of a ventilation that this is not the case is during shutdown, usually performed to enable maintenance on the system.

The key factor that affects air quality in these spaces is water. Water is essential for the growth of microorganisms and for corrosion of metals. Oxygen depletion can occur through oxidation of the zinc in the galvanizing on the surfaces of the ducts and rusting of the underlying steel when left undisturbed for a prolonged period. The process of rusting involves chemical reaction of atmospheric oxygen with metal surfaces. The process continues deeper into the metal long after initial rusting of the surface.

Some parts of airhandling equipment can contain wetted surfaces, as for example the bottom of the condensate pan and in some cases, insulation that has experienced condensation from air in the system or wetting from external sources. Wetted surfaces in ventilation systems provide the conditions for growth of microorganisms. Microorganisms consume oxygen during respiration. Microorganisms require oxygen for aerobic growth. Oxygen depletion through the action of microorganisms or oxidation of metals requires considerable time and quiescent conditions.

A ventilation system is an enclosed system that contains open ends. Development of quiescent conditions and the risk of oxygen deficiency are likely only under highly unusual circumstances. None of the preceding factors is predictable in a particular circumstance to the extent needed to guarantee that an oxygen-deficient condition cannot or will not develop. One statement that is reasonable in these circumstances is that conditions created by ventilation either through operation of the installed fan or use of a portable ventilation system and confirmed through atmospheric testing and very conservative setting of the alarm level of the oxygen sensor, in the absence of other measures, will not change during occupancy.

The airhandling equipment associated with this structure will be deactivated, de-energized, isolated and locked out prior to entry and work. Continuous atmospheric testing, and as necessary, continuous mechanical ventilation, will occur during this work to supplement natural airflow. The set point for the oxygen sensor is 20.5%. This prevents occurrence of a legally oxygen-deficient atmosphere (19.5%).

Oxygen Enrichment No

Bio/Chemical **Possible**

These spaces are actively ventilated components of ventilation systems. As a result, during operational conditions, interior surfaces experience considerable and prolonged contact with contaminants in the flowing air compared to what occurs under normal conditions. As well, volatile substances incorporated into materials of construction are entrained more efficiently into the rapidly moving air than would occur under normal circumstances. The only time in the history of a

ventilation that this is not the case is during shutdown, usually performed to enable maintenance on the system.

Volatile materials vaporize at the surface of materials. Under quiescent conditions vaporization and condensation occur simultaneously until an equilibrium occurs. Equilibrium is highly unlikely to develop in a ventilation system even during quiescent conditions. While long stretches of the system are enclosed, the ends are open to the atmosphere.

The other factor that affects air quality in these structures is water. Water is essential for the growth of microorganisms. A biofilm resulting from colonization by microorganisms forms over the passage of time on wetted interior surfaces. Organic debris can support growth of microorganisms, such as fungi and bacteria. The products of aerobic respiration include primarily carbon dioxide.

Accumulation of contamination through the action of microorganisms requires considerable time and quiescent conditions. Anaerobic growth can occur in sludges in some circumstances. The products of anaerobic respiration include hydrogen sulphide and mercaptans (substituted hydrogen sulphide), methane and possibly ammonia and amines.

Development of quiescent conditions and the risk of atmospheric contamination are likely to occur only under highly unusual circumstances. None of the preceding factors is predictable in a particular circumstance to the extent needed to guarantee that an atmospheric hazard cannot or will not develop. One statement that is reasonable in these circumstances is that conditions created by ventilation either through operation of the installed fan or use of a portable ventilation system and confirmed through atmospheric testing and conservative setting of the alarm level of sensors, in the absence of other measures, will not change during occupancy.

Exhaust from vehicles and mobile equipment can enter the space under conditions of careless placement near air intakes. Conditions of inversion or cool or cold weather and the cold temperatures that exist in the building can trap exhaust in the building. Exhaust from gasoline engines contains carbon monoxide, carbon dioxide, unburned fuel vapour and particulates. Exhaust from diesel engines contains nitric oxide (NO), nitrogen dioxide (NO_2), unburned fuel vapour and particulates.

The airhandling equipment associated with this structure will be deactivated, de-energized, isolated and locked out prior to entry and work. Continuous atmospheric testing, and as necessary, continuous mechanical ventilation, will occur during this work to supplement natural airflow

Fire/Explosion No

· Micro/Biological **Possible**

A biofilm resulting from colonization by microorganisms forms over the passage of time on damp or wet interior surfaces. Bacteria and fungi grow on damp or wetted surfaces. Organic debris can support growth of microorganisms, such as fungi and bacteria. Microbiological activity results in formation of spores and cysts. Spores can cause allergic reactions and respiratory distress in sensitized individuals. In operation, movement of air at high velocity removes spores from surfaces. Slow movement of air can lead to deposition. Entrapment of spores occurs in filters. Under quiescent conditions, aerosolization of spores becomes subject to active disturbance of the structure. The space may also contain insects and spiders.

The airhandling equipment associated with this structure will be deactivated, de-energized, isolated and locked out prior to entry and work. Close proximity to the source and active disturbance of growth will create additional potential for exposure.

· Ingestion/Skin & Eye Contact Hazard No

· Physical Agents

Noise/Vibration **Possible**

This equipment produces some noise, mainly at low frequencies. Within the structure the noise may impede communication and cause hearing loss. This equipment often contains sound insulation intended to minimize noise

transmission in the air being processed and transported and distributed This sound insulation also can prevent transmission of calls for help from inside the equipment during operation. The airhandling equipment associated with this structure will be deactivated, de-energized, isolated and locked out prior to entry and work.

Noise from portable electric tools could exceed regulatory limits. Noise levels in spaces containing reflective walls are considerably higher than those outdoors.

Heat/Cold Stress No

Non/Ionizing Radiation No

Laser No

· Personal Confinement **Yes**

Access/egress is restricted to the ladder and the entry point. Headroom is an issue in this space due to the low ceiling. Piping may restrict movement.

· Bio/Mechanical Hazard **Possible**

The interior of these structures normally is accessible during operation through access doors. Movement by motorized dampers poses a risk of traumatic injury. Openings into the fan casing may be unguarded. Movement of the impeller can cause serious traumatic injury, including death. The motor that drives the fan is unguarded. The enclosure of the airhandling equipment serves as the guard. Movement of the motor and belts and pulleys during occupancy can cause severe traumatic injury, including death. The airhandling equipment associated with this structure will be deactivated, de-energized, isolated and locked out prior to entry and work.

Overhead work and awkward postures when performed on hands and knees considerably increases the potential for musculoskeletal injury.

· Hydraulic/Pneumatic/Vacuum Hazard **Yes**

Vacuuming using high vacuum equipment poses a suction hazard. Some vacuum systems operate at -27 inches of mercury vacuum (-90 kPa). Systems creating high vacuum are capable of causing severe traumatic injury.

· Process Hazard No

· Safety Hazards

Rundown No

Structural Hazard No

Engulfment/Immersion No

Entanglement **Possible**

Entanglement of lifelines and restricted movement in the space can occur in internal structures.

Electrical/Electrostatic **Possible**

Faulty, deteriorated or inappropriate wiring in lights and other electrical equipment brought into the space also poses an electrocution risk.

Fall No

Vertically oriented structures requiring ladder access or horizontally oriented structures accessed by ladder pose fall risk. Irregular surfaces in the contact zone could increase the severity of fall-related injury. Fall protection will be used during entry into this structure when fall risks are present.

Slip/Trip **Possible**

Interior metal surfaces are slippery especially when wet. Protrusions pose trip hazards.

Visibility/Light level No

The space has no lighting. Light level is not likely to be an issue during work performed in the space near access openings owing to illumination provided by building lighting. Considerable light enters the space through access/egress openings. Supplementary lighting will be provided during this work. Lighting is adequate when one can read this document unaided.

Explosive/Implosive No

Gaining access to the interior of these structures during operation requires overcoming the static pressure exerted on them by the fan. Upstream from the fan, the door opens outward, and suction acts inward. Downstream from the fan the door opens inward and static pressure acts outward. A person injured while working inside the structure during operation must overcome these forces fo open the access door and to exit fo gain assistance. This is not always possible. At the time of entry and work, the fans are deactivated, de-energized, isolated and locked out.

Hot/Cold Surfaces No

Hazard Assessment — Work Tasks in Airhandling Units and Related Structures

Hazardous Condition	**Real or Potential Consequence**		
	Low	**Moderate**	**High**
· hot work	NA		
· atmospheric hazards			
oxygen deficiency	NA		
oxygen enrichment	NA		
bio/chemical	x		
fire/explosion	NA		
· micro/biological		x	
· ingestion/skin & eye contact	NA		
· physical agents			
noise/vibration		x	
heat/cold stress	NA		
non/ionizing radiation	NA		
laser	NA		
· personal confinement			x
· bio/mechanical hazard		x	
· hydraulic/pneumatic/vacuum hazard		x	
· process hazard	NA		
· safety hazards			
rundown	NA		
structural	NA		
engulfment/immersion	NA		
entanglement		x	
electrical/electrostatic		x	
fall	NA		
slip/trip	x		
visibility/light level	NA		
explosive/implosive	NA		
hot/cold surfaces	NA		

In this table, toxic substance, oxygen deficiency, oxygen enrichment and flammable or combustible atmosphere derive

their meaning from Exposure Limits and standards contained in the Occupational Health and Safety Regulation. **NA** means not applicable.

Action Required

· Refer to accompanying procedure.

<table>
<tr><th>Sunshine Coast Regional District</th><th>First Aid Assessment</th><th>Airhandling Units and Related Structures</th></tr>
<tr><td>Owner: Sunshine Coast Regional District</td><td>Work Location: Sechelt Aquatic Centre</td><td rowspan="2">Assessed by: Neil McManus, CIH, ROH, CSP
NorthWest OH&S
Tel: 604-980-8512
Date: 2010-02-10</td></tr>
<tr><td>Project: inspection, cleaning, minor mechanical work</td><td>Number of Workers: 2 to 3</td></tr>
<tr><td>Work Activity:

· lifting and moving tools, equipment, supplies</td><td>Probable Incident/Accident:

· slip, trip, fall, overexertion, fall from ladder</td><td>Probable Injury:

· broken bones, soft tissue injury</td></tr>
<tr><td>Workplace Hazard Rating: moderate risk (This rating applies to all accidents occurring in the industry and not to the specifics of this situation.)</td><td>Types of Work Activity/Accidents: typical of industry; refer to hazard assessment</td><td>Types of Injury: typical of industry; some types require hospital treatment</td></tr>
<tr><td>Rating Modification Factors: none anticipated</td><td>FAA Required: one, Level 1 minimum</td><td>FAA Selected: one, available on site</td></tr>
<tr><td rowspan="2">Site Access Issues: not applicable</td><td>Nearest Hospital: St. Mary’s Hospital, Sechelt (all emergencies)</td><td>Alternate Hospital: Gibsons Medical Clinic; Sechelt Medical Clinic; Pender Harbour & District Health Centre</td></tr>
<tr><td>Route to Hospital:</td><td>Route to Hospital:</td></tr>
<tr><td rowspan="2">External Emergency Response: FIRE and AMBULANCE through 911 service</td><td>Estimated Distance: km</td><td>Estimated Distance: km</td></tr>
<tr><td>Estimated Travel Time: min</td><td>Estimated Travel Time: min</td></tr>
<tr><td>Transportation: BC Ambulance Service, company vehicle, taxi, industrial ambulance; varies with location</td><td>Transportation Issues: rush hour traffic</td><td>Transportation Issues: rush hour traffic</td></tr>
<tr><td colspan="3">Implementation</td></tr>
<tr><td>Name: Ken Robinson</td><td>Title: Facilities Operation Supervisor</td><td>Date: 2010-02-10</td></tr>
<tr><td colspan="3">Comments:
· Refer to the overall OH&S program.
· for each location, provide a map indicating the address and route to the Hospital and nearest alternate medical services and emergency telephone numbers.
· ensure that alternate medical services are equipped and amenable to providing assistance.</td></tr>
</table>

Sunshine Coast Regional District	**Confined Space Procedure**	**Airhandling Units and Related Structures**
Permit Required: Yes At time of entry, atmosphere is expected to be low hazard and not to exceed moderate hazard during work activity. The space contains equipment requiring lockout or isolation, but does not pose an immersion or engulfment hazard.	**Pgm Admin:** Ken Robinson **Tel:** 604-885-6822 **Cell/Pgr:** 604-989-1185 **Site Contact:** Daryl Lowey **Tel:** 604-885-6822 **Cell/Pgr:** 604-741-3680	**Prepared by:** N. McManus, CIH, ROH, CSP NorthWest OH&S **Tel:** 604-980-8512 **Date:** 2010-02-10

Equipment Required	**Co-ordination of Work Activities**
· two-way radio, cellular telephone · operating vehicles and fuel-powered equipment · secondary barricades, barrier tape, warning signs	· prior to starting work, invite the Fire Department to inspect the space for possible rescue issues, and to review the hazard assessment and preparatory measures included in this document Contractors: · upon arriving at the worksite, check in with the Pool Operator to determine the status of equipment and operations in the surroundings where this work is to occur and to establish reliability of communication · Pool Operator or First Aid Attendant can act as standby for contractor personnel provided that this is pre-arranged and that the duties of the standby are known and followed · work is not to start unless the standby is prearranged · establish the reliability of radio or cellular communication. Reliable communication may not exist in some areas. · keep operating vehicles and fuel-powered portable equipment at least 10 m downwind from the entry to the space and intake of ventilating equipment to prevent entry of exhaust gases. · as needed to keep bystanders away from the area while work is occurring, erect secondary barriers · at the end of the work or the workshift, close the access door or hatch
Equipment Required	**Isolation & Lockout**
· keyed padlock and tag	· the Owner is to prepare and implement a procedure to deactivate, de-energize, isolate and lock out the equipment in this structure
Equipment Required	**Cleaning, Purging, Venting or Inerting**
· to be determined, ft^3/min, free air delivery	· operate the installed ventilation system immediately prior to shutdown for entry · in the absence of air contaminants, verified by testing (see below), conditions in the space will not change during occupancy of short duration where shutdown is prolonged, or where the activity generates air contaminants: · locate the intake of the fan in an area of clean respirable air and use as a supply unit · direct flow from the duct into the space to push vapour away from workers in the space
Equipment Required	**Verification & Testing**

· atmosphere testing instrument, Industrial Scientific M40, containing sensors for oxygen, flammable/combustibles, hydrogen sulphide, carbon monoxide · calibration kit · additional instrument containing sensor for nitrogen dioxide (Note: Monitoring for nitrogen dioxide is required where exposure to diesel exhaust can occur. If one can smell diesel, one must monitor it.)	· calibrate the instrument at the beginning of the workshift or immediately before use according to manufacturer's instructions. Persons calibrating and operating the instrument must have appropriate training. Keep records of calibration and testing. · measure conditions at the access opening to the space, and progressively inward · enter and work only if the following conditions are met: **Entry** **Work Activity/Alarm Setting** **oxygen:** 20.9% 20.5 % **flammable/combustibles:** 0% 0% **carbon monoxide:** 0 ppm 0 ppm **hydrogen sulphide:** 0 ppm 0 ppm **nitrogen dioxide:** 0 ppm 0 ppm · one entrant must wear the instrument at all times while in the space. · test each section prior to entry; note the acceptable criteria stated above · vacate the space in the event that the alarm sounds. For oxygen set the alarm at 20.5%; for other gases, set the alarm at the TLV level. If an alarm sounds, the standby shall order the entrants to vacate the space immediately. · at the end of the workshift record all data provided by the instrument (peak, TWA, STEL, occurrence of alarms)
Equipment Required	**Ventilation**
· to be determined, ft^3/min, free air delivery	· operate the installed ventilation system immediately prior to shutdown for entry · in the absence of air contaminants, verified by testing (see below), conditions in the space will not change during occupancy of short duration where shutdown is prolonged, or where the activity generates air contaminants: · locate the intake of the fan in an area of clean respirable air and use as a supply unit · direct flow from the duct into the space to push vapour away from workers in the space
Equipment Required	**Personal Protective Equipment & Other Precautions**
· hard hat, safety glasses + sideshields, hearing protection (muffs or plugs) when noise sources are present, work area clothing, safety boots, work gloves	· all workers require personal protective equipment, as specified. Personal protective equipment shall comply with requirements of the respective certifying and testing agencies, CSA (Canadian Standards Association) and ANSI (American National Standards Institute).
· respiratory protection: not applicable	· in view of the information available, respiratory protection is not required. Provision of clean respirable air to the work area from an uncontaminated source, in the absence of sources of contamination, is believed sufficient to protect against overexposure to other air contaminants. In the event that this strategy does not provide sufficient protection, this situation requires re-evaluation.
· GFCIs	· all electrical circuits involving portable electrical equipment require Ground Fault Circuit Interrupters (GFCIs)
· work area lighting	· portable lighting is required during work occurring in areas lacking installed lighting; inspect electrical cords prior to the start of work; do not use if damaged. Light level is satisfactory if this document is readable in the work area.
Equipment Required	**Personal Hygiene and Decontamination**
· soap and water	· thoroughly wash hands, face and all exposed surfaces of skin prior to eating, drinking, or smoking

· portable eyewash, ANSI-compliant eyewash	· portable eyewash must be immediately available for use during work that creates a known eye hazard · continue flushing the eye after extrication using the ANSI-compliant eyewash; seek medical attention
Equipment Required	**Lifelines, Harnesses & Lifting Equipment**
· harness: dorsal D-ring	· required to assist in extrication where lifting must occur; continuous connection to lifelines not required due to potential for entanglement
· fall restraint device: winch (Make model)	· fall restraint is required where work occurs on the top of structures lacking fall prevention in the form of railings or other devices where fall can occur · fall restraint device is required during ascent and descent of ladder where free fall distance can exceed 3 m (10 feet)
· retrieval system: tripod or davit arm (Make model) positioned at access	· retrieval device required for entry and for lifting injured victim from the space
Equipment Required	**Standby Person**
· telephone, two-way radio	· standby must be accessible to the telephone and two-way radio at all times. · standby must have training in monitoring duties and initiating emergency response. · standby must communicate periodically and reliably with entrants in the space · standby must not enter the space
Equipment Required	**Rescue**
· cellular telephone, two-way radio	· rescue personnel must have training in first aid and CPR · to activate the emergency response, standby person sounds three long blasts on the air horn, as appropriate or contacts the Lifeguards on the two-way radio, indicates the occurrence of the accident and asks the Lifeguard to call 911 to request assistance from FIRE and AMBULANCE and states the exact location and the nature of the problem. · the Lifeguard contacts the Assistant Supervisor, Maintenance and Operations, to inform about the situation · if the instrument in the space is not alarming, and no other hazardous condition has arisen, the rescue person may enter the space to assist the victim; otherwise, use the winch to remove the victim. The standby must not enter the space. · rescue person assesses condition of the victim and determines whether serious injury has occurred and whether serious injury has occurred to the head, neck or back. If serious injury has not occurred and does not involve the head, neck or back, the victim may be assisted to the access and removed from the space. If the preceding conditions cannot be met, the victim is to be packaged for transport.

Sunshine Coast Regional District		**Confined Space Identification and Hazard Assessment**		**Backwash Tank**	
Owner: Sunshine Coast Regional District		**Location:** Sechelt Aquatic Centre		**Assessed by:** Neil McManus, CIH, ROH, CSP NorthWest OH&S **Tel:** 604-980-8512 **Date:** 2010-02-10	
underground working?	enclosed or partially enclosed?	designed/ intended for continuous human occupancy?	limited or restricted entry or exit?	large enough and configured for entry to perform work?	**Confined Space?** **Yes** ▲
No	**Yes**	**No**	**Yes**	**Yes**	» All entries **bold**?
Description: vented, cast-in-place, in-floor concrete structure typically 1.2. m by 4.6 m by 3.7 m high. A baffle which Is open at the bottom divides the space into two chambers, occupying about 2/3 and 1/3 of the volume. The opening at the base of the baffle is about 0.6 m high and extends along the length.		**Access/Egress:** hatch typically measuring about 0.9 m square; built-in rungs or extension-type ladder for internal access.		**Contents:** pool water; miscellaneous debris, including band-aids, hair, foam bits, jewellry, lint, plastic finger nails, foam bits, and so on; dead skin; filtration medium suspended and transferred during backwashing; biofilm on wet surfaces, mould possible on wetted and dry surfaces	
		Adjacent Spaces: Pump Room located in the basement		**Equipment:** not applicable	
		Function/Use: collect backwash from the filters and hold during treatment to destroy residual hypochlorous acid and hypochlorite ion prior to discharge to the sewer..		**Process:** not applicable	
External Surroundings: storage room		**Downgrading Conditions:** not applicable		**Potential Impact on Work Activity:** not applicable	

Hazard Assessment — Undisturbed/Operational Space

This hazard assessment identifies and discusses hazardous conditions that can develop during operation or quiescent conditions in the space and indicates hazardous conditions requiring correction during entry preparation.

· Atmospheric Hazards

Oxygen Deficiency **Possible**

A biofilm resulting from colonization by microorganisms forms over the passage of time, given the quantity of debris and fine organic material (shed skin flakes, for example) present on interior surfaces in the space. Microbiological activity involving the biofilm could contribute to creating an oxygen-deficient atmosphere.

Rusting of steel surfaces also can deplete oxygen. This situation is likely to pose greatest risk when the space remains undisturbed for a long period of time with minimal airflow.

Humidification of the airspace above the water due to the high temperature (28℃), humidity and mist also create growth conditions. Water vapour evaporating from the surface of the liquid water reduces the concentration of oxygen in the

airspace. At 20℃, the partial pressure of water vapour (100% Relative Humidity) is about 18 mm Hg (millimetres of mercury). At this pressure, for a total atmospheric pressure of 760 mm Hg, the combined pressure of oxygen and nitrogen would be 742 mm Hg. The pressure of oxygen, which is 20.9% of the total would be about 155 mm Hg. This corresponds to a composition of 20.4 % relative to the norm of 20.9 % at normal atmospheric conditions. The legally oxygen-deficient concentration is 19.5 % at normal atmospheric conditions. At 28℃, the partial pressure of water vapour (100% Relative Humidity) is about 28 mm Hg. At this pressure, the combined pressure of oxygen and nitrogen would be 732 mm Hg. The pressure of oxygen would be about 153 mm Hg. This corresponds to a composition of 20.1 % relative to the norm of 20.9 % at normal atmospheric conditions.

Development of these conditions and the risk of oxygen deficiency is governed by the extent of enclosure of the space, and the period of quiescence between filling and emptying (about once per month) and openings. None of the preceding factors is predictable in a particular circumstance to the extent needed to guarantee that an oxygen-deficient condition cannot or will not develop. One statement that is reasonable in these circumstances is that the *status quo,* as created by conditions and ascertained through testing, in the absence of other measures is unlikely to change during occupancy.

Oxygen Enrichment No

Bio/Chemical **Possible**

A biofilm resulting from colonization by microorganisms forms over the passage of time, given the quantity of debris and fine organic material (shed skin flakes, for example) present on interior surfaces in the space. Temperature and humidification of the airspace above the water also create growth conditions. Growth of microorganisms could lead to production of carbon dioxide (aerobic conditions).

Pool waters contain low concentrations of hypochlorous acid, hypochlorite ion, and various levels of calcium and sodium ions, and chloride and sulphate and carbonate and bicarbonate ions. These waters may off-gas chloramines and nitrogen trichloride (the source of the 'swimming pool odour'. Quantities should reflect the level of exposure of users of the pool.

Development of these conditions is governed by the extent of enclosure of the space, the presence of extraneous contents that can undergo aerobic and possibly anaerobic decay and the period of quiescence between filling and emptying (about once per month) and openings. None of the preceding factors is predictable in a particular circumstance to the extent needed to guarantee that production and accumulation of these gases cannot or will not occur. One statement that is reasonable in these circumstances is that the *status quo,* as created by conditions and ascertained through testing, in the absence of other measures is unlikely to change during occupancy.

Fire/Explosion No

· Micro/Biological **Possible**

A biofilm resulting from colonization by microorganisms forms over the passage of time, given the quantity of debris and fine organic material (shed skin flakes, for example) present on interior surfaces in the space. Temperature and humidification of the airspace above the water also create growth conditions. Growth of microorganisms could lead to production of spores and cysts. Spores and cysts can cause allergic respiratory symptoms in sensitized individuals. The space also can contain insects and spiders.

· Ingestion/Skin & Eye Contact Hazard **Possible**

A biofilm resulting from colonization by microorganisms forms over the passage of time, given the quantity of debris and fine organic material (shed skin flakes, for example) that is present on interior surfaces in the space. Temperature and humidification of the airspace above the water also create growth conditions. Contact with surfaces containing growth of microorganisms can cause rashes in sensitized individuals. These spaces also can contain sharps, usually in the form of discarded hypodermic syringes and needles. Hypodermic syringes and needles are potential sources of exposure to HIV and hepatitis viruses. HIV can survive a week outside the body, and hepatitis viruses, up to three months.

· Physical Agents

Noise/Vibration No

Heat/Cold Stress **Possible**

Water temperature in the pool is 28℃. The temperature in the space is about this level accompanied by a high level of humidity. These conditions potentially can cause heat stress in unacclimatized individuals while performing heavy work.

Non/Ionizing Radiation No

Laser No

· Personal Confinement **Yes**

Access/egress requires vertical climb by ladder. Interior is large compared to availability of access. Headroom is not an issue in ths space.

· Bio/Mechanical Hazard No

· Hydraulic/Pneumatic/Vacuum Hazard **Possible**

This chamber fills through the manual opening and closing valves located on the sand filters. The control of these valves on the inflow circuit enables isolation. Note that this is a single valve isolation. The structure drains through the manual opening of the drain valve that discharges to the sewer.

· Process Hazard No

· Safety Hazards

Rundown No

Structural Hazard **Possible**

Deterioration of the structure and rungs of in-place ladders may occur. Failure of a rung or a bracket can lead to fall during descent or ascent of an in-place ladder. This situation can develop only after prolonged exposure to conditions that are corrosive to metal and concrete. Structural integrity requires confirmation by the Owner. This reflects longevity projected in designs of these structures.

Engulfment/Immersion **Yes**

In operation, this structure is often partly full of wash water. Drowning of a prone individual can occur in 15 cm of water. Accumulated water will be pumped from the space prior to the start of work.

Entanglement No

Electrical/Electrostatic No

Fall **Yes**

Distance from top of the space to the floor through the access hatch is sufficient to cause serious fall-related injury and exceeds the distance for which fall protection is required.

Slip/Trip **Yes**

Floor of the space is slippery from growth of microorganisms.

Visibility/Light level **Yes**

Interior of the space has no lighting.

Explosive/Implosive No

Hot/Cold Surfaces No

Hazard Assessment - Undisturbed/Operational Space

Hazardous Condition	Real or Potential Consequence		
	Low	Moderate	High
· atmospheric hazards			
oxygen deficiency		x	
oxygen enrichment	NA		
bio/chemical	x		
fire/explosion	NA		
· micro/biological		x	
· ingestion/skin & eye contact		x	
· physical agents			
noise/vibration	NA		
heat/cold stress		x	
non/ionizing radiation	NA		
laser	NA		
· personal confinement		x	
· bio/mechanical hazard	NA		
· hydraulic/pneumatic/vacuum hazard		x	
· process hazard	NA		
· safety hazards			
rundown	NA		
structural		x	
engulfment/immersion			x
entanglement	NA		
electrical/electrostatic	NA		
fall		x	
slip/trip	x		
visibility/light level		x	
explosive/implosive	NA		
hot/cold surfaces	NA		

In this table, toxic substance, oxygen deficiency, oxygen enrichment and flammable or combustible atmosphere derive their meaning from Exposure Limits and standards contained in the Occupational Health and Safety Regulation. **NA** means not applicable.

Action Required

· Drain the space and pump accumulated water from the space prior to entry and work.
· Ventilate the interior of the space prior to entry.
· The Owner is to implement a procedure to deactivate, de-energize, isolate and lock out sources of water that can enter the structure.

Hazard Assessment — Work Tasks in Backwash Tank

This hazard assessment refers to entry for the purpose of performing work tasks in surge tanks in swimming pools. These include: water- and powerwashing interior surfaces, and concrete repair. Concrete repair involves chipping and use of epoxy products and cementitious grouts. Setting of concrete anchors involves drilling and use of epoxy products. This hazard assessment considers hazardous conditions posed by the work activity in context with those remaining in the space following preparatory activity.

· Hot Work No

· Atmospheric Hazards

Oxygen Deficiency No

A biofilm resulting from colonization by microorganisms forms over the passage of time, given the quantity of debris and fine organic material (shed skin flakes, for example) present on interior surfaces in the space. Microbiological activity involving the biofilm could contribute to creating an oxygen-deficient atmosphere.

Rusting of steel surfaces also can deplete oxygen. This situation is likely to pose greatest risk when the space remains undisturbed for a long period of time with minimal airflow.

Humidification of the airspace above the water due to the high temperature (28℃), humidity and mist also create growth conditions. Water vapour evaporating from the surface of the liquid water reduces the concentration of oxygen in the airspace. At 20℃, the partial pressure of water vapour (100% Relative Humidity) is about 18 mm Hg (millimetres of mercury). At this pressure, for a total atmospheric pressure of 760 mm Hg, the combined pressure of oxygen and nitrogen would be 742 mm Hg. The pressure of oxygen, which is 20.9% of the total would be about 155 mm Hg. This corresponds to a composition of 20.4 % relative to the norm of 20.9 % at normal atmospheric conditions. The legally oxygen-deficient concentration is 19.5 % at normal atmospheric conditions. At 28℃, the partial pressure of water vapour (100% Relative Humidity) is about 28 mm Hg. At this pressure, the combined pressure of oxygen and nitrogen would be 732 mm Hg. The pressure of oxygen would be about 153 mm Hg. This corresponds to a composition of 20.1 % relative to the norm of 20.9 % at normal atmospheric conditions.

Draining the water from the interior of the space changes the growth relationship between the organisms involved in the biofilm and can lead to colonization by foreign microorganisms. The likelihood of this depends on time and temperature following drainage. Powerwashing will create mist, a suspension of droplets in the physical volume of the space. The bulk volume of the droplets and evaporation from the surface of the droplets will displace some of the atmosphere, leading to potential oxygen deficiency. The extent to which this action occurs depends on the water pressure required to clean the surfaces. Oxygen depletion can also occur through absorption by the walls of the concrete if left undisturbed for a prolonged period.

The key factor that affects air quality in these spaces is water. Water is essential for corrosion of metals and for the growth of microorganisms. The process of rusting involves chemical reaction of atmospheric oxygen with metal surfaces. The process continues deeper into the metal long after initial rusting of the surface. Microorganisms require oxygen for aerobic growth.

Development of these conditions and the risk of oxygen deficiency is governed by the extent of enclosure of the space, and the period of quiescence between filling and emptying (about once per month) and openings. None of the preceding factors is predictable in a particular circumstance to the extent needed to guarantee that an oxygen-deficient condition cannot or will not develop. One statement that is reasonable in these circumstances is that the *status quo,* as created by conditions and ascertained through testing, in the absence of other measures is unlikely to change during occupancy.

Continuous mechanical ventilation and continuous atmospheric testing will occur during this work. The alarm set point for the oxygen sensor is 20.5% not the legal limit of 19.5%. This will ensure that an oxygen-deficient atmosphere cannot develop.

Oxygen Enrichment No

Bio/Chemical **Possible**

A biofilm resulting from colonization by microorganisms forms over the passage of time, given the quantity of debris and fine organic material (shed skin flakes, for example) present on interior surfaces in the space. Temperature and humidification of the airspace above the water also create growth conditions. Growth of microorganisms could lead to production of carbon dioxide (aerobic conditions).

Pool waters contain low concentrations of hypochlorous acid, hypochlorite ion, and various levels of calcium and sodium ions, and chloride and sulphate and carbonate and bicarbonate ions. These waters may off-gas chloramines and nitrogen trichloride (the source of the ‘swimming pool odour’. Quantities should reflect the level of exposure of users of the pool.

Draining the water from the interior of the space changes the growth relationship of the organisms involved in the biofilm

and can lead to colonization by foreign microorganisms. The likelihood of this depends on time and temperature following drainage. Increased growth will increase the rate of production of carbon dioxide. During shutdown conditions, these structures become similar to structures otherwise only partly filled with water. New growth resulting from colonization by fungi will also occur on residual material and surfaces. Fungi also produce carbon dioxide. The level of emission of carbon dioxide currently is unknown.

The key factor that affects air quality in these spaces is water. Water is essential for the growth of microorganisms. Development of these conditions is governed by the extent of enclosure of the space, the presence of extraneous contents that can undergo aerobic and possibly anaerobic decay and the period of quiescence between filling and emptying (about once per month) and openings. None of the preceding factors is predictable in a particular circumstance to the extent needed to guarantee that production and accumulation of these gases cannot or will not develop. One statement that is reasonable in these circumstances is that the *status quo,* as created by conditions and ascertained through testing, in the absence of other measures is unlikely to change during occupancy.

Exhaust from vehicles and mobile equipment can enter the work space under conditions related to cold weather or inappropriate placement of equipment, and can cause needless exposure. This is especially probable where the geometry of structures prevents dispersion. Exhaust from gasoline engines contains carbon monoxide (CO), carbon dioxide (CO_2), unburned fuel vapour and particulates. Exhaust from vehicles is less of a problem at this time due to use of catalytic converters in the exhaust system. Small engines used in generator sets, pumps, powerwashers, and other small portable units are major sources of exposure to exhaust, especially where the geometry of structures prevents dispersion.

Exhaust from diesel engines contains nitric oxide (NO), nitrogen dioxide (NO_2), unburned fuel vapour and particulates. Exhaust from the diesel engine of trucks is often directed horizontally at ground level. In cool or cold weather, vertically directed exhaust will cool rapidly and stratify in a layer just above the top of the truck. Descent to ground level is possible. In confining geometries, accumulation could pose a serious exposure risk.

Combustion gases discharged from propane-fuelled air heaters used in cold weather conditions are sources of carbon dioxide and possibly carbon monoxide. Under cool or cold conditions, these gases do not disperse and can be entrained into the air provided by portable ventilation systems.

Abrasive blasting to remove coatings is a source of exposure to dust from the coating and from the blast medium. Refer to the Material Safety Data Sheets for both products for further information. WorkSafeBC lists respirable quartz as an ALARA substance to which exposure is to be kept as low as reasonably achievable. This involves use of wet methods and dust collection.

Abrasive blasting using dry ice (solid carbon dioxide) is a source of exposure to carbon dioxide gas. Such applications require careful scrutiny by an individual well qualified and experienced in the practice of occupational hygiene.

Spraypainting in large structures can lead to high concentrations of solvent vapours and the solids present in the paint formulation. The coated surface plus each airborne droplet is a potential source of evaporation of solvent into the air. Such applications require careful scrutiny by an individual well qualified and experienced in the practice of occupational hygiene and safety.

Dry drilling, chipping or coring of concrete can evolve quartz (a form of crystalline silica) in respirable form. WorkSafeBC lists respirable quartz as an ALARA substance to which exposure is to be kept as low as reasonably achievable. This involves use of wet methods and dust collection.

Concrete, grout products, cement, and brick contain quartz, a form of crystalline silica. Chipping and drilling can create airborne dust and exposure to silica. These tasks are short in duration relative to the length of the work day. Quartz in the respirable form is an ALARA substance to which WorkSafeBC requires exposure to be maintained as low as reasonably achievable. Dust suppression using wet methods and dust collection are required. Refer to the Material Safety Data Sheet for further information.

Epoxies are sources of exposure to solvent vapour, and vapour from unreacted components. Refer to the Material Safety

Data Sheets for these products for further information. Crack filling involving large quantities of epoxy could generate sufficient vapour to pose an exposure risk.

Continuous mechanical ventilation and continuous atmospheric testing will occur during this work.

Fire/Explosion **Possible**

Abrasive blasting using agricultural by-products, such as corn husks and walnut shells can create high concentrations of dust in poorly ventilated situations. Similar considerations apply to dust from paint resins made airborne during abrasive blasting. Determination of dust concentration in such circumstances is very difficult. The ‘rule of thumb’ in such circumstances is that the inability to see an operating light bulb at a distance of 1.8 m (5 ft) indicates a potential explosible atmosphere of dust. (Refer to the section on electrical considerations.)

Spraypainting in large structures can lead to high concentrations of solvent vapours and the solids present in the paint formulation. The coated surface plus each airborne droplet are potential sources of evaporation of solvent into the air. Such applications require careful scrutiny by an individual well qualified and experienced in the practice of occupational hygiene and safety.

· Micro/Biological **Possible**

A biofilm resulting from colonization by microorganisms forms over the passage of time, given the quantity of debris and fine organic material (shed skin flakes, for example) present on interior surfaces in the space. Temperature and humidification of the airspace above the water also create growth conditions. Growth of microorganisms could lead to production of spores and cysts. Spores and cysts can cause allergic respiratory symptoms in sensitized individuals. The space also can contain insects and spiders.

Draining the water from the interior of the space changes the growth relationship of the organisms involved in the biofilm and can lead to colonization by foreign microorganisms. The likelihood of this depends on time and temperature following drainage.

Break-up of the biofilm by powerwashing creates airborne droplets containing viable microorganisms. These could include bacteria, yeasts, amoeba, and *Cryptosporidium*, among others. Inhalation of airborne spores and cysts and viable microorganisms could cause disease and allergic respiratory reactions in sensitized individuals.

Continuous mechanical ventilation will occur during this work. Turbulence created by the ventilation system could aerosolize spores contained in the structure.

· Ingestion/Skin & Eye Contact Hazard **Possible**

A biofilm resulting from colonization by microorganisms forms over the passage of time, given the quantity of debris and fine organic material (shed skin flakes, for example) that is present on interior surfaces in the space. Temperature and humidification of the airspace above the water also create growth conditions. Contact with surfaces containing growth of microorganisms can cause rashes in sensitized individuals. These spaces also can contain sharps, usually in the form of discarded hypodermic syringes and needles. Hypodermic syringes and needles are potential sources of exposure to HIV and hepatitis viruses. HIV can survive a week outside the body, and hepatitis viruses, up to three months.

Concrete patching products and grouts are skin and severe eye irritants and are capable of causing chemical burns to the cornea. Refer to the Material Safety Data Sheet for further information.

Epoxy products are allergic sensitizers. Sensitization can occur through skin contact. Epoxy resin systems often are packaged in tubes with built-in mixing chambers. These minimize potential for skin contact. Refer to the Material Safety Data Sheet for these products for further information

· Physical Agents

Noise/Vibration **Possible**

Spraying using high pressure equipment, and concrete chipping, grinding, and sawing can create high levels of noise.

This is exacerbated by reflection off the surfaces of the space. Noise produced by portable electrical and pneumatic tools can exceed regulatory limits.

Heat/Cold Stress **Yes**

Water temperature in the pool is 28℃. The temperature in the space is about this level accompanied by a high level of humidity. These conditions potentially can cause heat stress in unacclimatized individuals while performing heavy work. Wearing of impervious suits during powerwashing exacerbates the problem fo heat stress. The fabric of the suit traps inside heat and moisture produced by the body during the work.

Non/Ionizing Radiation No

Laser No

· Personal Confinement **Yes**

Access/egress requires vertical climb by ladder. Interior is large compared to availability of access. Headroom is not an issue in ths space.

· Bio/Mechanical Hazard **Possible**

Mechanical equipment used for chipping, grinding and sawing poses an injury risk from striking and entangling.

· Hydraulic/Pneumatic/Vacuum Hazard **Possible**

This chamber fills through the manual opening and closing valves located on the sand filters. The control of these valves on the inflow circuit enables isolation. Note that this is a single valve isolation. The structure drains through the manual opening of the drain valve that discharges to the sewer.

Powerwashing poses an injection hazard (up to 5000 lb/in^2). Fluid injected into the tissues in this manner follows an unpredictable path. This path can damage tissues under the skin. This kind of injury requires prompt attention from an experienced medical practitioner, as there is a risk of gangrene and loss of the limb. The risk of gangrene is related to the delay in receiving proper medical attention.

Vacuuming using high vacuum equipment poses a suction hazard. Some vacuum systems operate at -27 inches of mercury vacuum (-90 kPa). Systems creating high vacuum are capable of causing severe traumatic injury.

· Process Hazard No

· Safety Hazards

Rundown No

Structural Hazard **Possible**

Deterioration of the structure and rungs of in-place ladders may occur. Failure of a rung or a bracket can lead to fall during descent or ascent of an in-place ladder. This situation can develop only after prolonged exposure to conditions that are corrosive to metal and concrete. Structural integrity requires confirmation by the Owner. This reflects longevity projected in designs of these structures. Fall protection will be used, as deemed appropriate.

Engulfment/Immersion **Possible**

In operation, this structure is partly full of wash water. Drowning of a prone individual can occur in 15 cm of water. Accumulated water will be pumped from the space prior to the start of work.

Residual liquid will be drained prior to entry. Isolation valves will be closed securely and locked out. Catastrophic failure of valves would lead to entry of a jet of water into one corner of the space. This should not hinder evacuation Catastrophic failure is highly unlikely to occur, given criteria used by design engineers in selection of components and adherence of components to standards of performance that recognize conditions to which components are subjected during service of long duration. Entry into a space containing water of sufficient depth to cause drowning is not permitted.

A fall protection/work positioning system will be used where immersion in water is possible.

Entanglement No

Electrical/Electrostatic **Possible**

Portable electrical equipment used in the space containing faulty, deteriorated or inappropriate components or wiring poses an electrocution risk.

Fall No

Distance from top of the space to the floor through the access hatch is sufficient to cause serious fall-related injury and exceeds the distance for which fall protection is required. Fall protection will be used, as deemed appropriate.

Slip/Trip **Yes**

Floor of the space is slippery from growth of microorganisms.

Visibility/Light level No

Interior of the space has no lighting. Supplemental lighting will be used, as needed. Lighting is satisfactory when one can read this document unaided.

Explosive/Implosive No

Hot/Cold Surfaces No

Hazard Assessment — Work Tasks in The Backwash Tank

Hazardous Condition	**Real or Potential Consequence**		
	Low	**Moderate**	**High**
· hot work	NA		
· atmospheric hazards			
oxygen deficiency	NA		
oxygen enrichment	NA		
bio/chemical		x	
fire/explosion	x		
· micro/biological		x	
· ingestion/skin & eye contact		x	
· physical agents			
noise/vibration		x	
heat/cold stress		x	
non/ionizing radiation	NA		
laser	NA		
· personal confinement		x	
· bio/mechanical hazard		x	
· hydraulic/pneumatic/vacuum hazard		x	
· process hazard	NA		
· safety hazards			
rundown	NA		
structural	x		
engulfment/immersion	x		
entanglement	NA		
electrical/electrostatic		x	
fall	NA		

slip/trip	x
visibility/light level	NA
explosive/implosive	NA
hot/cold surfaces	NA

In this table, toxic substance, oxygen deficiency, oxygen enrichment and flammable or combustible atmosphere derive their meaning from Exposure Limits and standards contained in the Occupational Health and Safety Regulation. **NA** means not applicable.

Action Required

· Refer to procedure for entry and work in this space.

Sunshine Coast Regional District	**First Aid Assessment**	**Backwash Tank**
Owner: Sunshine Coast Regional District	**Work Location:** Sechelt Aquatic Centre 5500 Shorncliffe AVE, Sechelt, BC	**Assessed by:** Neil McManus, CIH, ROH, CSP NorthWest OH&S **Tel:** 604-980-8512 **Date:** 2010-02-10
Project: inspection, powerwashing and concrete repair of structures	**Number of Workers:** 2 to 3	
Work Activity:	**Probable Incident/Accident:**	**Probable Injury:**
· lifting and moving tools, equipment, supplies	· slip, trip, fall, overexertion, fall from ladder	· broken bones, soft tissue injury
· powerwashing	· slip, trip, overexertion, suction injury involving vacuum system, foreign object in the eye	· soft tissue injury, muscle strain, back injury, broken bones, corneal scratch
· concrete drilling	· dust and material in the eye, skin contact with hot surface, overexposure to noise	· soft tissue injury, muscle strain, back injury, temporary hearing loss
· grout patching	· material in the eye or on the skin	· chemical burn in the eye, eye injury, skin burn
· epoxy handling and application	· material in the eye or on the skin	· chemical burn in the eye, eye injury, skin irritation
Workplace Hazard Rating: high risk (This rating applies to all accidents occurring in the industry and not to the specifics of this situation.)	**Types of Work Activity/Accidents:** typical of industry; refer to hazard assessment	**Types of Injury:** typical of industry; some types require hospital treatment
Rating Modification Factors: none anticipated	**FAA Required**: one, Level 1 minimum	**FAA Selected**:
Site Access Issues:	**Nearest Hospital:** St. Mary's Hospital, Sechelt (all emergencies)	**Alternate Hospital:** Sechelt Medical Clinic
	Route to Hospital: Shorncliffe Ave to Cowrie ST. Left onto Cowrie ST to HYW 101. Follow HYW 101 South to St Mary's Hospital	**Route to Clinic:** Shorncliffe Ave to Cowrie ST. Right onto Cowrie ST. Follow Cowrie ST to Inlet AVE. Left onto Inlet AVE. Follow Inlet AVE to Sechelt Medical Clinic located at 5531 Inlet AVE.
External Emergency Response: FIRE and AMBULANCE through 911 service	**Estimated Distance:** 2 km	**Estimated Distance:** 1.5 km
	Estimated Travel Time: 5 min	**Estimated Travel Time:** 3 min

Transportation: BC Ambulance Service, company vehicle, taxi, industrial ambulance; airlift possibly required	**Transportation Issues:** winter weather	**Transportation Issues:** winter weather
Implementation		
Name: Ken Robinson	**Title:** Facilities Operation Supervisor	**Date:** 2010-02-10
Comments: · Refer to the overall OH&S program. · for each location, provide a map indicating the address and route to the Hospital and nearest alternate medical services and emergency telephone numbers. · ensure that alternate medical services are equipped and amenable to providing assistance.		

Sunshine Coast Regional District	**Fluid/Material Flow Assessment**	**Backwash Tank**
Location: Sechelt Aquatic Centre	**Equipment:** valves, components, and piping associated with pool water circuits	**Assessed by:** Neil McManus, CIH, ROH, CSP NorthWest OH&S **Tel:** 604-980-8512 **Date:** 2010-02-10
Description of Equipment/Operation: The backwash system cycles water through the filters in a direction reverse to normal flow through energy provided by the Main Pool Circulation Pump and reversal of position of flow isolation valves located on the filter units. Backwashing removes debris deposited on the filtration medium and discharges backwashed water into the Backwash Tank. The Backwash Tank stores backwash water until treated by the Sodium Thiosulphate Injection System to destroy hypochlorous acid and hypochlorites and other reducible substances prior to discharge to the sewer.		
Hierarchy of Energy/Fluid Inputs	**Conversion Energy Output**	**Equipment/System Affected**
pump	fluid pressure	pool water, fluid transfer system
Backwash Tank		
Input: backwash water from the Main Pool Filter and/or the Leisure Pool Filter and/or the Swirl Pool Filter; sodium thiosulphate solution from the injector circuit	**Storage:** backwash water in the Backwash Tank creates pressure in the input pipe string (about 2.8 lb/in^2 or 20 kPa) when not emptied prior to isolation	**Dissipation/Purge:** drain the Backwash Tank prior to starting work
	Output: water flow to the sewer	**Immobilization/Isolation:** isolation from sewer gases provided by the closed drain valve; isolation of the Sodium Thiosulphate Injection System required
Fluid/Material Flow Isolation Strategy: isolate the backwash system from the Backwash Tank; drain the Backwash Tank to the sewer and isolate from sewer gases using the Backwash Tank Drain Valve.		

System Operating Pressure	**Rated Working Pressure**	**Residual Pressure**	**Performance Standard(s)**	**Allowable Leakage**

Failure/Consequence Analysis: Failure or deliberate defeat of the isolation would lead to inflow of backwash water into the Backwash Tank from one or more of the filters. Under this condition, inflow would occur from the top corner of the Backwash Tank and could fill the chamber, possibly leading to overflow and spillage into surrounding area. Inflow in this manner is reflective of a deliberate act of sabotage to the operation of the pool.		
Primary Deactivation/Isolation: Filter Influent Valves	**Secondary Deactivation/Isolation:** Backwash Tank Drain Valve	**Tertiary Deactivation/Isolation:** Sodium Thiosulphate Injector Pump
Location: Filter Room	**Location:** Pump Room	**Location:** Pump Room

Action: move Main Pool Filter Influent Valve, V006, to the CLOSED position; move Leisure Pool Filter Influent Valve, V035, to the CLOSED position; move Swirl Pool Filter Influent Valve, V020, to the CLOSED position; apply lockout devices and keyed padlocks and tags	**Action:** move Backwash Tank Drain Valve to the OPEN position and drain contents fully to the sewer; when empty, move to the CLOSED position; apply keyed padlock and tag	**Action:** remove the plug from the receptacle; apply lockout device and keyed padlock and tag
Flow Isolation: yes	**Flow Isolation:** yes	**Flow Isolation:** yes

Backwash Tank Isolation Procedure:

· remove the plug of the Sodium Thiosulphate Injector Pump from the receptacle located in the Pump Room.
· apply lockout device and keyed padlock and tag when loss of exclusive control can occur.
· move Main Pool Filter Influent Valve, V006, Leisure Pool Filter Influent Valve, V035, and Swirl Pool Filter Influent Valve, V020, located in the Filter Room to the CLOSED position; apply lockout devices and keyed padlocks and tags when loss of exclusive control can occur.
· move the Backwash Tank Drain Valve located in the Pump Room to the OPEN position and drain contents fully to the sewer.
· when empty, move the Backwash Tank Drain Valve located in the Pump Room to the CLOSED position; apply keyed padlock and tag when loss of exclusive control can occur.

Verification Test Procedure:

· observe the continuing flow of water into the Backwash Tank. Water flow indicates unsuccessful isolation.
· ensure that the sight tube for the Backwash Tank located in the Pump Room indicates no residual liquid. Residual liquid indicates incomplete drainage.

Notes:

· gradual motion in the movement of valve components minimizes the potential for water hammer.
· valves require unique, consistent identification
· exclusive control means that the individual who isolates the component string will perform or directly supervise the work of others on the component string and will remain constantly on the job site and in exclusive control of the component string.
· loss of exclusive control means that the individual who has control of the isolated component string leaves the work area.
· a high pressure jet of fluid can cause injection injury. Injection injuries are very serious and can lead to gangrene when left untreated.

Energy Hazard Assessment

System	**Real or Potential Consequence**		
	Low	**Moderate**	**High**
· backwash tank isolation		x	

In this table, **NA** means that the category does not apply in any normally foreseeable situation. **Low** means that exposure is readily identifiable, but believed to be much less than applicable limits or that exposure to nonquantifiable hazardous conditions is unlikely to produce injury. **Low-Moderate** means that exceedence of regulatory limits is believed possible or that nonquantifiable exposure could produce minor injury requiring self-administered treatment. Control measures or protective equipment should be considered. **Moderate** means that exposure is believed capable of exceeding regulatory limits or causing traumatic injury requiring first aid treatment or attention by a physician. Protective equipment or other control measures are necessary. **Moderate-High** means that exposure is believed capable of considerable exceedence of regulatory limits or causing serious traumatic injury. Advanced control measures or protective equipment are required. **High** means that short-term exposure is believed capable of causing irreversible injury, including death. Advanced control measures or protective equipment are required.

Sunshine Coast Regional District	Confined Space Procedure	Work Tasks in the Backwash Tank
Permit Required: Yes At time of entry the atmosphere is expected to be low hazard and not to exceed moderate hazard during work activity. Space can contain a potential immersion hazard requiring pump-out. Isolation of the space is required prior to entry.	**Pgm Admin:** Ken Robinson **Tel:** 604-885-6822 **Cell/Pgr:** 604-989-1185 **Site Contact:** Daryl Lowey **Tel:** 604-885-6822 **Cell/Pgr:** 604-741-3680	**Prepared by:** N. McManus, CIH, ROH, CSP NorthWest OH&S **Date:** 2010-02-10 **Tel:** 604-980-8512

Equipment Required	Co-ordination of Work Activities
	Note: this procedure is not intended to cover abrasive blasting and spray application of coatings
	Contractors:
· two-way radio, cellular telephone	· on arriving at the site, contact the Pool Operator to establish reliability of communication. Reliable communication may not exist in some areas.
· operating vehicles and fuel-powered equipment	· keep operating vehicles and fuel-powered portable equipment at least 10 m downwind from the entry to the space and intake of ventilating equipment to prevent entry of exhaust gases.
· exhaust hose	· install exhaust hose to divert flow up the side of the truck to discharge above the roof when the engine continues to operate
	Operators:
· two-way radio, cellular telephone	· on arriving at the site, contact the Pool Operator to establish reliability of communication. Reliable communication may not exist in some areas.
	· keep operating vehicles and fuel-powered portable equipment at least 10 m downwind from the entry to the space and intake of ventilating equipment to prevent entry of exhaust gases.
· exhaust hose	· install exhaust hose to divert flow up the side of the truck to discharge above the roof when the engine continues to operate
	· erect primary barriers around openings to the space when unoccupied to prevent falls
· primary barriers	· as needed to keep bystanders and traffic away from the area while work is occurring, erect secondary barriers
· secondary barricades, barrier tape, warning signs	· at the end of the work or the workshift, replace the manhole cover
· garden sprayer	· keep concrete wet when chipping or drilling to suppress dust generation

Equipment Required	Isolation & Lockout
	· the Owner is to prepare and implement a procedure for deactivating, de-energizing, isolating and locking out equipment and fluid circuits that could influence the safety of the entry and work · prior to starting, inspect the component strings carefully to ensure that they are intact and structurally sound and unlikely to experience catastrophic failure while under pressure as a result of this work. · if there is any doubt about the structural integrity of the components or piping system during or as a result of this work, do not proceed until this issue is resolved.

Equipment Required	Cleaning, Purging, Venting or Inerting

· to be determined, xxxx ft^3/min free air delivery	· install fan intake in an area of clean respirable air and utilize as a supply unit. · position outlet of duct to provide air as close as possible into the zone in which work will occur. This will ensure that the entrant breathes air from the exterior rather than the atmosphere in the space. · begin ventilating at least 5 minutes prior to initial entry to ensure that purging of the atmosphere in the work zone has occurred
Equipment Required	**Verification & Testing**
· atmosphere testing instrument (Biosystems PhD Lite and Draeger XAM 2000) containing sensors for oxygen, flammable/combustibles, carbon monoxide, hydrogen sulphide · calibration kit · additional instrument containing sensor for nitrogen dioxide when diesel engines are operating. (If one can smell diesel exhaust, one must monitor the exhaust gases.)	· calibrate or bump test the instrument at the beginning of the workshift or immediately before use, per the manufacturer's instructions. Persons calibrating and operating the instrument must have appropriate training. Keep records of calibration and testing. · measure conditions at the top, middle and bottom of the space through which access/egress, and extrication will occur in the event of an emergency or accident by lowering the sampling line. Remember that there is a delay in response as air is pumped into the instrument. · record these readings and readings obtained periodically during work activity · where use of portable equipment powered by small engines is occurring, monitor the surroundings to ensure that exposure is not happening
	· entry and work in the space without respiratory protection for gases can occur only if the following conditions are met: **Entry** — **Work Activity/Alarm Settings** **oxygen:** 20.9 or 21.0% — 20.5 % or greater **flammable/combustibles:** 0 % of LEL — 5 % of LEL or less **carbon monoxide:** 0 ppm — 25 ppm or less **nitrogen dioxide:** 0 ppm — 1.0 ppm or less **hydrogen sulphide:** 0 ppm — 10 ppm or less
	· if these conditions are not met prior to entry, continue ventilating the space for 5 minutes and retest. If these conditions cannot be met, the situation requires reevaluation.
	· the entrant must wear the instrument at all times while in the space, and must vacate in the event that the alarm sounds. If an alarm sounds, the standby shall order the entrant(s) to vacate the space immediately. · at the end of the workshift record all data provided by the instrument (peak, TWA, STEL, occurrence of alarms)
Equipment Required	**Ventilation**
· to be determined, xxxx ft^3/min free air delivery ft^3/min free air delivery	· locate the intake to the supply fan upwind from operating engines and other sources of contamination. Direct exhaust flows away from air intakes. · position the end of supply duct as close as possible to the work zone and support, as necessary, to direct flow from directly above the worker.
Equipment Required	**Personal Protective Equipment & Other Precautions**

· hard hat, safety glasses + sideshields, hearing protection (muffs or plugs) when noise sources are present, work area clothing, safety boots, protective gloves. Powerwashing requires additional protection (faceshield, industrial raingear, rubber safety boots, waterproof gloves).	· all persons working in the space require personal protective equipment, as specified. Personal protective equipment shall comply with requirements of the respective certifying and testing agencies, CSA (Canadian Standards Association) and ANSI (American National Standards Institute).
· NIOSH-approved half-facepiece respirator containing HEPA filters and acid gas/organic vapour cartridges	· in view of the information available, persons working in the space should wear respiratory protection as a precaution against potential exposure to bacteria and viruses and spores from moulds and odours. Respiratory protection is required during operations that can generate concrete and cement dust. Wet methods greatly reduce the potential for dust generation. Provision of clean respirable air in the work zone by the supply system and atmospheric monitoring are believed sufficient to protect against overexposure to other contaminants. In the event that this strategy does not provide sufficient protection, the situation requires reevaluation.
· GFCIs	·all electrical circuits require Ground Fault Circuit Interrupters (GFCIs)
· sharps kit	· use tongs to handle sharps for disposal in the protected container
Equipment Required	**Personal Hygiene and Decontamination**
· personal eyewash, ANSI-compliant eyewash station	· a personal eyewash bottle must be available in the event of a splash into the face to flush the eyes immediately following contact with irritating substances · flush the eyes for 15 to 20 minutes using the ANSI-compliant unit · seek medical attention
· household bleach (1:20 dilution)	· utilize bleach solution (or similar disinfectant product) for cleaning following exposure to biofilms as part of the initial clean-up. Sewer workers must clean hands, face and exposed skin prior to eating, drinking or smoking.
· soap and water	· thoroughly wash hands, face and all exposed surfaces of skin prior to eating, drinking, or smoking
Equipment Required	**Lifelines, Harnesses & Lifting Equipment**
· harness (dorsal D-ring)	· all persons entering and working in the space where vertical extrication may occur require a harness, if feasible. Connection to the winch is required when standing water is present and to permit extrication. · inspect all equipment for damage before use. Remove damaged equipment from service.
· fall restraint device: winch (Make model)	· fall restraint is required where work occurs on the top of structures lacking fall prevention in the form of railings or other devices where fall can occur · fall restraint device is required during ascent and descent of ladder where free fall distance can exceed 3 m (10 feet)
· retrieval system: tripod or davit arm (Make model) positioned at manhole above the entry ladder	· retrieval device required for entry and for lifting injured victim from the space
Equipment Required	**Standby Person**

· two-way radio, cellular telephone, air horn	· standby person must remain near the access when equipment noise causes difficulty in communication. The standby can assist the entrant with equipment and supplies. The standby must be able to extricate the worker vertically in the event of an emergency or an accident. Standby must have training in monitoring duties, initiating emergency response, operation of retrieval equipment and removal of injured victims using this equipment. · standby must not enter the space
Equipment Required	**Rescue**
· two-way radio, cellular telephone, air horn	· rescue personnel must have training in first aid and CPR · to activate the emergency response, standby person sounds three long blasts on the air horn, as appropriate or contacts the Lifeguards on the two-way radio, indicates the occurrence of the accident and asks the Lifeguard to call 911 to request assistance from FIRE and AMBULANCE and states the exact location and the nature of the problem. · the Lifeguard contacts the Asistant Supervisor, Maintenance and Operations, to inform about the situation · if the instrument in the space is not alarming, and no other hazardous condition has arisen, the rescue person may enter the space to assist the victim; otherwise, use the winch to remove the victim. The standby must not enter the space. · rescue person assesses condition of the victim and determines whether serious injury has occurred and whether serious injury has occurred to the head, neck or back. If serious injury has not occurred and does not involve the head, neck or back, the victim may be assisted to the access and removed from the space. If the preceding conditions cannot be met, the victim is to be packaged for transport.

<table>
<tr><td colspan="2">Sunshine Coast Regional District</td><td colspan="2">Confined Space Identification and Hazard Assessment</td><td colspan="2">Ceiling Spaces</td></tr>
<tr><td colspan="2">Owner: Sunshine Coast Regional District</td><td colspan="2">Location: Sechelt Aquatic Centre (Lifeguard Office ceiling space), Storage Room ceiling space</td><td colspan="2">Assessed by: Neil McManus, CIH, ROH, CSP
NorthWest OH&S
Tel: 604-980-8512
Date: 2010-02-10</td></tr>
<tr><td>underground working?</td><td>enclosed or partially enclosed?</td><td>designed/ intended for continuous human occupancy?</td><td>limited or restricted entry or exit?</td><td>large enough and configured for entry to perform work?</td><td>Confined Space?

Yes
▲</td></tr>
<tr><td>No</td><td>Yes</td><td>No</td><td>Yes</td><td>Yes</td><td>» All entries bold?</td></tr>
<tr><td colspan="2" rowspan="3">Description: enclosed structures of varying size constructed from galvanized steel and gypsumboad (drywall). The structures are open to the occupied zone below through penetrations.</td><td colspan="2">Access/Egress: hatches mounted in the ceiling of the structure. These hatches measure typically about 0.5 m square.</td><td colspan="2">Contents: dust possible on surfaces following long-term operation, especially if building air filtration is faulty or uncontrolled renovation has occurred. Asbestos is possible in settled dust in older structures.</td></tr>
<tr><td colspan="2">Adjacent Spaces: occupied spaces</td><td colspan="2">Equipment: piping, valves and other components, ventilation ducts, wiring, light fixtures</td></tr>
<tr><td colspan="2">Function/Use: enclose mechanical and electrical equipment including piping, valves and other components, ventilation ducts, wiring, light fixtures. Some spaces are voids intended to create architectural features.</td><td colspan="2">Process: not applicable</td></tr>
<tr><td colspan="2">External Surroundings: mechanical rooms in the building</td><td colspan="2">Downgrading Conditions: noise</td><td colspan="2">Potential Impact on Work Activity: impaired communication, possible hearing loss</td></tr>
</table>

Notes:

· The ceiling space is adjacent to a ventilated structure. Opening the hatch allows free flow and exchange of air to occur at an enhanced rate between the ventilated structure and the ceiling space. Exchange of air between the ceiling space and the ventilated structure occurs through penetrations when the access hatch is closed.

· The structure that forms the floor of the ceiling space is not designed or intended to support the weight of workers.

· The hatches in the ceiling are located in positions intended to provide access to specific equipment rather than to provide general access to the ceiling space.

· Access to equipment located in the ceiling space within reach from a ladder positioned below the hatch does not expose the worker to the fall risk intrinsic to the ceiling space.

· Entry into the ceiling space to perform modifications to the *status quo* is not expected to occur in the foreseeable future.

· Entry into the ceiling space to perform modifications to the status quo requires completion of the full hazard assessment in order to fully assess the risk of this work.

Sunshine Coast Regional District	**Fluid/Material Flow Assessment**	**Main Pool Water Circulation Circuit**
Location: Sechelt Aquatic Centre	**Equipment:** valves, components, and piping associated with pool water circuits	**Assessed by:** Neil McManus, CIH, ROH, CSP NorthWest OH&S **Tel:** 604-980-8512 **Date:** 2010-02-10

Description of Equipment/Operation: The pool water circulation circuit receives flow from the Surge Tank and the drain at he bottom of the main pool. A float valve located in the Surge Tank signals a servo mechanism to control the relative proportion of flow from each contributor. Combined flow passes to the Main Pool Pump and the Main Pool Sand Filter prior to redistribution.

Hierarchy of Energy/Fluid Inputs	**Conversion Energy Output**	**Equipment/System Affected**
electrical pump	mechanical fluid pressure	pump motor/pump pool water, fluid transfer system

Main Pool Circulation Pump (P001)

Input: .BC Hydro (600 V) to Main Circuit Breaker to P001 Disconnect to P001 Control Switch	**Storage:** not applicable	**Dissipation/Purge:** not applicable
	Output: conversion to mechanical energy (rotation)	**Immobilization/Isolation:** not applicable

Electrical Isolation Strategy: deactivate, de-energize, isolate and lock out the control circuit and the power actuation circuit. An open switch or disconnect at these voltages contains an air gap of 12 mm or more. An air gap of 10 mm provides protection against flash-over due to air ionization up to 30,000 V.

Failure/Consequence Analysis: Failure or deliberate defeat of the isolation could lead to activation of the pump motor or electrocution during contact with energized conductors. Failure of the isolation most likely would result from failure of opening of the switch or disconnect or from flash-over. These are rare events. Failure of opening of the switch or disconnect should be detectable from the verification step.

Primary Deactivation: P001 Control Switch	**Secondary Deactivation:** P001 Disconnect	**Tertiary Deactivation:**
Location: Control Cabinet located in the Pump Room	**Location:** Control Cabinet located in the Pump Room	**Location:**
Action: move P001 Control Switch to the OFF position	**Action:** move P001 Disconnect to the OFF position; apply keyed padlock and tag.	**Action:** .
Energy Isolation: no, unless retrofitted	**Energy Isolation:** yes	**Energy Isolation:**

Main Pool Circulation Pump Electrical Isolation Procedure:
· move P001 Control Switch in the Control Cabinet located in the Pump Room to the OFF position.
· move P001 Disconnect in the Control Cabinet located in the Pump Room to the OFF position.
· apply keyed padlock and tag when loss of exclusive control can occur

Verification Test Procedure:
· attempt to restart the pump by moving the P001 Control Switch to the HAND position. Return to OFF position.
Or
· use voltmeter to test electrical circuit.

Notes:
· switches and disconnects require unique, consistent identification
· exclusive control means that the individual who isolates the circuit will perform or directly supervise the work of others on the circuit and will remain constantly on the job site and in exclusive control of the isolated circuit.
· loss of exclusive control means that the individual who has control of the isolated circuit leaves the work area

Main Pool Circulation Circuit				
Fluid/Material Flow Isolation Strategy: isolate the Main Pool Circulation Circuit using the isolation valves and depressurize the circuit using the bleed valve located on the strainer. Prevent entry of swimmers into the pool during this work. Isolate the Main Pool Make-up Water Circuit using the isolation valves to prevent entry of water into the Surge Tank.				
System Operating Pressure	**Rated Working Pressure**	**Residual Pressure**	**Performance Standard(s)**	**Allowable Leakage**

Failure/Consequence Analysis: Failure or deliberate defeat of the isolation could lead to:
· inflow of water into the Surge Tank. Inflow of water into the Surge Tank from the pool due to displacement could occur only if people or objects cf similar dimensions were to enter the pool. This situation reflects the normal intended function of the Surge Tank, namely to receive water displaced by these objects. This situation is controllable through strict prohibition of use of the pool during work in the Surge Tank following drainage. Inflow from this source cannot occur otherwise. In the event that inflow does occur, the rate of inflow is sufficiently low enough to enable evacuation to occur. Design value for a person for this pool was 28 L.

· inflow of water into the Surge Tank also can occur from operation of the pool make-up water system. Lockout and isolation of the make-up water system prevents entry of make-up water. The rate of entry of water by this route in the event of failure is sufficiently low enough to enable evacuation to occur.

· inflow of pool water into the Pump Room from the Surge Tank or from the drain at the bottom of the pool or from the line leading from the Main Pool Circulating Pump to the Main Filter. Inflow under the former condition could lead to partial flooding of the Pump Room. Inflow under the latter condition would be minor and involve the contents of the rising and elevated portion of the line that connects to the Main Pool Filter. There is no credible reason for occurrence of these events associated with this isolation.

Inflow could occur due to exterior leakage from the stem of a valve or interior leakage from the flange used to attach adjacent components or outright catastrophic failure of the valve. Catastrophic failure ranges from crackage of the body of the valve to outright rupture of the casing.

Leakage from the stem of a valve is slow and readily visible. During work activity, this situation would provide considerable warning to workers occupying the space. Leakage from the flange of the isolated line occurs due to leakage at the seat. The seat forms the seal between internal moveable parts of the valve and the body of the valve. Leakage from the flange of a valve due to leakage at the seat also is slow and is readily visible. Leakage at the flange also could occur due to catastrophic failure of the geometric relationship between the seat and the movable part or catastrophic failure of either the seat or the movable part. In either case the body of the valve would remain intact, as would attachments to piping at the flanges. The latter would constrain flow should this occur at the time of disassembly. During work activity, these occurrences would provide considerable warning to workers about the need to take emergency action.

External catastrophic failure involving cracking of the body of a valve is also possible. This would lead to leakage at a rate beyond that experienced due to leakage at the stem and potentially is about the same as that experienced at the flange due to internal catastrophic failure. Leakage from a valve that has failed catastrophically is rapid compared to leakage by the other routes. Outright failure of the body of a valve involving splitting open is possible, but is a very rare event. In the event that outright failure of the body of the valve was to occur, rapid release of water into the space at the pressure created by the head in the Surge Tank likely would occur. Maximum head is about 2.5 m and head pressure is about 3.6 lb/in^2 (25 kPa). Outright failure of the body of the valve also could lead to ejection of projectiles. Outright failure of the body of a valve is a very rare and very unlikely event.

Valves specified by design engineers are used at a fraction of maximum service pressure. Standard engineering consideration for failure pressure is a factor of 4 to 6 beyond maximum service pressure. Hence, actual operating pressure usually is a small fraction of the failure pressure. This consideration in design accommodates for the many unknowns associated with the operation of valves in real-world environments.

Metal valves are subject to corrosion from within and without, and erosion from within. They have internal and external coatings in an attempt to minimize the impact of the internal and external environments. Plastic valves are subject to embrittlement caused by attack by ozone and other incompatible substances. The experience of valve manufacturers and valve users is extremely important in assisting in the assessment of the long-term impact of conditions on the longevity of these products. This experience is even more critical where single valve isolation is the norm in design and installation. This applies to maintaining the reliability of the pool water circulation system, as well as the safety of workers who work with this equipment. Regarding reliability, the unexpected failure of valves in service would indicate that reliability is an issue that deserves consideration. This consideration would impact requirements for maintenance and for replacement. Requirements for replacement indicate acknowledgment of the accepted longevity for a product in service.

Newly manufactured valves meet requirements in various standards and are subject to hydrostatic testing to ensure that leakage does not occur.

Input:	**Storage:**	**Dissipation/Purge:**
· pool water from the Surge Tank to the Outflow Isolation Valve, V003, and pool water from the main drain to the Outflow Isolation Valve, V002, to the Upstream Main Pool Circulation Pump Isolation Valve, V004, to the Main Pool	**Storage:** storage does not occur during normal operation; storage at operating pressure can occur in the isolated circuit of the pump string; pool water in the Surge Tank creates pressure in the input pipe string (about 2.8 lb/in^2 or 20 kPa) when not emptied prior to isolation	**Dissipation/Purge:** slowly and carefully open the bleed valve in the body of the strainer to depressurize the isolated circuit

Circulation Pump to the Downstream Main Circulation Pump Isolation Valve, V005 to the Main Filter Isolation Valves, V006 and V008 · municipal water supply to the Surge Tank	**Output:** water flow	**Immobilization/Isolation:** isolation of pool make-up water system (Auto-Fill Valves, V075 and V076 and Manual Fill Valve, V074) required when work occurs in the Surge Tank
Primary /Isolation: Surge Tank to the Outflow Isolation Valve, V003, and pool water from the main drain to the Outflow Isolation Valve, V002, to the Upstream Main Pool Circulation Pump Isolation Valve, V004, to the Main Pool Circulation Pump to the check valve to the Downstream Main Circulation Pump Isolation Valve, V005 to the Main Filter Isolation Valves, V006 and V008	**Secondary Isolation:** municipal water supply to the Surge Tank	**Tertiary Isolation:**
Location: Pump Room	**Location:** Pump Room	**Location:**
Action: refer to main procedure	**Action:** move Auto-Fill Valves, V075 and V076, and Manual Fill Valve, V074 to the CLOSED position; apply lockout device and keyed padlock and tag	**Action:**
Energy Isolation: yes	**Energy Isolation:** yes	**Energy Isolation:**

Main Pool Circulation Circuit Isolation Procedure:
Main Actions
· perform the Main Pool Circulation Pump electrical isolation procedure before beginning this procedure.
· prior to starting, inspect the component strings carefully to ensure that they are intact and structurally sound and unlikely to experience catastrophic failure while under pressure as a result of this work.
· if there is any doubt about the structural integrity of the components or piping system during or as a result of this work, do not proceed until this issue is resolved
· move Downstream Main Pool Circulation Pump Isolation Valve, V005, located in the Pump Room to the CLOSED position.
· apply lockout device and keyed padlock and tag when loss of exclusive control can occur.
· move Upstream Main Pool Circulation Pump Isolation Valve, V004, located in the Pump Room to the CLOSED position.
· apply lockout device and keyed padlock and tag when loss of exclusive control can occur.
· move Auto-Fill Valves, V075 and V076, and Manual Fill Valve, V074, located in the Pump Room to the CLOSED position; apply lockout device and keyed padlock and tag when loss of exclusive control can occur
move Auto-Fill Valves, V075 and V076, and Manual Fill Valve, V074 to the CLOSED position; apply keyed padlock and tag
· slowly move the Drain Valve in the Main Pool Circulation Strainer to the OPEN position to remove pressure retained in the component string. Avoid contact with the jet of water.
Contingency Actions
· if V004 leaks, move Surge Tank Discharge Valve, V003, located in the Pump Room to the CLOSED position.
· apply lockout device and keyed padlock and tag when loss of exclusive control can occur.
· if V004 leaks, move Main Pool Drain Discharge Valve, V002, located in the Pump Room to the CLOSED position.
· apply lockout device and keyed padlock and tag when loss of exclusive control can occur.
· if V005 leaks, move Main Filter Isolation Valves, V006 and V008, to the CLOSED position.
· apply lockout device and keyed padlock and tag.

Verification Test Procedure:
· observe the continuing flow of water from the Drain Valve on the Strainer. If water flow does not cease, the isolation is not successful.

Notes:
· gradual motion in the movement of valve components minimizes the potential for water hammer.
· valves require unique, consistent identification
· exclusive control means that the individual who isolates the component string will perform or directly supervise the work of others on the component string and will remain constantly on the job site and in exclusive control of the component string.
· loss of exclusive control means that the individual who has control of the isolated component string leaves the work area
· a high pressure jet of fluid can cause injection injury. Injection injuries are very serious and can lead to gangrene when left untreated.

System	Real or Potential Consequence		
	Low	Moderate	High
· Main Pool Circulation Pump		x	
· Main Pool Circulation Circuit	x		

In this table, **NA** means that the category does not apply in any normally foreseeable situation. **Low** means that exposure is readily identifiable, but believed to be much less than applicable limits or that exposure to nonquantifiable hazardous conditions is unlikely to produce injury. **Low-Moderate** means that exceedence of regulatory limits is believed possible or that nonquantifiable exposure could produce minor injury requiring self-administered treatment. Control measures or protective equipment should be considered. **Moderate** means that exposure is believed capable of exceeding regulatory limits or causing traumatic injury requiring first aid treatment or attention by a physician. Protective equipment or other control measures are necessary. **Moderate-High** means that exposure is believed capable of considerable exceedence of regulatory limits or causing serious traumatic injury. Advanced control measures or protective equipment are required. **High** means that short-term exposure is believed capable of causing irreversible injury, including death. Advanced control measures or protective equipment are required.

Sunshine Coast Regional District		**Confined Space Identification and Hazard Assessment**		**Pump Stations – Aquatic Centres**	
Owner: Sunshine Coast Regional District		**Location:** Gibsons and District Aquatic Facility, Sechelt Aquatic Centre		**Assessed by:** Neil McManus, CIH, ROH, CSP NorthWest OH&S **Tel:** 604-980-8512 **Date:** 2012-03-14	
underground working?	enclosed or partially enclosed?	designed/ in-tended for continuous human occupancy?	limited or re-stricted entry or exit?	large enough and configured for entry to perform work?	**Confined Space?** **Yes** ▲
No	**Yes**	**No**	**Yes**	**Yes**	← All entries **bold**?
Description: prefabricated, in-floor concrete structures • Gibsons and District Aquatic Facility: 1.5 m in diameter by 3.5 m deep. • Sechelt Aquatic Centre: 1.5 m in diameter by 1.5 m deep.		**Access/Egress:** manhole measuring about 0.6 m in diameter; built-in ladder for internal access.		**Contents:** groundwater; tidewater possible; mould possible on wetted and dry surfaces	
		Adjacent Spaces: • Gibsons and District Aquatic Facility: not applicable • Sechelt Aquatic Centre: Pump Room located in the basement		**Equipment:** • Gibsons and District Aquatic Facility: one submersible pump, level sensing equipment, valves • Sechelt Aquatic Centre: two submersible pumps, level-sensing equipment, valves	
		Function/Use: • Gibsons and District Aquatic Facility and Sechelt Aquatic Centre: collect flow from perimeter drainage and groundwater for pumping to the storm sewer • Sechelt Aquatic Centre: collect from water sources in the basement for pumping to the sanitary sewer, not believed to handle wastewater from sanitary sources, such as toilets		**Process:** not applicable	
External Surroundings: • Gibsons and District Aquatic Centre: outdoor location beside the building • Sechelt Aquatic Centre: indoor location in the Pump Room		**Downgrading Conditions:** equipment noise		**Potential Impact on Work Activity:** interference with communication, possible overexposure	

Notes:
- Isolation of inflow during work activity is not possible.
- Gases accompanying water inflow and entry can be present.
- Service work will entail entry for removal of the pumps and level-detection equipment.
- Electrical lockout and isolation of this equipment is required prior to entry.

- **Atmospheric Hazards**

Oxygen Deficiency **Possible**

Oxygen deficiency can develop in these structures, but only through a limited number of mechanisms that may or may not apply in the specifics of this situation. These mechanisms include oxidation of metal surfaces, aging of reactive surfaces through oxidation, respiration by microorganisms, off-gassing of large quantities of vapour or gases from surfaces and vapours from liquids that displace and/or dilute the existing atmosphere, and adsorption by reactive surfaces.

Partial filling and emptying of these structures acts like a piston in a cylinder to expel and to entrain air through the vents. The likelihood of oxygen deficiency is reduced because of the movement of air into and out of the space in response to fluctuation in the level of water.

A biofilm resulting from colonization by microorganisms forms over the passage of time, given the quantity of debris and fine organic material present on interior surfaces in the space. Microbiological activity involving the biofilm could contribute to creating an oxygen-deficient atmosphere. This situation is unlikely given the action of the level control system.

Rusting of steel surfaces also can deplete oxygen. This situation is likely to pose risk only when the space remains undisturbed for a long period of time with minimal airflow.

Humidification of the airspace above the water due to the high temperature (28 °C), humidity and mist also create growth conditions. Water vapour evaporating from the surface of the liquid water reduces the concentration of oxygen in the airspace. At 20 °C, the partial pressure of water vapour (100% Relative Humidity) is about 18 mm Hg (millimetres of mercury). At this pressure, for a total atmospheric pressure of 760 mm Hg, the combined pressure of oxygen and nitrogen would be 742 mm Hg. The pressure of oxygen, which is 20.9% of the total would be about 155 mm Hg. This corresponds to a composition of 20.4 % relative to the norm of 20.9 % at normal atmospheric conditions. The legally oxygen-deficient concentration is 19.5 % at normal atmospheric conditions. At 28 °C, the partial pressure of water vapour (100% Relative Humidity) is about 28 mm Hg. At this pressure, the combined pressure of oxygen and nitrogen would be 732 mm Hg. The pressure of oxygen would be about 153 mm Hg. This corresponds to a composition of 20.1 % relative to the norm of 20.9 % at normal atmospheric conditions.

Development of these conditions and the risk of oxygen deficiency is governed by the extent of enclosure of the space, and the period of quiescence between openings. None of the preceding factors is predictable in a particular circumstance to the extent needed to guarantee that an oxygen-deficient condition cannot or will not develop. One statement that is reasonable in these circumstances is that the *status quo,* as created by conditions and ascertained through testing, in the absence of other measures is unlikely to change during occupancy.

Oxygen Enrichment No

Bio/Chemical **Possible**

A biofilm resulting from colonization by microorganisms forms over the passage of time, given accumulation of debris on interior surfaces in the space. Temperature and humidification of the airspace above the water also create growth conditions. Growth of microorganisms could lead to production of carbon dioxide (aerobic conditions).

Partial filling and emptying of these structures through action of the level control system acts like a piston in a cylinder to expel and to entrain air through the vents. The likelihood of accumulation of hazardous levels of contaminants is reduced because of the movement of air into and out of the space in response to fluctuation in the level of water.

Pool waters contain low concentrations of hypochlorous acid, hypochlorite ion, and various levels of calcium and sodium ions, and chloride and sulphate and carbonate and bicarbonate ions. If present in the flow, these waters may off-gas chloramines and nitrogen trichloride (the source of the ‘swimming pool odour’). Quantities should reflect the level of exposure of users of the pool.

Development of these conditions is governed by the extent of enclosure of the space, the presence of extraneous contents that can undergo aerobic and possibly anaerobic decay and the period of quiescence between openings. None of the preceding factors is predictable in a particular circumstance to the extent needed to guarantee that production and accumulation of these gases cannot or will not occur. One statement that is reasonable in these circumstances is that the *status quo,* as created by conditions and ascertained through testing, in the absence of other measures is unlikely to change during occupancy.

Fire/Explosion No

• Micro/Biological **Possible**

A biofilm resulting from colonization by microorganisms forms over the passage of time, given accumulation of debris on interior surfaces in the space. Temperature and humidification of the airspace above the water also create growth conditions. Growth of microorganisms could lead to production of spores and cysts. Spores and cysts can cause allergic respiratory symptoms in sensitized individuals. The space also can contain insects and spiders.

• Ingestion/Skin & Eye Contact Hazard **Possible**

A biofilm resulting from colonization by microorganisms forms over the passage of time, given accumulation of debris on interior surfaces in the space. Temperature and humidification of the airspace above the water also create growth conditions. Contact with surfaces containing growth of microorganisms can cause rashes in sensitized individuals. These spaces also can contain sharps, usually in the form of discarded hypodermic syringes and needles. Hypodermic syringes and needles are potential sources of exposure to HIV and hepatitis viruses. HIV can survive a week outside the body, and hepatitis viruses, up to three months.

• Physical Agents

Noise/Vibration No

Heat/Cold Stress No

Non/Ionizing Radiation No

Laser No

• **Personal Confinement** **Yes**

Access/egress requires vertical climb by ladder. Interior is large compared to availability of access. Headroom is an issue in the spaces at the Sechelt Aquatic Centre.

• **Bio/Mechanical Hazard** No

• **Hydraulic/Pneumatic/Vacuum Hazard** No

• **Process Hazard** No

• **Safety Hazards**

Rundown/Strikedown No

Structural Hazard **Possible**

Deterioration of the structure and rungs of in-place ladders may occur. Failure of a rung or a bracket can lead to fall during descent or ascent of an in-place ladder. This situation can develop only after prolonged exposure to conditions that are corrosive to metal and concrete. Structural integrity requires confirmation by the Owner. This reflects longevity projected in designs of these structures.

Engulfment/Immersion **Yes**

In operation, the spaces are partly full of water. Drowning of a prone individual can occur in 15 cm of water.

Entanglement No

Electrical/Electrostatic No

Fall **Yes**

Distance from top of the space to the floor through the access hatch in the structure at the Gibsons and District Aquatic Facility is sufficient to cause serious fall-related injury and exceeds the distance for which fall protection is required.

Slip/Trip **Yes**

Floor of the space may be slippery from growth of microorganisms.

Visibility/Light level **Yes**

Interior of the space has no lighting.

Explosive/Implosive No

Hot/Cold Surfaces No

Hazard Assessment - Undisturbed/Operational Space

Hazardous Condition	**Real or Potential Consequence**		
	Low	**Moderate**	**High**
	*	*	*
• atmospheric hazards			
oxygen deficiency	x		
oxygen enrichment	NA		
bio/chemical	x		
fire/explosion	NA		
• micro/biological		x	
• ingestion/skin & eye contact		x	
• physical agents			
noise/vibration	NA		
heat/cold stress	NA		
non/ionizing radiation	NA		
laser	NA		
• personal confinement		x	
• bio/mechanical hazard	NA		
• hydraulic/pneumatic/vacuum hazard	NA		
• process hazard	NA		
• safety hazards			
rundown/strikedown	NA		
structural		x	
engulfment/immersion			x
entanglement	NA		
electrical/electrostatic	NA		
fall		x	
slip/trip		x	

visibility/light level		x
explosive/implosive	NA	
hot/cold surfaces	NA	

In this table, toxic substance, oxygen deficiency, oxygen enrichment and flammable or combustible atmosphere derive their meaning from Exposure Limits and standards contained in the Occupational Health and Safety Regulation. **NA** means not applicable.

Action Required
• Pump accumulated water from the space prior to entry and work.
• Ventilate the interior of the space prior to entry.
• The Owner is to implement a procedure to deactivate, de-energize, isolate and lock out sources of water that can enter the structure.

Hazard Assessment — Work Tasks in the Pump Stations – Aquatic Centres
This hazard assessment refers to entry for the purpose of performing work tasks in the sumps in the Sechelt Aquatic Centre and the Gibsons and District Aquatic Facility. These include water- and powerwashing interior surfaces, and piping and concrete repair. Piping repair can involve use of adhesives. Concrete repair involves chipping and use of epoxy products and cementitious grouts. Setting of concrete anchors involves drilling and use of epoxy products. This hazard assessment considers hazardous conditions posed by the work activity in context with those remaining in the space following preparatory activity.

• **Hot Work** No

• **Atmospheric Hazards**

Oxygen Deficiency No

Oxygen deficiency can develop in these structures, but only through a limited number of mechanisms that may or may not apply in the specifics of this situation. These mechanisms include oxidation of metal surfaces, aging of reactive surfaces through oxidation, respiration by microorganisms, off-gassing of large quantities of vapour or gases from surfaces and vapours from liquids that displace and/or dilute the existing atmosphere, and adsorption by reactive surfaces.

Partial filling and emptying of these structures acts like a piston in a cylinder to expel and to entrain air through the vents. The likelihood of oxygen deficiency is reduced because of the movement of air into and out of the space in response to fluctuation in the level of water.

A biofilm resulting from colonization by microorganisms forms over the passage of time, given the quantity of debris and fine organic material present on interior surfaces in the space. Microbiological activity involving the biofilm could contribute to creating an oxygen-deficient atmosphere. This situation is unlikely given the action of the level control system.

Rusting of steel surfaces also can deplete oxygen. This situation is likely to pose risk only when the space remains undisturbed for a long period of time with minimal airflow.

Humidification of the airspace above the water due to the high temperature (28 °C), humidity and mist also create growth conditions. Water vapour evaporating from the surface of the liquid water reduces the concentration of oxygen in the airspace. At 20 °C, the partial pressure of water vapour (100% Relative Humidity) is about 18 mm Hg (millimetres of mercury). At this pressure, for a total atmospheric pressure of 760 mm Hg, the combined pressure of oxygen and nitrogen would be 742 mm Hg. The pressure of oxygen, which is 20.9% of the total would be about 155 mm Hg. This corresponds to a composition of 20.4 % relative to the norm of 20.9 % at normal atmospheric conditions. The legally oxygen-deficient concentration is 19.5 % at normal atmospheric conditions. At 28 °C, the partial pressure of water vapour (100% Relative Humidity) is about 28 mm Hg. At this pressure, the combined pressure of oxygen and nitrogen would be 732 mm Hg. The pressure of oxygen would be about 153 mm Hg. This corresponds to a composition of 20.1 % relative to the norm of 20.9 % at normal atmospheric conditions.

Development of these conditions and the risk of oxygen deficiency is governed by the extent of enclosure of the space, and the period of quiescence between openings. None of the preceding factors is predictable in a particular circumstance to the extent needed to guarantee that an oxygen-deficient condition cannot or will not develop. One statement that is reasonable in these circumstances is that the *status quo,* as created by conditions and ascertained through testing, in the absence of other measures is unlikely to change during occupancy.

Continuous mechanical ventilation and continuous atmospheric testing will occur during this work. The alarm set point for the oxygen sensor is 20.5% not the legal limit of 19.5%. This will ensure that an oxygen-deficient atmosphere cannot develop.

Oxygen Enrichment No

Bio/Chemical **Possible**

A biofilm resulting from colonization by microorganisms forms over the passage of time, given accumulation of debris on interior surfaces in the space. Temperature and humidification of the airspace above the water also create growth conditions. Growth of microorganisms could lead to production of carbon dioxide (aerobic conditions).

Partial filling and emptying of these structures through action of the level control system acts like a piston in a cylinder to expel and

to entrain air through the vents. The likelihood of accumulation of hazardous levels of contaminants is reduced because of the movement of air into and out of the space in response to fluctuation in the level of water.

Pool waters contain low concentrations of hypochlorous acid, hypochlorite ion, and various levels of calcium and sodium ions, and chloride and sulphate and carbonate and bicarbonate ions. If present in the flow, these waters may off-gas chloramines and nitrogen trichloride (the source of the 'swimming pool odour'). Quantities should reflect the level of exposure of users of the pool.

Development of these conditions is governed by the extent of enclosure of the space, the presence of extraneous contents that can undergo aerobic and possibly anaerobic decay and the period of quiescence between openings. None of the preceding factors is predictable in a particular circumstance to the extent needed to guarantee that production and accumulation of these gases cannot or will not occur. One statement that is reasonable in these circumstances is that the *status quo,* as created by conditions and ascertained through testing, in the absence of other measures is unlikely to change during occupancy.

Exhaust from vehicles and mobile equipment can enter the work space under conditions related to cold weather or inappropriate placement of equipment, and can cause needless exposure. This is especially probable where the geometry of structures prevents dispersion. Exhaust from gasoline engines contains carbon monoxide (CO), carbon dioxide (CO_2), unburned fuel vapour and particulates. Exhaust from vehicles is less of a problem at this time due to use of catalytic converters in the exhaust system. Small engines used in generator sets, pumps, powerwashers, and other small portable units are major sources of exposure to exhaust, especially where the geometry of structures prevents dispersion.

Exhaust from diesel engines contains nitric oxide (NO), nitrogen dioxide (NO_2), unburned fuel vapour and particulates. Exhaust from the diesel engine of trucks is often directed horizontally at ground level. In cool or cold weather, vertically directed exhaust will cool rapidly and stratify in a layer just above the top of the truck. Descent to ground level is possible. In confining geometries, accumulation could pose a serious exposure risk.

Combustion gases discharged from propane-fuelled air heaters used in cold weather conditions are sources of carbon dioxide and possibly carbon monoxide. Under cool or cold conditions, these gases do not disperse and can be entrained into the air provided by portable ventilation systems.

Abrasive blasting to remove coatings is a source of exposure to dust from the coating and from the blast medium. Refer to the Material Safety Data Sheets for both products for further information. WorkSafeBC lists respirable quartz as an ALARA substance to which exposure is to be kept as low as reasonably achievable below the exposure limit. This involves use of wet methods and dust collection.

Abrasive blasting using dry ice (solid carbon dioxide) is a source of exposure to carbon dioxide gas. Such applications require careful scrutiny by an individual well qualified and experienced in the practice of occupational hygiene.

Dry drilling, chipping or coring of concrete can evolve quartz (a form of crystalline silica) in respirable form. WorkSafeBC lists respirable quartz as an ALARA substance to which exposure is to be kept as low as reasonably achievable below the exposure limit. This involves use of wet methods and dust collection.

Concrete, grout products, cement, and brick contain quartz, a form of crystalline silica. Chipping and drilling can create airborne dust and exposure to silica. These tasks are short in duration relative to the length of the work day. Quartz in the respirable form is an ALARA substance to which WorkSafeBC requires exposure to be maintained as low as reasonably achievable below the exposure limit. Dust suppression using wet methods and dust collection are required. Refer to the Material Safety Data Sheet for further information.

Adhesives and cleaners used with the plastic piping contain methylethylketone (MEK) and/or toluene and/or cyclohexanone, and tetrahydrofuran. The vapours of these solvents provide excellent warning properties. The products are used very briefly and in very small quantity. As much of the work as possible occurs outside the space. Overexposure under normal circumstances of use is highly unlikely when the space undergoes continuous mechanical ventilation. Refer to the Material Safety Data Sheet for these products for further information.

Epoxies are sources of exposure to solvent vapour, and vapour from unreacted components. Refer to the Material Safety Data Sheets for these products for further information. Crack filling involving large quantities of epoxy could generate sufficient vapour to pose an exposure risk.

Continuous mechanical ventilation and continuous atmospheric testing will occur during this work.

Fire/Explosion No

• Micro/Biological **Possible**

A biofilm resulting from colonization by microorganisms forms over the passage of time, given accumulation of debris on interior surfaces in the space. Temperature and humidification of the airspace above the water also create growth conditions. Growth of microorganisms could lead to production of spores and cysts. Spores and cysts can cause allergic respiratory symptoms in sensitized individuals. The space also can contain insects and spiders.

Break-up of the biofilm by powerwashing creates airborne droplets containing viable microorganisms. These could include bacteria, yeasts, amoeba, and *Cryptosporidium*, among others. Inhalation of airborne spores and cysts and viable microorganisms could cause disease and allergic respiratory reactions in sensitized individuals.

Continuous mechanical ventilation will occur during this work. Turbulence created by the ventilation system could aerosolize spores contained in the structure.

• Ingestion/Skin & Eye Contact Hazard **Possible**

A biofilm resulting from colonization by microorganisms forms over the passage of time, given accumulation of debris on interior surfaces in the space. Temperature and humidification of the airspace above the water also create growth conditions. Contact with surfaces containing growth of microorganisms can cause rashes in sensitized individuals. These spaces also can contain sharps, usually in the form of discarded hypodermic syringes and needles. Hypodermic syringes and needles are potential sources of exposure to HIV and hepatitis viruses. HIV can survive a week outside the body, and hepatitis viruses, up to three months.

Concrete patching products and grouts are skin and severe eye irritants and are capable of causing chemical burns to the cornea. Refer to the Material Safety Data Sheet for further information.

Epoxy products are allergic sensitizers. Sensitization can occur through skin contact. Epoxy resin systems often are packaged in tubes with built-in mixing chambers. These minimize potential for skin contact. Refer to the Material Safety Data Sheet for these products for further information

• Physical Agents

Noise/Vibration **Possible**

Spraying using high pressure equipment, and concrete chipping, grinding, and sawing can create high levels of noise. This is exacerbated by reflection off the surfaces of the space. Noise produced by portable electrical and pneumatic tools can exceed regulatory limits.

Heat/Cold Stress No

Non/Ionizing Radiation No

Laser No

• Personal Confinement **Yes**

Access/egress requires vertical climb by ladder. Interior is large compared to availability of access. Headroom is an issue in the spaces at the Sechelt Aquatic Centre.

• Bio/Mechanical Hazard **Possible**

Mechanical equipment used for chipping, grinding and sawing poses an injury risk from striking and entangling.

• Hydraulic/Pneumatic/Vacuum Hazard **Possible**

Powerwashing poses an injection hazard (up to 5000 lb/in^2). Fluid injected into the tissues in this manner follows an unpredictable path. This path can damage tissues under the skin. This kind of injury requires prompt attention from an experienced medical practitioner, as there is a risk of gangrene and loss of the limb. The risk of gangrene is related to the delay in receiving proper medical attention.

Vacuuming using high vacuum equipment poses a suction hazard. Some vacuum systems operate at -27 inches of mercury vacuum (-90 kPa). Systems creating high vacuum are capable of causing severe traumatic injury, including avulsion and evisceration.

• Process Hazard No

• Safety Hazards

Rundown/Strikedown No

Structural Hazard No

Deterioration of the structure and rungs of in-place ladders may occur. Failure of a rung or a bracket can lead to fall during descent or ascent of an in-place ladder. This situation can develop only after prolonged exposure to conditions that are corrosive to metal and concrete. Structural integrity requires confirmation by the Owner. This reflects longevity projected in designs of these structures. Fall protection will be used, as deemed appropriate.

Engulfment/Immersion No

In operation, these structures are partly full of water. Drowning of a prone individual can occur in 15 cm of water. Accumulated water will be pumped from the space prior to the start of work. Water flow into the pump station at the Gibsons and District Aquatic Facility requires on-going control during the work to be performed.

Entry into a space containing water of sufficient depth to cause drowning is not permitted. A fall protection/work positioning system will be used where immersion in water is possible.

Entanglement No

Electrical/Electrostatic **Possible**

Portable electrical equipment used in the space containing faulty, deteriorated or inappropriate components or wiring poses an electrocution risk.

Fall No

Distance from top of the space to the floor through the access hatch in the structure at the Gibsons and District Aquatic Facility is sufficient to cause serious fall-related injury and exceeds the distance for which fall protection is required. Fall protection will be used, as deemed appropriate.

Slip/Trip **Yes**

Floor of the space is slippery from growth of microorganisms.

Visibility/Light level No

Interior of the space has no lighting. Supplemental lighting will be used, as needed. Lighting is satisfactory when one can read this document unaided.

Explosive/Implosive No

Hot/Cold Surfaces No

Hazard Assessment — Work Tasks in The Pump Stations – Aquatic Centres

Hazardous Condition	**Real or Potential Consequence**		
	Low *	**Moderate** *	**High** *
• hot work	NA		
• atmospheric hazards			
oxygen deficiency	NA		
oxygen enrichment	NA		
bio/chemical		x	
fire/explosion	NA		
• micro/biological		x	
• ingestion/skin & eye contact		x	
• physical agents			
noise/vibration		x	
heat/cold stress	NA		
non/ionizing radiation	NA		
laser	NA		
• personal confinement		x	
• bio/mechanical hazard		x	
• hydraulic/pneumatic/vacuum hazard		x	
• process hazard	NA		
• safety hazards			
rundown/strikedown	NA		
structural	NA		
engulfment/immersion	NA		
entanglement	NA		
electrical/electrostatic		x	
fall	NA		
slip/trip		x	
visibility/light level	NA		
explosive/implosive	NA		
hot/cold surfaces	NA		

In this table, toxic substance, oxygen deficiency, oxygen enrichment and flammable or combustible atmosphere derive their meaning from Exposure Limits and standards contained in the Occupational Health and Safety Regulation. **NA** means not applicable.

Action Required

• Refer to procedure for entry and work in this space.

Sunshine Coast Regional District	**First Aid Assessment**	**Pump Stations – Aquatic Centres**
Owner: Sunshine Coast Regional District	**Work Location:** Gibsons and District Aquatic Facility, Sechelt Aquatic Centre	**Assessed by:** Neil McManus, CIH, ROH, CSP NorthWest OH&S **Tel:** 604-980-8512 **Date:** 2012-03-14
Project: inspection, powerwashing concrete repair of structures, and valve repair and replacement	**Number of Workers:** 2 to 3	
Work Activity: • lifting and moving tools, equipment, supplies • powerwashing • concrete drilling • grout patching • epoxy handling and application, adhesive handling	**Probable Incident/Accident:** • slip, trip, fall, overexertion, fall from ladder • slip, trip, overexertion, suction injury involving vacuum system, foreign object in the eye • dust and material in the eye, overexposure to noise • material in the eye or on the skin • material in the eye or on the skin	**Probable Injury:** • broken bones, soft tissue injury • soft tissue injury, muscle strain, back injury, broken bones, corneal scratch • soft tissue injury, muscle strain, back injury, temporary hearing loss • chemical burn in the eye, eye injury, skin burn • chemical burn in the eye, eye injury, skin irritation
Workplace Hazard Rating: moderate risk (This rating applies to all accidents occurring in the industry and not to the specifics of this situation.)	**Types of Work Activity/Accidents:** typical of industry; refer to hazard assessment	**Types of Injury:** typical of industry; some types require hospital treatment
Rating Modification Factors: none anticipated	**FAA Required**: one, Level 1 minimum	**FAA Selected**:
Site Access Issues:	**Nearest Hospital:** St. Mary's Hospital, Sechelt (all emergencies)	**Alternate Hospital:** Gibsons Medical Clinic; Sechelt Medical Clinic; Pender Harbour & District Health Centre
	Route to Hospital:	**Route to Hospital:**
External Emergency Response: FIRE and AMBULANCE through 911 service	**Estimated Distance:** km	**Estimated Distance:** km
	Estimated Travel Time: min	**Estimated Travel Time:** min
Transportation: BC Ambulance Service, company vehicle, taxi, industrial ambulance; airlift possibly required	**Transportation Issues:** winter weather	**Transportation Issues:**
Implementation		
Name: Ken Robinson	**Title:** Facilities Operation Supervisor	**Date:** 2012-03-14
Comments: • Refer to the overall OH&S program. • for each location, provide a map indicating the address and route to the Hospital and nearest alternate medical services and emergency telephone numbers. • ensure that alternate medical services are equipped and amenable to providing assistance.		

Sunshine Coast Regional District	**Confined Space Procedure**	**Work Tasks in the Pump Stations – Aquatic Centres**
Permit Required: Yes At time of entry the atmosphere is expected to be low hazard and not to exceed moderate hazard during work activity. Space can contain a potential immersion hazard requiring continuous pump-out. Isolation of the space from inflow is not possible due to the absence of isolation valves.	**Pgm Admin:** Ken Robinson **Tel:** 604-885-6822 **Cell/Pgr:** to be determined **Site Contact:** Allen van Velzen **Tel:** 604-885-6822 **Cell/Pgr:** 604-741-1547	**Prepared by:** N. McManus, CIH, ROH, CSP NorthWest OH&S **Date:** 2010-03-14 **Tel:** 604-980-8512
Equipment Required	**Co-ordination of Work Activities**	
• two-way radio, cellular telephone • operating vehicles and fuel-powered equipment • exhaust hose • two-way radio, cellular telephone • exhaust hose • primary barriers • secondary barricades, barrier tape, warning signs	**Note**: • perform this work only when inflow into the Pump Station is fully controlled to a low level in the space. • locate the pump externally to the space to avoid potential electrical contact with the water Contractors: • on arriving at the site, contact the Pool Operator to establish reliability of communication. Reliable communication may not exist in some areas. • keep operating vehicles and fuel-powered portable equipment at least 10 m downwind from the entry to the space and intake of ventilating equipment to prevent entry of exhaust gases. • install exhaust hose to divert flow up the side of the truck to discharge above the roof when the engine continues to operate Operators: • on arriving at the site, contact the Pool Operator to establish reliability of communication. Reliable communication may not exist in some areas. • keep operating vehicles and fuel-powered portable equipment at least 10 m downwind from the entry to the space and intake of ventilating equipment to prevent entry of exhaust gases. • install exhaust hose to divert flow up the side of the truck to discharge above the roof when the engine continues to operate • erect primary barriers around openings to the space when unoccupied to prevent falls • as needed to keep bystanders and traffic away from the area while work is occurring, erect secondary barriers • at the end of the work or the workshift, replace the manhole cover	
Equipment Required	**Isolation & Lockout**	
	.• the Owner is to prepare and implement a procedure for deactivating, de-energizing, isolating and locking out equipment and fluid circuits that could influence the safety of the entry and work	
Equipment Required	**Cleaning, Purging, Venting or Inerting**	
• to be determined, xxxx ft^3/min free air delivery • garden sprayer or hose	• install fan intake in an area of clean respirable air and utilize as a supply unit. • position outlet of duct to provide air as close as possible into the zone in which work will occur. This will ensure that the entrant breathes air from the exterior rather than the atmosphere in the space. • begin ventilating at least 5 minutes prior to initial entry to ensure that purging of the atmosphere in the work zone has occurred • keep concrete wet when chipping or drilling to suppress dust generation	
Equipment Required	**Verification & Testing**	

• atmosphere testing instrument (Biosystems PhD Lite and Draeger XAM 2000) containing sensors for oxygen, flammable/combustibles, carbon monoxide, hydrogen sulphide • calibration kit • additional instrument containing sensor for nitrogen dioxide when diesel engines are operating. (If one can smell diesel exhaust, one must monitor the exhaust gases.)	• calibrate or bump test the instrument at the beginning of the workshift or immediately before use, per the manufacturer's instructions. Persons calibrating and operating the instrument must have appropriate training. Keep records of calibration and testing. • measure conditions at the top, middle and bottom of the space through which access/egress, and extrication will occur in the event of an emergency or accident by lowering the sampling line. Remember that there is a delay in response as air is pumped into the instrument. • record these readings and readings obtained periodically during work activity • where use of portable equipment powered by small engines is occurring, monitor the surroundings to ensure that exposure is not happening
	• entry and work in the space without respiratory protection for gases can occur only if the following conditions are met: **Entry** — **Work Activity/Alarm Settings** **oxygen:** 20.9 or 21.0% — 20.5 % or greater **flammable/combustibles:** 0 % of LEL — 5 % of LEL or less **carbon monoxide:** 0 ppm — 25 ppm or less **nitrogen dioxide:** 0 ppm — 1.0 ppm or less **hydrogen sulphide:** 0 ppm — 10 ppm or less
	• if these conditions are not met prior to entry, continue ventilating the space for 5 minutes and retest. If these conditions cannot be met, the situation requires reevaluation.
	• the entrant must wear the instrument at all times while in the space, and must vacate in the event that the alarm sounds. If an alarm sounds, the standby shall order the entrant(s) to vacate the space immediately. • at the end of the workshift record all data provided by the instrument (peak, TWA, STEL, occurrence of alarms)
Equipment Required	**Ventilation**
• to be determined, xxxx ft^3/min free air delivery ft^3/min free air delivery	• locate the intake to the supply fan upwind from operating engines and other sources of contamination. Direct exhaust flows away from air intakes. • position the end of supply duct as close as possible to the work zone and support, as necessary, to direct flow from directly above the worker.
Equipment Required	**Personal Protective Equipment & Other Precautions**
• hard hat, safety glasses + side-shields, hearing protection (muffs or plugs) when noise sources are present, work area clothing, safety boots, protective gloves. Powerwashing requires additional protection (faceshield, industrial raingear, rubber safety boots, waterproof gloves).	• all persons working in the space require personal protective equipment, as specified. Personal protective equipment shall comply with requirements of the respective certifying and testing agencies, CSA (Canadian Standards Association) and ANSI (American National Standards Institute).
• NIOSH-approved half-facepiece respirator containing HEPA filters and acid gas/organic vapour cartridges	• in view of the information available, persons working in the space should wear respiratory protection as a precaution against potential exposure to bacteria and viruses and spores from moulds and odours. Respiratory protection is required during operations that can generate concrete and cement dust. Wet methods greatly reduce the potential for dust generation. Provision of clean respirable air in the work zone by the supply system and atmospheric monitoring are believed sufficient to protect against overexposure to other contaminants. In the event that this strategy does not provide sufficient protection, the situation requires reevaluation.
• GFCIs	•all electrical circuits require Ground Fault Circuit Interrupters (GFCIs)
• sharps kit	• use tongs to handle sharps for disposal in the protected container
Equipment Required	**Personal Hygiene and Decontamination**
• personal eyewash, ANSI-compliant eyewash station	• a personal eyewash bottle must be available in the event of a splash into the face to flush the eyes immediately following contact with irritating substances • flush the eyes for 15 to 20 minutes using the ANSI-compliant unit • seek medical attention

• household bleach (1:20 dilution)	• utilize bleach solution (or similar disinfectant product) for cleaning following exposure to biofilms as part of the initial clean-up. Sewer workers must clean hands, face and exposed skin prior to eating, drinking or smoking.
• soap and water	• thoroughly wash hands, face and all exposed surfaces of skin prior to eating, drinking, or smoking
Equipment Required	**Lifelines, Harnesses & Lifting Equipment**
• harness (dorsal D-ring)	• all persons entering and working in the space where vertical extrication may occur require a harness, if feasible. Connection to the winch is required when standing water is present and to permit extrication. • inspect all equipment for damage before use. Remove damaged equipment from service.
• fall restraint device: winch (Make model)	• fall restraint is required where work occurs on the top of structures lacking fall prevention in the form of railings or other devices where fall can occur • fall restraint device is required during ascent and descent of ladder where free fall distance can exceed 3 m (10 feet)
• retrieval system: tripod or davit arm (Make model) positioned at manhole above the entry ladder	• retrieval device required for entry and for lifting injured victim from the space
Equipment Required	**Standby Person**
• two-way radio, cellular telephone	• standby person must remain near the access when equipment noise causes difficulty in communication. The standby can assist the entrant with equipment and supplies. The standby must be able to extricate the worker vertically in the event of an emergency or an accident. Standby must have training in monitoring duties, initiating emergency response, operation of retrieval equipment and removal of injured victims using this equipment. • standby must not enter the space
Equipment Required	**Rescue**
• two-way radio, cellular telephone, air horn	• rescue personnel must have training in first aid and CPR • to activate the emergency response, standby person sounds three long blasts on the air horn, as appropriate or contacts the Lifeguards on the two-way radio, indicates the occurrence of the accident and asks the Lifeguard to call 911 to request assistance from FIRE and AMBULANCE and states the exact location and the nature of the problem. • the Lifeguard contacts the Assistant Supervisor, Maintenance and Operations, to inform about the situation • if the instrument in the space is not alarming, and no other hazardous condition has arisen, the rescue person may enter the space to assist the victim; otherwise, use the winch to remove the victim. The standby must not enter the space. • rescue person assesses condition of the victim and determines whether serious injury has occurred and whether serious injury has occurred to the head, neck or back. If serious injury has not occurred and does not involve the head, neck or back, the victim may be assisted to the access and removed from the space. If the preceding conditions cannot be met, the victim is to be packaged for transport.

Sunshine Coast Regional District		**Confined Space Identification and Hazard Assessment**		**Sand Filters**	
Owner: Sunshine Coast Regional District		**Location:** Sechelt Aquatic Centre		**Assessed by:** Neil McManus, CIH, ROH, CSP NorthWest OH&S **Tel:** 604-980-8512 **Date:** 2010-10-18	
underground working?	enclosed or partially enclosed?	designed/ intended for continuous human occupancy?	limited or restricted entry or exit?	large enough and configured for entry to perform work?	**Confined Space?** **Yes** ▲
No	**Yes**	**No**	**Yes**	**Yes**	≈ All entries **bold**?
Description: horizontal, welded, coated steel cylindrical pressure vessels Main Pool Filter: about 2.5 m long by 1.8 m in diameter Leisure Pool Filter: about .2.5 m long by 1 m in diameter Swirl Pool (Hot Tub) Filter: about 1.5 m long by 0.9 m in diameter		**Access/Egress:** hatch typically measuring about 40 cm by 60 cm located at the mid-point on the upper side wall		**Contents:** pool water; filtration media (zeolite containing less than 0.1% quartz or silica sand); miscellaneous debris, including band-aids, hair, foam bits, jewellery, lint, plastic finger nails, foam bits, and so on; dead skin; biofilm on wet surfaces, mould possible on wetted and dry surfaces	
		Adjacent Spaces: Filter Room located in the on the main floor		**Equipment:** distribution piping and spray heads near the top of the space; collection piping and diffusers near the bottom of the space	
		Function/Use: filter flow from the pools to remove suspended material		**Process:** not applicable	
External Surroundings: Filter Room		**Downgrading Conditions:** not applicable		**Potential Impact on Work Activity:** not applicable	

Hazard Assessment — Undisturbed/Operational Space

This hazard assessment identifies and discusses hazardous conditions that can develop during operation or quiescent conditions in the space and indicates hazardous conditions requiring correction during entry preparation.

· Atmospheric Hazards

Oxygen Deficiency **Possible**

A biofilm resulting from colonization by microorganisms forms over the passage of time, given the quantity of debris and fine organic material (shed skin flakes, for example) present on interior surfaces in the space. Microbiological activity involving the biofilm could contribute to creating an oxygen-deficient atmosphere in the airspace above the water level.

Rusting of steel surfaces also can deplete oxygen. This situation is likely to pose greatest risk when the space remains undisturbed for a long period of time with minimal airflow.

Humidification of the airspace above the water due to the high temperature (28℃), humidity and mist also create growth conditions. Water vapour evaporating from the surface of the liquid water reduces the concentration of oxygen in the airspace. At 20℃, the partial pressure of water vapour (100% Relative Humidity) is about 18 mm Hg (millimetres of mercury). At this pressure, for a total

atmospheric pressure of 760 mm Hg, the combined pressure of oxygen and nitrogen would be 742 mm Hg. The pressure of oxygen, which is 20.9% of the total would be about 155 mm Hg. This corresponds to a composition of 20.4 % relative to the norm of 20.9 % at normal atmospheric conditions. The legally oxygen-deficient concentration is 19.5 % at normal atmospheric conditions. At 28℃, the partial pressure of water vapour (100% Relative Humidity) is about 28 mm Hg. At this pressure, the combined pressure of oxygen and nitrogen would be 732 mm Hg. The pressure of oxygen would be about 153 mm Hg. This corresponds to a composition of 20.1 % relative to the norm of 20.9 % at normal atmospheric conditions.

Partial filling and emptying of these structures acts like a piston in a cylinder to expel and to entrain air through the vents. The likelihood of oxygen deficiency is reduced because of the movement of air into and out of the space in response to fluctuations in the level of water.

Development of these conditions and the risk of oxygen deficiency is governed by the extent of enclosure of the space, and the period of quiescence between openings. None of the preceding factors is predictable in a particular circumstance to the extent needed to guarantee that an oxygen-deficient condition cannot or will not develop. One statement that is reasonable in these circumstances is that the *status quo,* as created by conditions and ascertained through testing, in the absence of other measures is unlikely to change during occupancy.

Oxygen Enrichment No

Bio/Chemical **Possible**

A biofilm resulting from colonization by microorganisms forms over the passage of time, given the quantity of debris and fine organic material (shed skin flakes, for example) present on interior surfaces in the space. Temperature and humidification of the airspace above the water also create growth conditions. Growth of microorganisms could lead to production of carbon dioxide (aerobic conditions).

Pool waters contain low concentrations of hypochlorous acid, hypochlorite ion, and various levels of calcium and sodium ions, and chloride and sulphate and carbonate and bicarbonate ions. These waters may off-gas chloramines and nitrogen trichloride (the source of the ‘swimming pool odour’. Quantities should reflect the level of exposure of users of the pool.

Development of these conditions is governed by the extent of enclosure of the space, the presence of extraneous contents that can undergo aerobic and possibly anaerobic decay and the period of quiescence between openings. None of the preceding factors is predictable in a particular circumstance to the extent needed to guarantee that production and accumulation of these gases cannot or will not occur. One statement that is reasonable in these circumstances is that the *status quo,* as created by conditions and ascertained through testing, in the absence of other measures, is unlikely to change during occupancy.

Fire/Explosion No

· Micro/Biological **Possible**

A biofilm resulting from colonization by microorganisms forms over the passage of time, given the quantity of debris and fine organic material (shed skin flakes, for example) present on interior surfaces in the space. Temperature and humidification of the airspace above the water also create growth conditions. Growth of microorganisms could lead to production of spores and cysts. Spores and cysts can cause allergic respiratory symptoms in sensitized individuals.

· Ingestion/Skin & Eye Contact Hazard **Possible**

A biofilm resulting from colonization by microorganisms forms over the passage of time, given the quantity of debris and fine organic material (shed skin flakes, for example) present on interior surfaces in the space. Temperature and humidification of the airspace above the water also create growth conditions. Contact with surfaces containing growth of microorganisms can cause rashes in sensitized individuals.

· Physical Agents

Noise/Vibration No

Heat/Cold Stress **Possible**

Water temperature in the pool is 28℃. The temperature in the space is about this level accompanied by a high level of humidity. These conditions potentially can cause heat stress in unacclimatized individuals while performing heavy work.

Non/Ionizing Radiation No

Laser No

· Personal Confinement **Yes**

Access/egress occurs through a small opening located in the upper side wall. The interior is cramped due to the presence of the distribution piping. Headroom is an issue in this space.

· Bio/Mechanical Hazard No

· Hydraulic/Pneumatic/Vacuum Hazard **Possible**

This space receives water from a shower-like distribution system that sprays into the airspace above the filtration medium. Water passes through the coarse sand and drains to the diffusers embedded in the sand.

· Process Hazard No

· Safety Hazards

Rundown No

Structural Hazard No

Engulfment/Immersion **Yes**

In operation, this structure is mostly full of pool water. Drowning of a prone individual can occur in 15 cm of water.

Entanglement No

Electrical/Electrostatic No

Fall No

Slip/Trip **Yes**

Interior surfaces of the space above the sand may be slippery from growth of microorganisms.

Visibility/Light level **Yes**

Interior of the space has no lighting.

Explosive/Implosive No

Hot/Cold Surfaces No

Hazard Assessment - Undisturbed/Operational Space

Hazardous Condition	**Real or Potential Consequence**		
	Low	**Moderate**	**High**
· atmospheric hazards			
oxygen deficiency		x	
oxygen enrichment	NA		
bio/chemical		x	
fire/explosion	NA		
· micro/biological		x	

· ingestion/skin & eye contact			x		
· physical agents					
noise/vibration		NA			
heat/cold stress			x		
non/ionizing radiation		NA			
laser		NA			
· personal confinement					x
· bio/mechanical hazard		NA			
· hydraulic/pneumatic/vacuum hazard		x			
· process hazard		NA			
· safety hazards					
rundown		NA			
structural		NA			
engulfment/immersion					x
entanglement		NA			
electrical/electrostatic		NA			
fall		NA			
slip/trip		x			
visibility/light level			x		
explosive/implosive		NA			
hot/cold surfaces	NA				

In this table, toxic substance, oxygen deficiency, oxygen enrichment and flammable or combustible atmosphere derive their meaning from Exposure Limits and standards contained in the Occupational Health and Safety Regulation. **NA** means not applicable.

Action Required

· Drain the space and pump accumulated water from the space prior to entry and work.
· Ventilate the interior of the space prior to entry.
· The Owner is to implement a procedure to deactivate, de-energize, isolate and lock out sources of water that can enter the structure.
· The Owner is to implement a procedure to deactivate, de-energize, isolate and lock out electrical sources associated with operation of this equipment.

Hazard Assessment — Work Tasks in the Sand Filters

This hazard assessment refers to entry for the purpose of performing work tasks in the sand filters. These include inspection, removal and replacement of the sand medium, removal and replacement of damaged components of the water distribution and collection network, and water- and powerwashing interior surfaces. This hazard assessment considers hazardous conditions posed by the work activity in context with those remaining in the space following preparatory activity.

· Hot Work No

· Atmospheric Hazards

Oxygen Deficiency No

A biofilm resulting from colonization by microorganisms forms over the passage of time, given the quantity of debris and fine organic material (shed skin flakes, for example) present on interior surfaces in the space. Microbiological activity involving the biofilm could contribute to creating an oxygen-deficient atmosphere in the airspace above the water level.

Rusting of steel surfaces also can deplete oxygen. This situation is likely to pose greatest risk when the space remains undisturbed for a long period of time with minimal airflow.

Humidification of the airspace above the water due to the high temperature (28℃), humidity and mist also create growth conditions. Water vapour evaporating from the surface of the liquid water reduces the concentration of oxygen in the airspace. At 20℃, the

partial pressure of water vapour (100% Relative Humidity) is about 18 mm Hg (millimetres of mercury). At this pressure, for a total atmospheric pressure of 760 mm Hg, the combined pressure of oxygen and nitrogen would be 742 mm Hg. The pressure of oxygen, which is 20.9% of the total would be about 155 mm Hg. This corresponds to a composition of 20.4 % relative to the norm of 20.9 % at normal atmospheric conditions. The legally oxygen-deficient concentration is 19.5 % at normal atmospheric conditions. At 28℃, the partial pressure of water vapour (100% Relative Humidity) is about 28 mm Hg. At this pressure, the combined pressure of oxygen and nitrogen would be 732 mm Hg. The pressure of oxygen would be about 153 mm Hg. This corresponds to a composition of 20.1 % relative to the norm of 20.9 % at normal atmospheric conditions.

Draining the water from the interior of the space changes the growth relationship between the organisms involved in the biofilm and can lead to colonization by foreign microorganisms. The likelihood of this depends on time and temperature following drainage. Powerwashing will create mist, a suspension of droplets in the physical volume of the space. The bulk volume of the droplets and evaporation from the surface of the droplets will displace some of the atmosphere, leading to potential oxygen deficiency. The extent to which this action occurs depends on the water pressure required to clean the surfaces. Oxygen depletion can also occur through absorption by the walls of the concrete if left undisturbed for a prolonged period.

The key factor that affects air quality in these spaces is water. Water is essential for corrosion of metals and for the growth of microorganisms. The process of rusting involves chemical reaction of atmospheric oxygen with metal surfaces. The process continues deeper into the metal long after initial rusting of the surface. Microorganisms require oxygen for aerobic growth.

Development of these conditions and the risk of oxygen deficiency is governed by the extent of enclosure of the space, and the period of quiescence between openings. None of the preceding factors is predictable in a particular circumstance to the extent needed to guarantee that an oxygen-deficient condition cannot or will not develop. One statement that is reasonable in these circumstances is that the *status quo,* as created by conditions and ascertained through testing, in the absence of other measures, is unlikely to change during occupancy.

Continuous mechanical ventilation and continuous atmospheric testing will occur during this work. The alarm set point for the oxygen sensor is 20.5% not the legal limit of 19.5%. This will ensure that an oxygen-deficient atmosphere cannot develop.

Oxygen Enrichment No

Bio/Chemical **Possible**

A biofilm resulting from colonization by microorganisms forms over the passage of time, given the quantity of debris and fine organic material (shed skin flakes, for example) present on interior surfaces in the space. Temperature and humidification of the airspace above the water also create growth conditions. Growth of microorganisms could lead to production of carbon dioxide (aerobic conditions).

Pool waters contain low concentrations of hypochlorous acid, hypochlorite ion, and various levels of calcium and sodium ions, and chloride and sulphate and carbonate and bicarbonate ions. These waters may off-gas chloramines and nitrogen trichloride (the source of the ‘swimming pool odour’. Quantities should reflect the level of exposure of users of the pool.

Draining the water from the interior of the space changes the growth relationship of the organisms involved in the biofilm and can lead to colonization by foreign microorganisms. The likelihood of this depends on time and temperature following drainage. Increased growth will increase the rate of production of carbon dioxide. During shutdown conditions, these structures become similar to structures otherwise only partly filled with water. New growth resulting from colonization by fungi will also occur on residual material and surfaces. Fungi also produce carbon dioxide. The level of emission of carbon dioxide currently is unknown.

The key factor that affects air quality in these spaces is water. Water is essential for the growth of microorganisms. Development of these conditions is governed by the extent of enclosure of the space, the presence of extraneous contents that can undergo aerobic and possibly anaerobic decay and the period of quiescence between openings. None of the preceding factors is predictable in a particular circumstance to the extent needed to guarantee that production and accumulation of these gases cannot or will not develop. One statement that is reasonable in these circumstances is that the *status quo,* as created by conditions and ascertained through testing, in the absence of other measures is unlikely to change during occupancy.

Exhaust from vehicles and mobile equipment can enter the work space under conditions related to cold weather or inappropriate

placement of equipment, and can cause needless exposure. This is especially probable where the geometry of structures prevents dispersion. Exhaust from gasoline engines contains carbon monoxide (CO), carbon dioxide (CO_2), unburned fuel vapour and particulates. Exhaust from vehicles is less of a problem at this time due to use of catalytic converters in the exhaust system. Small engines used in generator sets, pumps, powerwashers, and other small portable units are major sources of exposure to exhaust, especially where the geometry of structures prevents dispersion.

Exhaust from diesel engines contains nitric oxide (NO), nitrogen dioxide (NO_2), unburned fuel vapour and particulates. Exhaust from the diesel engine of trucks is often directed horizontally at ground level. In cool or cold weather, vertically directed exhaust will cool rapidly and stratify in a layer just above the top of the truck. Descent to ground level is possible. In confining geometries, accumulation could pose a serious exposure risk.
Combustion gases discharged from propane-fuelled air heaters used in cold weather conditions are sources of carbon dioxide and possibly carbon monoxide. Under cool or cold conditions, these gases do not disperse and can be entrained into the air provided by portable ventilation systems.

Small quantities of PVC pipe cleaner and adhesive may be used during piping repair. To the extent possible, use of these products will occur outside the space. These products contain cyclohexanol and cyclohexanone. These solvents provide excellent warning properties. Exposure to vapours from these products will be very brief.

The sand used as a filtration medium is coarse sand or a coarse sand and gravel mix. The quantity of crystalline silica (quartz) smaller than 10 µm is less than 0.005%. (µm is micrometres, millionths of a metre, a unit of measurement.) Airborne crystalline silica smaller than 10 µm passes to the air spaces in the lungs and causes silicosis and may cause lung cancer. WorkSafeBC has designated silica in respirable form as an alara substance to which exposure is to be maintained as low as reasonably possible below the exposure limit. Wet methods of handling and use of water-washed product are effective methods of dust suppression.

Continuous mechanical ventilation and continuous atmospheric testing will occur during this work.

Fire/Explosion No

· Micro/Biological **Possible**

A biofilm resulting from colonization by microorganisms forms over the passage of time, given the quantity of debris and fine organic material (shed skin flakes, for example) present on interior surfaces in the space. Temperature and humidification of the airspace above the water also create growth conditions. Growth of microorganisms could lead to production of spores and cysts. Spores and cysts can cause allergic respiratory symptoms in sensitized individuals.

Draining the water from the interior of the space changes the growth relationship of the organisms involved in the biofilm and can lead to colonization by foreign microorganisms. The likelihood of this depends on time and temperature following drainage.

Break-up of the biofilm by powerwashing creates airborne droplets containing viable microorganisms. These could include bacteria, yeasts, amoeba, and *Cryptosporidium*, among others. Inhalation of airborne spores and cysts and viable microorganisms could cause disease and allergic respiratory reactions in sensitized individuals.

Continuous mechanical ventilation will occur during this work. Turbulence created by the ventilation system could aerosolize spores contained in the structure.

· Ingestion/Skin & Eye Contact Hazard **Possible**

A biofilm resulting from colonization by microorganisms forms over the passage of time, given the quantity of debris and fine organic material (shed skin flakes, for example) present on interior surfaces in the space. Temperature and humidification of the airspace above the water also create growth conditions. Contact with surfaces containing growth of microorganisms can cause rashes in sensitized individuals.

· Physical Agents

Noise/Vibration **Possible**

Noise produced by portable equipment brought into the space could exceed regulatory limits.

Heat/Cold Stress **Yes**

Water temperature in the pool is 28℃. The temperature in the space is about this level accompanied by a high level of humidity. These conditions potentially can cause heat stress in unacclimatized individuals while performing heavy work. Wearing of impervious suits during powerwashing exacerbates the problem of heat stress. The fabric of the suit traps inside heat and moisture produced by the body during the work.

Non/Ionizing Radiation No

Laser No

· Personal Confinement **Yes**

Access/egress occurs through a small opening located in the upper side wall. The interior is cramped due to the presence of the distribution piping. Headroom is an issue in this space.

· Bio/Mechanical Hazard **Yes**

The interior of the space is very cramped. Internal geometry of piping considerably restricts movement, some of which involved with the handling of filter sand. These restrictions and the necessity for stooped and bent posture considerably increase the risk of musculoskeletal injury.

· Hydraulic/Pneumatic/Vacuum Hazard **Possible**

This space receives water from a shower-like distribution system that sprays into the airspace above the filtration medium. Water passes through the coarse sand and drains to the diffusers embedded in the sand.

Powerwashing poses an injection hazard (up to 5000 lb/in^2). Fluid injected into the tissues in this manner follows an unpredictable path. This path can damage tissues under the skin. This kind of injury requires prompt attention from an experienced medical practitioner, as there is a risk of gangrene and loss of the limb. The risk of gangrene is related to the delay in receiving proper medical attention.

Vacuuming using high vacuum equipment poses a suction hazard. Some vacuum systems operate at -27 inches of mercury vacuum (-90 kPa). Systems creating high vacuum are capable of causing severe traumatic injury.

· Process Hazard No

· Safety Hazards

Rundown No

Structural Hazard No

Engulfment/Immersion No

In operation, this structure is mostly full of pool water. Drowning of a prone individual can occur in 15 cm of water. Accumulated water will be pumped from the space prior to the start of work.

Residual liquid will be drained prior to entry. Work will occur when inflow cannot occur. Isolation valves will be closed securely and locked out. Catastrophic failure of valves would lead to entry of a jet of water into one corner of the space. This should not hinder evacuation Catastrophic failure is highly unlikely to occur, given criteria used by design engineers in selection of components and adherence of components to standards of performance that recognize conditions to which components are subjected during service of long duration. Entry into a space containing water of sufficient depth to cause drowning is not permitted.

Entanglement **Yes**

The space contains a network of piping arranged in two parallel layers. The access/opening is very small. This situation considerably complicates the use of lifelines and continuous tethering.

Electrical/Electrostatic **Possible**

Portable electrical equipment used in the space containing faulty, deteriorated or inappropriate components or wiring poses an electrocution risk.

Fall No

Slip/Trip **Yes**

Interior surfaces of the space above the sand may be slippery from growth of microorganisms.

Visibility/Light level No

Interior of the space has no lighting. Supplemental lighting will be used, as needed. Lighting is satisfactory when one can read this document unaided.

Explosive/Implosive No

Hot/Cold Surfaces No

Hazard Assessment — Work Tasks in The Sand Filters

Hazardous Condition		**Real or Potential Consequence**		
		Low	**Moderate**	**High**
· hot work	NA			
· atmospheric hazards				
oxygen deficiency		NA		
oxygen enrichment		NA		
bio/chemical			x	
fire/explosion		NA		
· micro/biological			x	
· ingestion/skin & eye contact			x	
· physical agents				
noise/vibration			x	
heat/cold stress			x	
non/ionizing radiation		NA		
laser		NA		
· personal confinement				x
· bio/mechanical hazard				x
· hydraulic/pneumatic/vacuum hazard				x
· process hazard		NA		
· safety hazards				
rundown		NA		
structural		NA		
engulfment/immersion		NA		
entanglement			x	
electrical/electrostatic			x	
fall		NA		
slip/trip		x		
visibility/light level		NA		
explosive/implosive		NA		
hot/cold surfaces	NA			

In this table, toxic substance, oxygen deficiency, oxygen enrichment and flammable or combustible atmosphere derive their meaning from Exposure Limits and standards contained in the Occupational Health and Safety Regulation. **NA** means not applicable.

Action Required

· Refer to procedure for entry and work in this space.

Sunshine Coast Regional District	**First Aid Assessment**	**Sand Filters**
Owner: Sunshine Coast Regional District	**Work Location:** Sechelt Aquatic Centre	**Assessed by:** Neil McManus, CIH, ROH, CSP NorthWest OH&S **Tel:** 604-980-8512 **Date:** 2010-10-18
Project: inspection, powerwashing concrete repair of structures, and valve repair and replacement	**Number of Workers:** 2 to 3	
Work Activity: · lifting and moving tools, equipment, supplies · powerwashing · sand handling	**Probable Incident/Accident:** · slip, trip, fall, overexertion, fall from ladder · slip, trip, overexertion, suction injury involving vacuum system, foreign object in the eye · overexertion, dust and foreign material in the eye, overexposure to noise	**Probable Injury:** · broken bones, soft tissue injury · soft tissue injury, muscle strain, back injury, broken bones, corneal scratch · soft tissue injury, muscle strain, back injury, corneal scratch, temporary hearing loss
Workplace Hazard Rating: high risk (This rating applies to all accidents occurring in the industry and not to the specifics of this situation.)	**Types of Work Activity/Accidents:** typical of industry; refer to hazard assessment	**Types of Injury:** typical of industry; some types require hospital treatment
Rating Modification Factors: none anticipated	**FAA Required**: one, Level 1 minimum	**FAA Selected**: one. Level 1
Site Access Issues:	**Nearest Hospital:** St. Mary's Hospital, Sechelt (all emergencies)	**Alternate Hospital:** Gibsons Medical Clinic; Sechelt Medical Clinic; Pender Harbour & District Health Centre
	Route to Hospital:	**Route to Hospital:**
External Emergency Response: FIRE and AMBULANCE through 911 service	**Estimated Distance:** km	**Estimated Distance:** km
	Estimated Travel Time: min	**Estimated Travel Time:** min
Transportation: BC Ambulance Service, company vehicle, taxi, industrial ambulance; airlift possibly required	**Transportation Issues:** winter weather	**Transportation Issues:**
Implementation		

Name: Ken Robinson	**Title:** Facilities Operation Supervisor	**Date:** 2010-10-18

Comments:

· Refer to the overall OH&S program.

· for each location, provide a map indicating the address and route to the Hospital and nearest alternate medical services and emergency telephone numbers.

· ensure that alternate medical services are equipped and amenable to providing assistance.

Sunshine Coast Regional District	Confined Space Procedure	Work Tasks in the Sand Filters
Permit Required: Yes At time of entry the atmosphere is expected to be low hazard and not to exceed moderate hazard during work activity. Space can contain a potential immersion hazard requiring lockout and isolation.	**Pgm Admin:** Ken Robinson **Tel:** 604-885-6822 **Cell/Pgr:** to be determined **Site Contact:** Daryl Lowey **Tel:** 604-885-6822 **Cell/Pgr:** 604-741-3680	**Prepared by:** N. McManus, CIH, ROH, CSP NorthWest OH&S **Date:** 2010-10-18 **Tel:** 604-980-8512
Equipment Required	**Co-ordination of Work Activities**	
· two-way radio, cellular telephone · operating vehicles and fuel-powered equipment · exhaust hose · two-way radio, cellular telephone · exhaust hose · primary barriers · secondary barricades, barrier tape, warning signs	Contractors: · on arriving at the site, contact the Pool Operator to establish reliability of communication. Reliable communication may not exist in some areas. · keep operating vehicles and fuel-powered portable equipment at least 10 m downwind from the entry to the space and intake of ventilating equipment to prevent entry of exhaust gases. · install exhaust hose to divert flow up the side of the truck to discharge above the roof when the engine continues to operate Operators: · on arriving at the site, contact the Pool Operator to establish reliability of communication. Reliable communication may not exist in some areas. · keep operating vehicles and fuel-powered portable equipment at least 10 m downwind from the entry to the space and intake of ventilating equipment to prevent entry of exhaust gases. · install exhaust hose to divert flow up the side of the truck to discharge above the roof when the engine continues to operate · erect primary barriers around openings to the space when unoccupied to prevent unauthorized entry · as needed to keep bystanders and traffic away from the area while work is occurring, erect secondary barriers · at the end of the work or the workshift, replace the manway hatch	
Equipment Required	**Isolation & Lockout**	
	.· the Owner is to prepare and implement a procedure for deactivating, de-energizing, isolating and locking out equipment and fluid circuits that could influence the safety of the entry and work ·	
	Main Pool Circulation Pump Electrical Isolation Procedure: · move P001 Control Switch in the Control Cabinet located in the Pump Room to the OFF position. · move P001 Disconnect in the Control Cabinet located in the Pump Room to the OFF position. · apply keyed padlock and tag when loss of exclusive control can occur.	

	Verification Test Procedure: · attempt to restart the pump by rotating the P001 Control Switch to the HAND position. Return to OFF position. Or · use voltmeter to test electrical circuit. **Notes:** · switches and disconnects require unique, consistent identification · exclusive control means that the individual who isolates the circuit will perform or directly supervise the work of others on the circuit and will remain constantly on the job site and in exclusive control of the isolated circuit. · loss of exclusive control means that the individual who has control of the isolated circuit leaves the work area
· lockout device, keyed padlock, tag · lockout device, keyed padlock, tag · lockout device, keyed padlock, tag	**Main Pool Circulation Circuit Isolation Procedure:** Main Actions · perform the Main Pool Circulation Pump electrical isolation procedure before beginning this procedure. · prior to starting, inspect the component strings carefully to ensure that they are intact and structurally sound and unlikely to experience catastrophic failure while under pressure as a result of this work. · if there is any doubt about the structural integrity of the components or piping system during or as a result of this work, do not proceed until this issue is resolved · move Downstream Main Pool Circulation Pump Isolation Valve, V005, located in the Pump Room to the CLOSED position. · apply lockout device and keyed padlock and tag when loss of exclusive control can occur. · move Upstream Main Pool Circulation Pump Isolation Valve, V004, located in the Pump Room to the CLOSED position. · apply lockout device and keyed padlock and tag when loss of exclusive control can occur. · move Auto-Fill Valves, V075 and V076, and Manual Fill Valve, V074, located in the Pump Room to the CLOSED position. · apply lockout device and keyed padlock and tag when loss of exclusive control can occur · slowly move the Drain Valve in the Main Pool Circulation Strainer to the OPEN position to remove pressure retained in the component string. Avoid contact with the jet of water.
· lockout device, keyed padlock, tag · lockout device, keyed padlock, tag · lockout device, keyed padlock, tag	Contingency Actions · if V004 leaks, move Surge Tank Discharge Valve, V003, located in the Pump Room to the CLOSED position. · apply lockout device and keyed padlock and tag when loss of exclusive control can occur. · if V004 leaks, move Main Pool Drain Discharge Valve, V002, located in the Pump Room to the CLOSED position. · apply lockout device and keyed padlock and tag when loss of exclusive control can occur. · if V005 leaks, move Main Filter Isolation Valves, V006 and V008, to the CLOSED position. · apply lockout device and keyed padlock and tag.

	Verification Test Procedure: · observe the continuing flow of water from the bleed valve. If water flow does not cease, the isolation is not successful. **Notes:** · gradual motion in the movement of valve components minimizes the potential for water hammer. · valves require unique, consistent identification · exclusive control means that the individual who isolates the component string will perform or directly supervise the work of others on the component string and will remain constantly on the job site and in exclusive control of the component string. · loss of exclusive control means that the individual who has control of the isolated component string leaves the work area · a high pressure jet of fluid can cause injection injury. Injection injuries are very serious and can lead to gangrene when left untreated.
Equipment Required	**Cleaning, Purging, Venting or Inerting**
· to be determined, xxxx ft^3/min free air delivery	· install fan intake in an area of clean respirable air and utilize as a supply unit. · position outlet of duct to provide air as close as possible into the zone in which work will occur. This will ensure that the entrant breathes air from the exterior rather than the atmosphere in the space. · begin ventilating at least 5 minutes prior to initial entry to ensure that purging of the atmosphere in the work zone has occurred · given the small access/egress opening, ventilate between entry and enter for only a very brief period · an alternative is to remove two of the pipes and to provide air through these openings
Equipment Required	**Verification & Testing**
· atmosphere testing instrument (Biosystems PhD Lite and Draeger XAM 2000) containing sensors for oxygen, flammable/combustibles, carbon monoxide, hydrogen sulphide · calibration kit · additional instrument containing sensor for nitrogen dioxide when diesel engines are operating. (If one can smell diesel exhaust, one must monitor the exhaust gases.)	· calibrate or bump test the instrument at the beginning of the workshift or immediately before use, per the manufacturer's instructions. Persons calibrating and operating the instrument must have appropriate training. Keep records of calibration and testing. · measure conditions at the top, middle and bottom of the space through which access/egress, and extrication will occur in the event of an emergency or accident by lowering the sampling line. Remember that there is a delay in response as air is pumped into the instrument. · record these readings and readings obtained periodically during work activity · where use of portable equipment powered by small engines is occurring, monitor the surroundings to ensure that exposure is not happening
	· entry and work in the space without respiratory protection for gases can occur only if the following conditions are met: **Entry** — **Work Activity/Alarm Settings** **oxygen:** 20.9 or 21.0% — 20.5 % or greater **flammable/combustibles:** 0 % of LEL — 5 % of LEL or less **carbon monoxide:** 0 ppm — 25 ppm or less **nitrogen dioxide:** 0 ppm — 1.0 ppm or less **hydrogen sulphide:** 0 ppm — 10 ppm or less

	· if these conditions are not met prior to entry, continue ventilating the space for 5 minutes and retest. If these conditions cannot be met, the situation requires reevaluation.
	· the entrant must wear the instrument at all times while in the space, and must vacate in the event that the alarm sounds. If an alarm sounds, the standby shall order the entrant(s) to vacate the space immediately. · at the end of the workshift record all data provided by the instrument (peak, TWA, STEL, occurrence of alarms)
Equipment Required	**Ventilation**
· to be determined, xxxx ft^3/min free air delivery ft^3/min free air delivery	· locate the intake to the supply fan upwind from operating engines and other sources of contamination. Direct exhaust flows away from air intakes. · position the end of supply duct as close as possible to the work zone and support, as necessary, to direct flow from directly above the worker. · given the small access/egress opening, ventilate between entry and enter for only a very brief period · an alternative is to remove two of the pipes and to provide air through these openings
Equipment Required	**Personal Protective Equipment & Other Precautions**
· hard hat, safety glasses + sideshields, hearing protection (muffs or plugs) when noise sources are present, work area clothing, safety boots, protective gloves. Powerwashing requires additional protection (faceshield, industrial raingear, rubber safety boots, waterproof gloves).	· all persons working in the space require personal protective equipment, as specified. Personal protective equipment shall comply with requirements of the respective certifying and testing agencies, CSA (Canadian Standards Association) and ANSI (American National Standards Institute).
· NIOSH-approved half-facepiece respirator containing HEPA filters and acid gas/organic vapour cartridges	· in view of the information available, persons working in the space should wear respiratory protection as a precaution against potential exposure to bacteria and viruses and spores from moulds and odours. Respiratory protection is required during operations that can generate dust from sand. Wet methods greatly reduce the potential for dust generation. Provision of clean respirable air in the work zone by the supply system and atmospheric monitoring are believed sufficient to protect against overexposure to other contaminants. In the event that this strategy does not provide sufficient protection, the situation requires reevaluation.
· GFCIs	·all electrical circuits require Ground Fault Circuit Interrupters (GFCIs)
· sharps kit	· use tongs to handle sharps for disposal in the protected container
Equipment Required	**Personal Hygiene and Decontamination**
· personal eyewash, ANSI-compliant eyewash station	· a personal eyewash bottle must be available in the event of a splash into the face to flush the eyes immediately following contact with irritating substances · flush the eyes for 15 to 20 minutes using the ANSI-compliant unit · seek medical attention
· household bleach (1:20 dilution)	· utilize bleach solution (or similar disinfectant product) for cleaning following exposure to biofilms as part of the initial clean-up. Sewer workers must clean hands, face and exposed skin prior to eating, drinking or smoking.

· soap and water	· thoroughly wash hands, face and all exposed surfaces of skin prior to eating, drinking, or smoking
Equipment Required	**Lifelines, Harnesses & Lifting Equipment**
· harness (dorsal D-ring)	· not applicable
· fall restraint device: winch (Make model)	· not applicable
· retrieval system: tripod or davit arm (Make model) positioned at manhole above the entry ladder	· not applicable
Equipment Required	**Standby Person**
· two-way radio, cellular telephone	· standby person must remain near the access when equipment noise causes difficulty in communication. The standby can assist the entrant with equipment and supplies. The standby must be able to extricate the worker vertically in the event of an emergency or an accident. Standby must have training in monitoring duties, initiating emergency response, operation of retrieval equipment and removal of injured victims using this equipment. · standby must not enter the space
Equipment Required	**Rescue**
· two-way radio, cellular telephone, air horn	· rescue personnel must have training in first aid and CPR · to activate the emergency response, standby person sounds three long blasts on the air horn, as appropriate or contacts the Lifeguards on the two-way radio, indicates the occurrence of the accident and asks the Lifeguard to call 911 to request assistance from FIRE and AMBULANCE and states the exact location and the nature of the problem. · the Lifeguard contacts the Assistant Supervisor, Maintenance and Operations, to inform about the situation · if the instrument in the space is not alarming, and no other hazardous condition has arisen, the rescue person may enter the space to assist the victim; otherwise, use the winch to remove the victim. The standby must not enter the space. · rescue person assesses condition of the victim and determines whether serious injury has occurred and whether serious injury has occurred to the head, neck or back. If serious injury has not occurred and does not involve the head, neck or back, the victim may be assisted to the access and removed from the space. If the preceding conditions cannot be met, the victim is to be packaged for transport.

Sunshine Coast Regional District		**Confined Space Identification and Hazard Assessment**		**Surge Tank**	
Owner: Sunshine Coast Regional District		**Location:** Sechelt Aquatic Centre		**Assessed by:** Neil McManus, CIH, ROH, CSP NorthWest OH&S **Tel:** 604-980-8512 **Date:** 2010-02-10	
underground working?	enclosed or partially enclosed?	designed/ intended for continuous human occupancy?	limited or restricted entry or exit?	large enough and configured for entry to perform work?	**Confined Space?** **Yes** ▲
No	**Yes**	**No**	**Yes**	**Yes**	» All entries **bold**?
Description: vented, cast-in-place, in-floor concrete structure typically 2.0 m by 4.6 m by 3.7 m high. A baffle which Is open at the bottom divides the space into two chambers, occupying about 2/3 and 1/3 of the volume. The opening at the base of the baffle is about 0.6 m high and extends along the length.		**Access/Egress:** hatch typically measuring about 0.9 m square; built-in rungs or extension-type ladder for internal access.		**Contents:** pool water; miscellaneous debris, including band-aids, hair, foam bits, jewellry, lint, plastic finger nails, foam bits, and so on; dead skin; biofilm on wet surfaces, mould possible on wetted and dry surfaces	
		Adjacent Spaces: Pump Room located in the basement		**Equipment:** not applicable	
		Function/Use: collect flow from the gutters resulting from overflow of the main pool caused by entry of people or local disturbance.		**Process:** not applicable	
External Surroundings: storage room		**Downgrading Conditions:** not applicable		**Potential Impact on Work Activity:** not applicable	

Hazard Assessment — Undisturbed/Operational Space

This hazard assessment identifies and discusses hazardous conditions that can develop during operation or quiescent conditions in the space and indicates hazardous conditions requiring correction during entry preparation.

· Atmospheric Hazards

Oxygen Deficiency **Possible**

A biofilm resulting from colonization by microorganisms forms over the passage of time, given the quantity of debris and fine organic material (shed skin flakes, for example) present on interior surfaces in the space. Microbiological activity involving the biofilm could contribute to creating an oxygen-deficient atmosphere.

Rusting of steel surfaces also can deplete oxygen. This situation is likely to pose greatest risk when the space remains undisturbed for a long period of time with minimal airflow.

Humidification of the airspace above the water due to the high temperature (28℃), humidity and mist also create growth conditions. Water vapour evaporating from the surface of the liquid water reduces the concentration of oxygen in the airspace. At 20℃, the partial pressure of water vapour (100% Relative Humidity) is about 18 mm Hg (millimetres of mercury). At this pressure, for a total atmospheric pressure of 760 mm Hg, the combined pressure of oxygen and nitrogen would be 742 mm Hg. The pressure of oxygen, which is 20.9% of the total would be about 155 mm Hg. This corresponds

to a composition of 20.4 % relative to the norm of 20.9 % at normal atmospheric conditions. The legally oxygen-deficient concentration is 19.5 % at normal atmospheric conditions. At 28℃, the partial pressure of water vapour (100% Relative Humidity) is about 28 mm Hg. At this pressure, the combined pressure of oxygen and nitrogen would be 732 mm Hg. The pressure of oxygen would be about 153 mm Hg. This corresponds to a composition of 20.1 % relative to the norm of 20.9 % at normal atmospheric conditions.

Partial filling and emptying of these structures acts like a piston in a cylinder to expel and to entrain air through the vents. The likelihood of oxygen deficiency is reduced because of the movement of air into and out of the space in response to fluctuations in the level of water.

Development of these conditions and the risk of oxygen deficiency is governed by the extent of enclosure of the space, and the period of quiescence between openings. None of the preceding factors is predictable in a particular circumstance to the extent needed to guarantee that an oxygen-deficient condition cannot or will not develop. One statement that is reasonable in these circumstances is that the *status quo,* as created by conditions and ascertained through testing, in the absence of other measures is unlikely to change during occupancy.

Oxygen Enrichment No

Bio/Chemical **Possible**

A biofilm resulting from colonization by microorganisms forms over the passage of time, given the quantity of debris and fine organic material (shed skin flakes, for example) present on interior surfaces in the space. Temperature and humidification of the airspace above the water also create growth conditions. Growth of microorganisms could lead to production of carbon dioxide (aerobic conditions). Partial filling and emptying of these structures acts like a piston in a cylinder to expel and to entrain air through the vents. The likelihood of accumulation of hazardous levels of contaminants is reduced because of the movement of air into and out of the space in response to fluctuations in the level of water.

Pool waters contain low concentrations of hypochlorous acid, hypochlorite ion, and various levels of calcium and sodium ions, and chloride and sulphate and carbonate and bicarbonate ions. These waters may off-gas chloramines and nitrogen trichloride (the source of the ‘swimming pool odour’. Quantities should reflect the level of exposure of users of the pool.

Development of these conditions is governed by the extent of enclosure of the space, the presence of extraneous contents that can undergo aerobic and possibly anaerobic decay and the period of quiescence between openings. None of the preceding factors is predictable in a particular circumstance to the extent needed to guarantee that production and accumulation of these gases cannot or will not occur. One statement that is reasonable in these circumstances is that the *status quo,* as created by conditions and ascertained through testing, in the absence of other measures is unlikely to change during occupancy.

Fire/Explosion No

· Micro/Biological **Possible**

A biofilm resulting from colonization by microorganisms forms over the passage of time, given the quantity of debris and fine organic material (shed skin flakes, for example) present on interior surfaces in the space. Temperature and humidification of the airspace above the water also create growth conditions. Growth of microorganisms could lead to production of spores and cysts. Spores and cysts can cause allergic respiratory symptoms in sensitized individuals. The space also can contain insects and spiders.

· Ingestion/Skin & Eye Contact Hazard **Possible**

A biofilm resulting from colonization by microorganisms forms over the passage of time, given the quantity of debris and fine organic material (shed skin flakes, for example) present on interior surfaces in the space. Temperature and humidification of the airspace above the water also create growth conditions. Contact with surfaces containing growth of microorganisms can cause rashes in sensitized individuals. These spaces also can contain sharps, usually in the form of discarded hypodermic syringes and needles. Hypodermic syringes and needles are potential sources of exposure to HIV and hepatitis viruses. HIV can survive a week outside the body, and hepatitis viruses, up to three months.

· Physical Agents

Noise/Vibration No

Heat/Cold Stress **Possible**

Water temperature in the pool is 28℃. The temperature in the space is about this level accompanied by a high level of humidity. These conditions potentially can cause heat stress in unacclimatized individuals while performing heavy work.

Non/Ionizing Radiation No

Laser No

· Personal Confinement **Yes**

Access/egress requires vertical climb by ladder. Interior is large compared to availability of access. Headroom is not an issue in ths space .A baffle which Is open at the bottom divides the space into two chambers, occupying about 2/3 and 1/3 of the volume. The opening at the base of the baffle is about 0.6 m high and extends along the length.

· Bio/Mechanical Hazard No

· Hydraulic/Pneumatic/Vacuum Hazard **Possible**

This chamber normally fills through the action of users in displacing the water from the main pool. Water inflow is not controllable. There are no valves in the inflow circuit to enable isolation. The structure drains to the pool water circulation circuit. The pool water circulation circuit also receives flow from the main pool drain and leads to the Main Pool Pump. Suction at the drain possibly can prevent escape. Backflow in the circuit from the main pool drain also is possible.

· Process Hazard No

· Safety Hazards

Rundown No

Structural Hazard **Possible**

Deterioration of the structure and rungs of in-place ladders may occur. Failure of a rung or a bracket can lead to fall during descent or ascent of an in-place ladder. This situation can develop only after prolonged exposure to conditions that are corrosive to metal and concrete. Structural integrity requires confirmation by the Owner. This reflects longevity projected in designs of these structures.

Engulfment/Immersion **Yes**

In operation, this structure is partly full of pool water. Drowning of a prone individual can occur in 15 cm of water. Accumulated water will be pumped from the space prior to the start of work.

Entanglement No

Electrical/Electrostatic No

Fall **Yes**

Distance from top of the space to the floor through the access hatch is sufficient to cause serious fall-related injury and exceeds the distance for which fall protection is required.

Slip/Trip **Yes**

Floor of the space may be slippery from growth of microorganisms.

Visibility/Light level **Yes**

Interior of the space has no lighting.

Explosive/Implosive	No
Hot/Cold Surfaces	No

Hazard Assessment - Undisturbed/Operational Space

Hazardous Condition	**Real or Potential Consequence**		
	Low	**Moderate**	**High**
· atmospheric hazards			
oxygen deficiency		x	
oxygen enrichment	NA		
bio/chemical	x		
fire/explosion	NA		
· micro/biological		x	
· ingestion/skin & eye contact		x	
· physical agents			
noise/vibration	NA		
heat/cold stress		x	
non/ionizing radiation	NA		
laser	NA		
· personal confinement		x	
· bio/mechanical hazard	NA		
· hydraulic/pneumatic/vacuum hazard		x	
· process hazard	NA		
· safety hazards			
rundown	NA		
structural		x	
engulfment/immersion			x
entanglement	NA		
electrical/electrostatic	NA		
fall		x	
slip/trip	x		
visibility/light level		x	
explosive/implosive	NA		
hot/cold surfaces	NA		

In this table, toxic substance, oxygen deficiency, oxygen enrichment and flammable or combustible atmosphere derive their meaning from Exposure Limits and standards contained in the Occupational Health and Safety Regulation. **NA** means not applicable.

Action Required

· Drain the space and pump accumulated water from the space prior to entry and work.
· Ventilate the interior of the space prior to entry.
· The Owner is to implement a procedure to deactivate, de-energize, isolate and lock out sources of water that can enter the structure.

Hazard Assessment — Work Tasks in Surge Tank

This hazard assessment refers to entry for the purpose of performing work tasks in surge tanks in swimming pools. These include: water- and powerwashing interior surfaces, and concrete repair. Concrete repair involves chipping and use of epoxy products and cementitious grouts. Setting of concrete anchors involves drilling and use of epoxy products. This hazard assessment considers hazardous conditions posed by the work activity in context with those remaining in the space following preparatory activity.

· Hot Work No

· Atmospheric Hazards

Oxygen Deficiency No

A biofilm resulting from colonization by microorganisms forms over the passage of time, given the quantity of debris and fine organic material (shed skin flakes, for example) present on interior surfaces in the space. Microbiological activity involving the biofilm could contribute to creating an oxygen-deficient atmosphere.

Rusting of steel surfaces also can deplete oxygen. This situation is likely to pose greatest risk when the space remains undisturbed for a long period of time with minimal airflow.

Humidification of the airspace above the water due to the high temperature (28℃), humidity and mist also create growth conditions. Water vapour evaporating from the surface of the liquid water reduces the concentration of oxygen in the airspace. At 20℃, the partial pressure of water vapour (100% Relative Humidity) is about 18 mm Hg (millimetres of mercury). At this pressure, for a total atmospheric pressure of 760 mm Hg, the combined pressure of oxygen and nitrogen would be 742 mm Hg. The pressure of oxygen, which is 20.9% of the total would be about 155 mm Hg. This corresponds to a composition of 20.4 % relative to the norm of 20.9 % at normal atmospheric conditions. The legally oxygen-deficient concentration is 19.5 % at normal atmospheric conditions. At 28℃, the partial pressure of water vapour (100% Relative Humidity) is about 28 mm Hg. At this pressure, the combined pressure of oxygen and nitrogen would be 732 mm Hg. The pressure of oxygen would be about 153 mm Hg. This corresponds to a composition of 20.1 % relative to the norm of 20.9 % at normal atmospheric conditions.

Partial filling and emptying of these structures acts like a piston in a cylinder to expel and to entrain air through the vents. The likelihood of oxygen deficiency is reduced because of the movement of air into and out of the space in response to fluctuations in the level of water.

Draining the water from the interior of the space changes the growth relationship between the organisms involved in the biofilm and can lead to colonization by foreign microorganisms. The likelihood of this depends on time and temperature following drainage. Powerwashing will create mist, a suspension of droplets in the physical volume of the space. The bulk volume of the droplets and evaporation from the surface of the droplets will displace some of the atmosphere, leading to potential oxygen deficiency. The extent to which this action occurs depends on the water pressure required to clean the surfaces. Oxygen depletion can also occur through absorption by the walls of the concrete if left undisturbed for a prolonged period.

The key factor that affects air quality in these spaces is water. Water is essential for corrosion of metals and for the growth of microorganisms. The process of rusting involves chemical reaction of atmospheric oxygen with metal surfaces. The process continues deeper into the metal long after initial rusting of the surface. Microorganisms require oxygen for aerobic growth.

Development of these conditions and the risk of oxygen deficiency is governed by the extent of enclosure of the space, and the period of quiescence between openings. None of the preceding factors is predictable in a particular circumstance to the extent needed to guarantee that an oxygen-deficient condition cannot or will not develop. One statement that is reasonable in these circumstances is that the *status quo,* as created by conditions and ascertained through testing, in the absence of other measures is unlikely to change during occupancy.

Continuous mechanical ventilation and continuous atmospheric testing will occur during this work. The alarm set point for the oxygen sensor is 20.5% not the legal limit of 19.5%. This will ensure that an oxygen-deficient atmosphere cannot develop.

Oxygen Enrichment No

Bio/Chemical **Possible**

A biofilm resulting from colonization by microorganisms forms over the passage of time, given the quantity of debris and

fine organic material (shed skin flakes, for example) present on interior surfaces in the space. Temperature and humidification of the airspace above the water also create growth conditions. Growth of microorganisms could lead to production of carbon dioxide (aerobic conditions). Partial filling and emptying of these structures acts like a piston in a cylinder to expel and to entrain air through the vents. The likelihood of accumulation of hazardous levels of contaminants is reduced because of the movement of air into and out of the space in response to fluctuations in the level of water.

Pool waters contain low concentrations of hypochlorous acid, hypochlorite ion, and various levels of calcium and sodium ions, and chloride and sulphate and carbonate and bicarbonate ions. These waters may off-gas chloramines and nitrogen trichloride (the source of the 'swimming pool odour'. Quantities should reflect the level of exposure of users of the pool.

Draining the water from the interior of the space changes the growth relationship of the organisms involved in the biofilm and can lead to colonization by foreign microorganisms. The likelihood of this depends on time and temperature following drainage. Increased growth will increase the rate of production of carbon dioxide. During shutdown conditions, these structures become similar to structures otherwise only partly filled with water. New growth resulting from colonization by fungi will also occur on residual material and surfaces. Fungi also produce carbon dioxide. The level of emission of carbon dioxide currently is unknown.

The key factor that affects air quality in these spaces is water. Water is essential for the growth of microorganisms. Development of these conditions is governed by the extent of enclosure of the space, the presence of extraneous contents that can undergo aerobic and possibly anaerobic decay and the period of quiescence between openings. None of the preceding factors is predictable in a particular circumstance to the extent needed to guarantee that production and accumulation of these gases cannot or will not develop. One statement that is reasonable in these circumstances is that the *status quo,* as created by conditions and ascertained through testing, in the absence of other measures is unlikely to change during occupancy.

Exhaust from vehicles and mobile equipment can enter the work space under conditions related to cold weather or inappropriate placement of equipment, and can cause needless exposure. This is especially probable where the geometry of structures prevents dispersion. Exhaust from gasoline engines contains carbon monoxide (CO), carbon dioxide (CO_2), unburned fuel vapour and particulates. Exhaust from vehicles is less of a problem at this time due to use of catalytic converters in the exhaust system. Small engines used in generator sets, pumps, powerwashers, and other small portable units are major sources of exposure to exhaust, especially where the geometry of structures prevents dispersion.

Exhaust from diesel engines contains nitric oxide (NO), nitrogen dioxide (NO_2), unburned fuel vapour and particulates. Exhaust from the diesel engine of trucks is often directed horizontally at ground level. In cool or cold weather, vertically directed exhaust will cool rapidly and stratify in a layer just above the top of the truck. Descent to ground level is possible. In confining geometries, accumulation could pose a serious exposure risk.

Combustion gases discharged from propane-fuelled air heaters used in cold weather conditions are sources of carbon dioxide and possibly carbon monoxide. Under cool or cold conditions, these gases do not disperse and can be entrained into the air provided by portable ventilation systems.

Abrasive blasting to remove coatings is a source of exposure to dust from the coating and from the blast medium. Refer to the Material Safety Data Sheets for both products for further information. WorkSafeBC lists respirable quartz as an ALARA substance to which exposure is to be kept as low as reasonably achievable. This involves use of wet methods and dust collection.

Abrasive blasting using dry ice (solid carbon dioxide) is a source of exposure to carbon dioxide gas. Such applications require careful scrutiny by an individual well qualified and experienced in the practice of occupational hygiene.

Spraypainting in large structures can lead to high concentrations of solvent vapours and the solids present in the paint formulation. The coated surface plus each airborne droplet is a potential source of evaporation of solvent into the air. Such applications require careful scrutiny by an individual well qualified and experienced in the practice of occupational hygiene and safety.

Dry drilling, chipping or coring of concrete can evolve quartz (a form of crystalline silica) in respirable form. WorkSafeBC lists respirable quartz as an ALARA substance to which exposure is to be kept as low as reasonably achievable. This involves use of wet methods and dust collection.

Concrete, grout products, cement, and brick contain quartz, a form of crystalline silica. Chipping and drilling can create airborne dust and exposure to silica. These tasks are short in duration relative to the length of the work day. Quartz in the respirable form is an ALARA substance to which WorkSafeBC requires exposure to be maintained as low as reasonably achievable. Dust suppression using wet methods and dust collection are required. Refer to the Material Safety Data Sheet for further information.

Epoxies are sources of exposure to solvent vapour, and vapour from unreacted components. Refer to the Material Safety Data Sheets for these products for further information. Crack filling involving large quantities of epoxy could generate sufficient vapour to pose an exposure risk.

Continuous mechanical ventilation and continuous atmospheric testing will occur during this work.

Fire/Explosion **Possible**

Abrasive blasting using agricultural by-products, such as corn husks and walnut shells can create high concentrations of dust in poorly ventilated situations. Similar considerations apply to dust from paint resins made airborne during abrasive blasting. Determination of dust concentration in such circumstances is very difficult. The ‘rule of thumb’ in such circumstances is that the inability to see an operating light bulb at a distance of 1.8 m (5 ft) indicates a potential explosible atmosphere of dust. (Refer to the section on electrical considerations.)

Spraypainting in large structures can lead to high concentrations of solvent vapours and the solids present in the paint formulation. The coated surface plus each airborne droplet are potential sources of evaporation of solvent into the air. Such applications require careful scrutiny by an individual well qualified and experienced in the practice of occupational hygiene and safety.

· Micro/Biological **Possible**

A biofilm resulting from colonization by microorganisms forms over the passage of time, given the quantity of debris and fine organic material (shed skin flakes, for example) present on interior surfaces in the space. Temperature and humidification of the airspace above the water also create growth conditions. Growth of microorganisms could lead to production of spores and cysts. Spores and cysts can cause allergic respiratory symptoms in sensitized individuals. The space also can contain insects and spiders..

Draining the water from the interior of the space changes the growth relationship of the organisms involved in the biofilm and can lead to colonization by foreign microorganisms. The likelihood of this depends on time and temperature following drainage.

Break-up of the biofilm by powerwashing creates airborne droplets containing viable microorganisms. These could include bacteria, yeasts, amoeba, and *Cryptosporidium*, among others. Inhalation of airborne spores and cysts and viable microorganisms could cause disease and allergic respiratory reactions in sensitized individuals.

Continuous mechanical ventilation will occur during this work. Turbulence created by the ventilation system could aerosolize spores contained in the structure.

· Ingestion/Skin & Eye Contact Hazard **Possible**

A biofilm resulting from colonization by microorganisms forms over the passage of time, given the quantity of debris and fine organic material (shed skin flakes, for example) present on interior surfaces in the space. Temperature and humidification of the airspace above the water also create growth conditions. Contact with surfaces containing growth of microorganisms can cause rashes in sensitized individuals. These spaces also can contain sharps, usually in the form of discarded hypodermic syringes and needles. Hypodermic syringes and needles are potential sources of exposure to HIV and hepatitis viruses. HIV can survive a week outside the body, and hepatitis viruses, up to three months.

Concrete patching products and grouts are skin and severe eye irritants and are capable of causing chemical burns to the cornea. Refer to the Material Safety Data Sheet for further information.

Epoxy products are allergic sensitizers. Sensitization can occur through skin contact. Epoxy resin systems often are packaged in tubes with built-in mixing chambers. These minimize potential for skin contact. Refer to the Material Safety Data Sheet for these products for further information

· Physical Agents

Noise/Vibration **Possible**

Spraying using high pressure equipment, and concrete chipping, grinding, and sawing can create high levels of noise. This is exacerbated by reflection off the surfaces of the space. Noise produced by portable electrical and pneumatic tools can exceed regulatory limits.

Heat/Cold Stress **Yes**

Water temperature in the pool is 28℃. The temperature in the space is about this level accompanied by a high level of humidity. These conditions potentially can cause heat stress in unacclimatized individuals while performing heavy work. Wearing of impervious suits during powerwashing exacerbates the problem fo heat stress. The fabric of the suit traps inside heat and moisture produced by the body during the work.

Non/Ionizing Radiation No

Laser No

· Personal Confinement **Yes**

Access/egress requires vertical climb by ladder. Interior is large compared to availability of access. Headroom is not an issue in ths space. A baffle which Is open at the bottom divides the space into two chambers, occupying about 2/3 and 1/3 of the volume. The opening at the base of the baffle is about 0.6 m high and extends along the length.

· Bio/Mechanical Hazard **Possible**

Mechanical equipment used for chipping, grinding and sawing poses an injury risk from striking and entangling.

· Hydraulic/Pneumatic/Vacuum Hazard **Possible**

This chamber normally fills through the action of users in displacing the water from the main pool. Water inflow is not controllable. There are no valves in the inflow circuit to enable isolation. The structure drains to the pool water circulation circuit. The pool water circulation circuit also receives flow from the main pool drain and leads to the Main Pool Pump. Suction at the drain possibly can prevent escape. Backflow in the circuit from the main pool drain also is possible.

Powerwashing poses an injection hazard (up to 5000 lb/in^2). Fluid injected into the tissues in this manner follows an unpredictable path. This path can damage tissues under the skin. This kind of injury requires prompt attention from an experienced medical practitioner, as there is a risk of gangrene and loss of the limb. The risk of gangrene is related to the delay in receiving proper medical attention.

Vacuuming using high vacuum equipment poses a suction hazard. Some vacuum systems operate at -27 inches of mercury vacuum (-90 kPa). Systems creating high vacuum are capable of causing severe traumatic injury.

· Process Hazard No

· Safety Hazards

Rundown No

Structural Hazard **Possible**

Deterioration of the structure and rungs of in-place ladders may occur. Failure of a rung or a bracket can lead to fall during

descent or ascent of an in-place ladder. This situation can develop only after prolonged exposure to conditions that are corrosive to metal and concrete. Structural integrity requires confirmation by the Owner. This reflects longevity projected in designs of these structures. Fall protection will be used, as deemed appropriate.

Engulfment/Immersion **Possible**

In operation, this structure is partly full of pool water. Drowning of a prone individual can occur in 15 cm of water. Accumulated water will be pumped from the space prior to the start of work.

Residual liquid will be drained prior to entry. Work will occur when inflow from pool gutters cannot occur. Isolation valves will be closed securely and locked out. Catastrophic failure of valves would lead to entry of a jet of water into one corner of the space. This should not hinder evacuation Catastrophic failure is highly unlikely to occur, given criteria used by design engineers in selection of components and adherence of components to standards of performance that recognize conditions to which components are subjected during service of long duration. Entry into a space containing water of sufficient depth to cause drowning is not permitted.

A fall protection/work positioning system will be used where immersion in water is possible.

Entanglement **Possible**

A baffle which Is open at the bottom divides the space into two chambers, occupying about 2/3 and 1/3 of the volume. The opening at the base of the baffle is about 0.6 m high and extends along the length. This situation considerably complicates the use of lifelines and continuous tethering.

Electrical/Electrostatic **Possible**

Portable electrical equipment used in the space containing faulty, deteriorated or inappropriate components or wiring poses an electrocution risk.

Fall No

Distance from top of the space to the floor through the access hatch is sufficient to cause serious fall-related injury and exceeds the distance for which fall protection is required. Fall protection will be used, as deemed appropriate.

Slip/Trip **Yes**

Floor of the space is slippery from growth of microorganisms.

Visibility/Light level No

Interior of the space has no lighting. Supplemental lighting will be used, as needed. Lighting is satisfactory when one can read this document unaided.

Explosive/Implosive No

Hot/Cold Surfaces No

Hazard Assessment — Work Tasks in The Surge Tank

Hazardous Condition	**Real or Potential Consequence**		
	Low	**Moderate**	**High**
· hot work	NA		
· atmospheric hazards			
oxygen deficiency	NA		
oxygen enrichment	NA		
bio/chemical		x	
fire/explosion	x		
· micro/biological		x	

· ingestion/skin & eye contact		x
· physical agents		
noise/vibration		x
heat/cold stress		x
non/ionizing radiation	NA	
laser	NA	
· personal confinement		x
· bio/mechanical hazard		x
· hydraulic/pneumatic/vacuum hazard		x
· process hazard	NA	
· safety hazards		
rundown	NA	
structural	x	
engulfment/immersion	x	
entanglement		x
electrical/electrostatic		x
fall	NA	
slip/trip	x	
visibility/light level	NA	
explosive/implosive	NA	
hot/cold surfaces	NA	

In this table, toxic substance, oxygen deficiency, oxygen enrichment and flammable or combustible atmosphere derive their meaning from Exposure Limits and standards contained in the Occupational Health and Safety Regulation. **NA** means not applicable.

Action Required

· Refer to procedure for entry and work in this space.

Sunshine Coast Regional District	**First Aid Assessment**	**Surge Tank**
Owner: Sunshine Coast Regional District	**Work Location:** Sechelt Aquatic Centre 5500 Shorncliffe AVE, Sechelt, BC	**Assessed by:** Neil McManus, CIH, ROH, CSP NorthWest OH&S **Tel:** 604-980-8512 **Date:** 2010-02-10
Project: inspection, powerwashing concrete repair of structures, and valve repair and replacement	**Number of Workers:** 2 to 3	
Work Activity:	**Probable Incident/Accident:**	**Probable Injury:**
· lifting and moving tools, equipment, supplies	· slip, trip, fall, overexertion, fall from ladder	· broken bones, soft tissue injury
· powerwashing	· slip, trip, overexertion, suction injury involving vacuum system, foreign object in the eye	· soft tissue injury, muscle strain, back injury, broken bones, corneal scratch
· concrete drilling	· dust and material in the eye, skin contact with hot surface, overexposure to noise	· soft tissue injury, muscle strain, back injury, temporary hearing loss
· grout patching	· material in the eye or on the skin	· chemical burn in the eye, eye injury, skin burn
· epoxy handling and application	· material in the eye or on the skin	· chemical burn in the eye, eye injury, skin irritation
Workplace Hazard Rating: high risk (This rating applies to all accidents occurring in the industry and not to the specifics of this situation.)	**Types of Work Activity/Accidents:** typical of industry; refer to hazard assessment	**Types of Injury:** typical of industry; some types require hospital treatment
Rating Modification Factors: none anticipated	**FAA Required**: one, Level 1 minimum	**FAA Selected**:
Site Access Issues:	**Nearest Hospital:** St. Mary's Hospital, Sechelt (all emergencies)	**Alternate Hospital:** Sechelt Medical Clinic
	Route to Hospital: Shorncliffe Ave to Cowrie ST. Left onto Cowrie ST to HYW 101. Follow HYW 101 South to St Mary's Hospital	**Route to Clinic:** Shorncliffe Ave to Cowrie ST. Right onto Cowrie ST. Follow Cowrie ST to Inlet AVE. Left onto Inlet AVE. Follow Inlet AVE to Sechelt Medical Clinic located at 5531 Inlet AVE.
External Emergency Response: FIRE	**Estimated Distance:** 2 km	**Estimated Distance:** 1.5 km

and AMBULANCE through 911 service	**Estimated Travel Time:** 5 min	**Estimated Travel Time:** 3 min
Transportation: BC Ambulance Service, company vehicle, taxi, industrial ambulance; airlift possibly required	**Transportation Issues:** winter weather	**Transportation Issues:** winter weather
Implementation		
Name: Ken Robinson	**Title:** Facilities Operation Supervisor	**Date:** 2010-02-10
Comments: · Refer to the overall OH&S program. · for each location, provide a map indicating the address and route to the Hospital and nearest alternate medical services and emergency telephone numbers. · ensure that alternate medical services are equipped and amenable to providing assistance.		

Sunshine Coast Regional District	**Fluid/Material Flow Assessment**	**Surge Tank**
Location: Sechelt Aquatic Centre	**Equipment:** valves, components, and piping associated with pool water circuits	**Assessed by:** Neil McManus, CIH, ROH, CSP NorthWest OH&S **Tel:** 604-980-8512 **Date:** 2010-02-10
Description of Equipment/Operation: The pool water circulation circuit receives flow from the Surge Tank and the drain at he bottom of the main pool. A float valve located in the Surge Tank signals a servo mechanism to control the relative proportion of flow from each contributor. Combined flow passes to the Main Pool Pump and the Main Pool Sand Filter prior to redistribution.		
Hierarchy of Energy/Fluid Inputs	**Conversion Energy Output**	**Equipment/System Affected**
electrical pump	mechanical fluid pressure	pump motor/pump pool water, fluid transfer system
Main Pool Circulation Pump (P001)		
Input: .BC Hydro (600 V) to Main Circuit Breaker to P001 Disconnect to P001 Control Switch	**Storage:** not applicable	**Dissipation/Purge:** not applicable
	Output: conversion to mechanical energy (rotation)	**Immobilization/Isolation:** not applicable
Electrical Isolation Strategy: deactivate, de-energize, isolate and lock out the control circuit and the power actuation circuit. An open switch or disconnect at these voltages contains an air gap of 12 mm or more. An air gap of 10 mm provides protection against flash-over due to air ionization up to 30,000 V.		
Failure/Consequence Analysis: Failure or deliberate defeat of the isolation could lead to activation of the pump motor or electrocution during contact with energized conductors. Failure of the isolation most likely would result from failure of opening of the switch or disconnect or from flash-over. These are rare events. Failure of opening of the switch or disconnect should be detectable from the verification step.		
Primary Deactivation: P001 Control Switch	**Secondary Deactivation:** P001 Disconnect	**Tertiary Deactivation:**
Location: Control Cabinet located in the Pump Room	**Location:** Control Cabinet located in the Pump Room	**Location:**
Action: move P001 Control Switch to the OFF position	**Action:** move P001 Disconnect to the OFF position; apply keyed padlock and tag.	**Action:** .
Energy Isolation: no, unless retrofitted	**Energy Isolation:** yes	**Energy Isolation:**

Main Pool Circulation Pump Electrical Isolation Procedure:
· move P001 Control Switch in the Control Cabinet located in the Pump Room to the OFF position.
· move P001 Disconnect in the Control Cabinet located in the Pump Room to the OFF position.
· apply keyed padlock and tag when loss of exclusive control can occur

Verification Test Procedure:
· attempt to restart the pump by rotating the P001 Control Switch to the HAND position. Return to OFF position.
Or
· use voltmeter to test electrical circuit.

Notes:
· gradual motion in the movement of valve components minimizes the potential for water hammer.
· switches and disconnects require unique, consistent identification
· exclusive control means that the individual who isolates the circuit will perform or directly supervise the work of others on the circuit and will remain constantly on the job site and in exclusive control of the isolated circuit.
· loss of exclusive control means that the individual who has control of the isolated circuit leaves the work area

Main Pool Circulation Circuit

Fluid/Material Flow Isolation Strategy: isolate the Main Pool Circulation Circuit using the isolation valves and depressurize the circuit using the bleed valve. Prevent entry of swimmers into the pool during this work. Isolate the Main Pool Make-up Water Circuit using the isolation valves to prevent entry of water into the Surge Tank.

System Operating Pressure	Rated Working Pressure	Residual Pressure	Performance Standard(s)	Allowable Leakage

Failure/Consequence Analysis: Failure or deliberate defeat of the isolation could lead to:
· inflow of water into the Surge Tank. Inflow of water into the Surge Tank from the pool due to displacement could occur only if people or objects cf similar dimensions were to enter the pool. This situation reflects the normal intended function of the Surge Tank, namely to receive water displaced by these objects. This situation is controllable through strict prohibition of use of the pool during work in the Surge Tank following drainage. Inflow from this source cannot occur otherwise. In the event that inflow does occur, the rate of inflow is sufficiently low enough to enable evacuation to occur. Design value for a person for this pool was 28 L.

· inflow of water into the Surge Tank also can occur from operation of the pool make-up water system. Lockout and isolation of the make-up water system prevents entry of make-up water. The rate of entry of water by this route in the event of failure is sufficiently low enough to enable evacuation to occur.

· inflow of pool water into the Pump Room from the Surge Tank or from the drain at the bottom of the pool or from the line leading from the Main Pool Circulating Pump to the Main Filter. Inflow under the former condition could lead to partial flooding of the Pump Room. Inflow under the latter condition would be minor and involve the contents of the rising and elevated portion of the line that connects to the Main Pool Filter. There is no credible reason for occurrence of these events associated with this isolation.

Inflow could occur due to exterior leakage from the stem of a valve or interior leakage from the flange used to attach adjacent components or outright catastrophic failure of the valve. Catastrophic failure ranges from crackage of the body of the valve to outright rupture of the casing.

Leakage from the stem of a valve is slow and readily visible. During work activity, this situation would provide considerable warning to workers occupying the space. Leakage from the flange of the isolated line occurs due to leakage at the seat. The seat forms the seal between internal moveable parts of the valve and the body of the valve. Leakage from the flange of a valve due to leakage at the seat also is slow and is readily visible. Leakage at the flange also could occur due to catastrophic failure of the geometric relationship between the seat and the movable part or catastrophic failure of either the seat or the movable part. In either case the body of the valve would remain intact, as would attachments to piping at the flanges. The latter would constrain flow should this occur at the time of disassembly. During work activity, these occurrences would provide considerable warning to workers about the need to take emergency action.

External catastrophic failure involving cracking of the body of a valve is also possible. This would lead to leakage at a rate beyond that experienced due to leakage at the stem and potentially is about the same as that experienced at the flange due to internal catastrophic failure. Leakage from a valve that has failed catastrophically is rapid compared to leakage by the other routes. Outright failure of the body of a valve involving splitting open is possible, but is a very rare event. In the event that outright failure of the body of the valve was to occur, rapid release of water into the space at the pressure created by the head in the Surge Tank likely would occur. Maximum head is about 2.5 m and head pressure is about 3.6 lb/in^2 (25 kPa). Outright failure of the body of the valve also could lead to ejection of projectiles. Outright failure of the body of a valve is a very rare and very unlikely event.

Valves specified by design engineers are used at a fraction of maximum service pressure. Standard engineering consideration for failure pressure is a factor of 4 to 6 beyond maximum service pressure. Hence, actual operating pressure usually is a small fraction of the failure pressure. This consideration in design accommodates for the many unknowns associated with the operation of valves in real-world environments.

Metal valves are subject to corrosion from within and without, and erosion from within. They have internal and external coatings in an attempt to minimize the impact of the internal and external environments. Plastic valves are subject to embrittlement caused by attack by ozone and other incompatible substances. The experience of valve manufacturers and valve users is extremely important in assisting in the assessment of the long-term impact of conditions on the longevity of these products. This experience is even more critical where single valve isolation is the norm in design and installation. This applies to maintaining the reliability of the pool water circulation system, as well as the safety of workers who work with this equipment. Regarding reliability, the unexpected failure of valves in service would indicate that reliability is an issue that deserves consideration. This consideration would impact requirements for maintenance and for replacement. Requirements for replacement indicate acknowledgment of the accepted longevity for a product in service.

Newly manufactured valves meet requirements in various standards and are subject to hydrostatic testing to ensure that leakage does not occur.

<table>
<tr><td rowspan="2">Input:
· pool water from the Surge Tank to the Outflow Isolation Valve, V003, and pool water from the main drain to the Outflow Isolation Valve, V002, to the Upstream Main Pool Circulation Pump Isolation Valve, V004, to the Main Pool Circulation Pump to the Downstream Main Circulation Pump Isolation Valve, V005 to the Main Filter Isolation Valves, V006 and V008
· municipal water supply to the Surge Tank</td><td>Storage: storage does not occur during normal operation; storage at operating pressure can occur in the isolated circuit of the pump string; pool water in the Surge Tank creates pressure in the input pipe string (about 2.8 lb/in^2 or 20 kPa) when not emptied prior to isolation</td><td>Dissipation/Purge: slowly and carefully open the bleed valve in the body of the strainer to depressurize the isolated circuit</td></tr>
<tr><td>Output: water flow</td><td>Immobilization/Isolation: isolation of pool make-up water system (Auto-Fill Valves, V075 and V076 and Manual Fill Valve, V074) required when work occurs in the Surge Tank</td></tr>
<tr><td>Primary /Isolation: Surge Tank to the Outflow Isolation Valve, V003, and pool water from the main drain to the Outflow Isolation Valve, V002, to the Upstream Main Pool Circulation Pump Isolation Valve, V004, to the Main Pool Circulation Pump to the check valve to the Downstream Main Circulation Pump Isolation Valve, V005 to the Main Filter Isolation Valves, V006 and V008</td><td>Secondary Isolation: municipal water supply to the Surge Tank</td><td>Tertiary Isolation:</td></tr>
<tr><td>Location: Pump Room</td><td>Location: Pump Room</td><td>Location:</td></tr>
<tr><td>Action: refer to main procedure</td><td>Action: move Auto-Fill Valves, V075 and V076, and Manual Fill Valve, V074 to the CLOSED position; apply keyed padlock and tag</td><td>Action:</td></tr>
<tr><td>Energy Isolation: yes, using lockout devices and keyed padlocks and tags</td><td>Energy Isolation:</td><td>Energy Isolation:</td></tr>
</table>

Main Pool Circulation Circuit Isolation Procedure:

Main Actions

· perform the Main Pool Circulation Pump electrical isolation procedure before beginning this procedure.

· prior to starting, inspect the component strings carefully to ensure that they are intact and structurally sound and unlikely to experience catastrophic failure while under pressure as a result of this work.

· if there is any doubt about the structural integrity of the components or piping system during or as a result of this work, do not proceed until this issue is resolved

· move Downstream Main Pool Circulation Pump Isolation Valve, V005, located in the Pump Room to the CLOSED position.

· apply lockout device and keyed padlock and tag when loss of exclusive control can occur.

· move Upstream Main Pool Circulation Pump Isolation Valve, V004, located in the Pump Room to the CLOSED position.

· apply lockout device and keyed padlock and tag when loss of exclusive control can occur.

· move Auto-Fill Valves, V075 and V076, and Manual Fill Valve, V074, located in the Pump Room to the CLOSED position.

· apply lockout device and keyed padlock and tag when loss of exclusive control can occur

· slowly move the Drain Valve in the Main Pool Circulation Strainer to the OPEN position to remove pressure retained in the component string. Avoid contact with the jet of water.

Contingency Actions

· if V004 leaks, move Surge Tank Discharge Valve, V003, located in the Pump Room to the CLOSED position.

· apply lockout device and keyed padlock and tag when loss of exclusive control can occur.

· if V004 leaks, move Main Pool Drain Discharge Valve, V002, located in the Pump Room to the CLOSED position.

· apply lockout device and keyed padlock and tag when loss of exclusive control can occur.

· if V005 leaks, move Main Filter Isolation Valves, V006 and V008, to the CLOSED position.

· apply lockout device and keyed padlock and tag.

Verification Test Procedure:

· observe the continuing flow of water from the bleed valve. If water flow does not cease, the isolation is not successful.

Notes:

· gradual motion in the movement of valve components minimizes the potential for water hammer.

· valves require unique, consistent identification

· exclusive control means that the individual who isolates the component string will perform or directly supervise the work of others on the component string and will remain constantly on the job site and in exclusive control of the component string.

· loss of exclusive control means that the individual who has control of the isolated component string leaves the work area

· a high pressure jet of fluid can cause injection injury. Injection injuries are very serious and can lead to gangrene when left untreated.

Energy Hazard Assessment

System	**Real or Potential Consequence**		
	Low	**Moderate**	**High**
· Main Pool Circulation Pump		x	
· Main Pool Circulation Circuit	x		

In this table, **NA** means that the category does not apply in any normally foreseeable situation. **Low** means that exposure is readily identifiable, but believed to be much less than applicable limits or that exposure to nonquantifiable hazardous conditions is unlikely to produce injury. **Low-Moderate** means that exceedence of regulatory limits is believed possible or that nonquantifiable exposure could produce minor injury requiring self-administered treatment. Control measures or protective equipment should be considered. **Moderate** means that exposure is believed capable of exceeding regulatory limits or causing traumatic injury requiring first aid treatment or attention by a physician. Protective equipment or other control measures are necessary. **Moderate-High** means that exposure is believed capable of considerable exceedence of regulatory limits or causing serious traumatic injury. Advanced control measures or protective equipment are required. **High** means that short-term exposure is believed capable of causing irreversible injury, including death. Advanced control measures or protective equipment are required.

Sunshine Coast Regional District	Confined Space Procedure	Work Tasks in the Surge Tank
Permit Required: Yes At time of entry the atmosphere is expected to be low hazard and not to exceed moderate hazard during work activity. Space can contain a potential immersion hazard requiring pump-out. Isolation of the space from pool water inflow is not possible due to the absence of isolation valves. Water inflow occurs only following displacement of pool water by users.	**Pgm Admin:** Ken Robinson **Tel:** 604-885-6822 **Cell/Pgr:** 604-989-1185 **Site Contact:** Daryl Lowey **Tel:** 604-885-6822 **Cell/Pgr:** 604-741-3680	**Prepared by:** N. McManus, CIH, ROH, CSP NorthWest OH&S **Date:** 2010-02-10 **Tel:** 604-980-8512

Equipment Required	**Co-ordination of Work Activities**
	Note: · perform this work only when inflow into the Surge Tank cannot occur. Inflow cannot occur when the pool is unoccupied and when make-up water cannot enter the pool · this procedure is not intended to cover abrasive blasting and spray application of coatings
	Contractors:
· two-way radio, cellular telephone	· on arriving at the site, contact the Pool Operator to establish reliability of communication. Reliable communication may not exist in some areas.
· operating vehicles and fuel-powered equipment	· keep operating vehicles and fuel-powered portable equipment at least 10 m downwind from the entry to the space and intake of ventilating equipment to prevent entry of exhaust gases.
· exhaust hose	· install exhaust hose to divert flow up the side of the truck to discharge above the roof when the engine continues to operate
	Operators:
· two-way radio, cellular telephone	· on arriving at the site, contact the Pool Operator to establish reliability of communication. Reliable communication may not exist in some areas.
	· keep operating vehicles and fuel-powered portable equipment at least 10 m downwind from the entry to the space and intake of ventilating equipment to prevent entry of exhaust gases.
· exhaust hose	· install exhaust hose to divert flow up the side of the truck to discharge above the roof when the engine continues to operate
· primary barriers	· erect primary barriers around openings to the space when unoccupied to prevent falls
· secondary barricades, barrier tape, warning signs	· as needed to keep bystanders and traffic away from the area while work is occurring, erect secondary barriers
	· at the end of the work or the workshift, replace the manhole cover

Equipment Required	**Isolation & Lockout**
	.· the Owner is to prepare and implement a procedure for deactivating, de-energizing, isolating and locking out equipment and fluid circuits that could influence the safety of the entry and work

	Main Pool Circulation Pump Electrical Isolation Procedure: · move P001 Control Switch in the Control Cabinet located in the Pump Room to the OFF position. · move P001 Disconnect in the Control Cabinet located in the Pump Room to the OFF position. · apply keyed padlock and tag when loss of exclusive control can occur.
	Verification Test Procedure: · attempt to restart the pump by rotating the P001 Control Switch to the HAND position. Return to OFF position. Or · use voltmeter to test electrical circuit. **Notes:** · switches and disconnects require unique, consistent identification · exclusive control means that the individual who isolates the circuit will perform or directly supervise the work of others on the circuit and will remain constantly on the job site and in exclusive control of the isolated circuit. · loss of exclusive control means that the individual who has control of the isolated circuit leaves the work area
· lockout device, keyed padlock, tag · lockout device, keyed padlock, tag · lockout device, keyed padlock, tag	**Main Pool Circulation Circuit Isolation Procedure:** Main Actions · perform the Main Pool Circulation Pump electrical isolation procedure before beginning this procedure. · prior to starting, inspect the component strings carefully to ensure that they are intact and structurally sound and unlikely to experience catastrophic failure while under pressure as a result of this work. · if there is any doubt about the structural integrity of the components or piping system during or as a result of this work, do not proceed until this issue is resolved · move Downstream Main Pool Circulation Pump Isolation Valve, V005, located in the Pump Room to the CLOSED position. · apply lockout device and keyed padlock and tag when loss of exclusive control can occur. · move Upstream Main Pool Circulation Pump Isolation Valve, V004, located in the Pump Room to the CLOSED position. · apply lockout device and keyed padlock and tag when loss of exclusive control can occur. · move Auto-Fill Valves, V075 and V076, and Manual Fill Valve, V074, located in the Pump Room to the CLOSED position. · apply lockout device and keyed padlock and tag when loss of exclusive control can occur · slowly move the Drain Valve in the Main Pool Circulation Strainer to the OPEN position to remove pressure retained in the component string. Avoid contact with the jet of water.

· lockout device, keyed padlock, tag · lockout device, keyed padlock, tag · lockout device, keyed padlock, tag	Contingency Actions · if V004 leaks, move Surge Tank Discharge Valve, V003, located in the Pump Room to the CLOSED position. · apply lockout device and keyed padlock and tag when loss of exclusive control can occur. · if V004 leaks, move Main Pool Drain Discharge Valve, V002, located in the Pump Room to the CLOSED position. · apply lockout device and keyed padlock and tag when loss of exclusive control can occur. · if V005 leaks, move Main Filter Isolation Valves, V006 and V008, to the CLOSED position. · apply lockout device and keyed padlock and tag.
	Verification Test Procedure: · observe the continuing flow of water from the bleed valve. If water flow does not cease, the isolation is not successful. **Notes:** · gradual motion in the movement of valve components minimizes the potential for water hammer. · valves require unique, consistent identification · exclusive control means that the individual who isolates the component string will perform or directly supervise the work of others on the component string and will remain constantly on the job site and in exclusive control of the component string. · loss of exclusive control means that the individual who has control of the isolated component string leaves the work area · a high pressure jet of fluid can cause injection injury. Injection injuries are very serious and can lead to gangrene when left untreated.
Equipment Required	**Cleaning, Purging, Venting or Inerting**
· to be determined, xxxx ft^3/min free air delivery · garden sprayer	· install fan intake in an area of clean respirable air and utilize as a supply unit. · position outlet of duct to provide air as close as possible into the zone in which work will occur. This will ensure that the entrant breathes air from the exterior rather than the atmosphere in the space. · begin ventilating at least 5 minutes prior to initial entry to ensure that purging of the atmosphere in the work zone has occurred · keep concrete wet when chipping or drilling to suppress dust generation
Equipment Required	**Verification & Testing**
· atmosphere testing instrument (Biosystems PhD Lite and Draeger XAM 2000) containing sensors for oxygen, flammable/combustibles, carbon monoxide, hydrogen sulphide · calibration kit · additional instrument containing sensor for nitrogen dioxide when diesel engines are operating. (If one can smell diesel exhaust, one must monitor the exhaust gases.)	· calibrate or bump test the instrument at the beginning of the workshift or immediately before use, per the manufacturer's instructions. Persons calibrating and operating the instrument must have appropriate training. Keep records of calibration and testing. · measure conditions at the top, middle and bottom of the space through which access/egress, and extrication will occur in the event of an emergency or accident by lowering the sampling line. Remember that there is a delay in response as air is pumped into the instrument. · record these readings and readings obtained periodically during work activity · where use of portable equipment powered by small engines is occurring, monitor the surroundings to ensure that exposure is not happening

	· entry and work in the space without respiratory protection for gases can occur only if the following conditions are met: **Entry** **Work Activity/Alarm Settings** **oxygen:** 20.9 or 21.0% 20.5 % or greater **flammable/combustibles:** 0 % of LEL 5 % of LEL or less **carbon monoxide:** 0 ppm 25 ppm or less **nitrogen dioxide:** 0 ppm 1.0 ppm or less **hydrogen sulphide:** 0 ppm 10 ppm or less
	· if these conditions are not met prior to entry, continue ventilating the space for 5 minutes and retest. If these conditions cannot be met, the situation requires reevaluation.
	· the entrant must wear the instrument at all times while in the space, and must vacate in the event that the alarm sounds. If an alarm sounds, the standby shall order the entrant(s) to vacate the space immediately. · at the end of the workshift record all data provided by the instrument (peak, TWA, STEL, occurrence of alarms)
Equipment Required	**Ventilation**
· to be determined, xxxx ft^3/min free air delivery ft^3/min free air delivery	· locate the intake to the supply fan upwind from operating engines and other sources of contamination. Direct exhaust flows away from air intakes. · position the end of supply duct as close as possible to the work zone and support, as necessary, to direct flow from directly above the worker.
Equipment Required	**Personal Protective Equipment & Other Precautions**
· hard hat, safety glasses + sideshields, hearing protection (muffs or plugs) when noise sources are present, work area clothing, safety boots, protective gloves. Powerwashing requires additional protection (faceshield, industrial raingear, rubber safety boots, waterproof gloves).	· all persons working in the space require personal protective equipment, as specified. Personal protective equipment shall comply with requirements of the respective certifying and testing agencies, CSA (Canadian Standards Association) and ANSI (American National Standards Institute).
· NIOSH-approved half-facepiece respirator containing HEPA filters and acid gas/organic vapour cartridges	· in view of the information available, persons working in the space should wear respiratory protection as a precaution against potential exposure to bacteria and viruses and spores from moulds and odours. Respiratory protection is required during operations that can generate concrete and cement dust. Wet methods greatly reduce the potential for dust generation. Provision of clean respirable air in the work zone by the supply system and atmospheric monitoring are believed sufficient to protect against overexposure to other contaminants. In the event that this strategy does not provide sufficient protection, the situation requires reevaluation.
· GFCIs	·all electrical circuits require Ground Fault Circuit Interrupters (GFCIs)
· sharps kit	· use tongs to handle sharps for disposal in the protected container
Equipment Required	**Personal Hygiene and Decontamination**

· personal eyewash, ANSI-compliant eyewash station	· a personal eyewash bottle must be available in the event of a splash into the face to flush the eyes immediately following contact with irritating substances · flush the eyes for 15 to 20 minutes using the ANSI-compliant unit · seek medical attention
· household bleach (1:20 dilution)	· utilize bleach solution (or similar disinfectant product) for cleaning following exposure to biofilms as part of the initial clean-up. Sewer workers must clean hands, face and exposed skin prior to eating, drinking or smoking.
· soap and water	· thoroughly wash hands, face and all exposed surfaces of skin prior to eating, drinking, or smoking
Equipment Required	**Lifelines, Harnesses & Lifting Equipment**
· harness (dorsal D-ring)	· all persons entering and working in the space where vertical extrication may occur require a harness, if feasible. Connection to the winch is required when standing water is present and to permit extrication. · inspect all equipment for damage before use. Remove damaged equipment from service.
· fall restraint device: winch (Make model)	· fall restraint is required where work occurs on the top of structures lacking fall prevention in the form of railings or other devices where fall can occur · fall restraint device is required during ascent and descent of ladder where free fall distance can exceed 3 m (10 feet)
· retrieval system: tripod or davit arm (Make model) positioned at manhole above the entry ladder	· retrieval device required for entry and for lifting injured victim from the space
Equipment Required	**Standby Person**
· two-way radio, cellular telephone	· standby person must remain near the access when equipment noise causes difficulty in communication. The standby can assist the entrant with equipment and supplies. The standby must be able to extricate the worker vertically in the event of an emergency or an accident. Standby must have training in monitoring duties, initiating emergency response, operation of retrieval equipment and removal of injured victims using this equipment. · standby must not enter the space
Equipment Required	**Rescue**

· two-way radio, cellular telephone, air horn	· rescue personnel must have training in first aid and CPR · to activate the emergency response, standby person sounds three long blasts on the air horn, as appropriate or contacts the Lifeguards on the two-way radio, indicates the occurrence of the accident and asks the Lifeguard to call 911 to request assistance from FIRE and AMBULANCE and states the exact location and the nature of the problem. · the Lifeguard contacts the Assistant Supervisor, Maintenance and Operations, to inform about the situation · if the instrument in the space is not alarming, and no other hazardous condition has arisen, the rescue person may enter the space to assist the victim; otherwise, use the winch to remove the victim. The standby must not enter the space. · rescue person assesses condition of the victim and determines whether serious injury has occurred and whether serious injury has occurred to the head, neck or back. If serious injury has not occurred and does not involve the head, neck or back, the victim may be assisted to the access and removed from the space. If the preceding conditions cannot be met, the victim is to be packaged for transport.

<table>
<tr><td colspan="2">Sunshine Coast Regional District</td><td colspan="2">Confined Space Identification and Hazard Assessment</td><td colspan="2">Ammonia Condenser</td></tr>
<tr><td colspan="2">Owner: Sunshine Coast Regional District</td><td colspan="2">Location: Sunshine Coast Arena</td><td colspan="2">Assessed by: Neil McManus, CIH, ROH, CSP
NorthWest OH&S
Tel: 604-980-8512
Date: 2010-02-26</td></tr>
<tr><td>underground working?</td><td>enclosed or partially enclosed?</td><td>designed/ intended for continuous human occupancy?</td><td>limited or restricted entry or exit?</td><td>large enough and configured for entry to perform work?</td><td>Confined Space?

Yes
▲</td></tr>
<tr><td>No</td><td>Yes</td><td>No</td><td>Yes</td><td>Yes</td><td>» All entries bold?</td></tr>
<tr><td colspan="2" rowspan="3">Description: horizontal steel, irregularly-shaped, enclosed structure. This structure forms the discharge plenum of the centrifugal fans that discharge upward through piping to cool ammonia gas used for refrigeration.</td><td colspan="2">Access/Egress: hatches measuring about 0.5 m in diameter located in the end walls of the structure. These hatches are about 2 m above the base of the structure.</td><td colspan="2">Contents: water, contents unlikely due to the upflow of air produced by the fans. Accumulation of debris and water is possible during shutdown conditions</td></tr>
<tr><td colspan="2">Adjacent Spaces: not applicable</td><td colspan="2">Equipment: four centrifugal fans</td></tr>
<tr><td colspan="2">Function/Use: evens the distribution of air discharged by the fans to improve heat transfer from the ammonia piping</td><td colspan="2">Process: not applicable</td></tr>
<tr><td colspan="2">External Surroundings: wall of the building and chain link fence enclosure.</td><td colspan="2">Downgrading Conditions: noise, potential for leakage of ammonia</td><td colspan="2">Potential Impact on Work Activity: impaired communication, possible hearing loss, overexposure to ammonia</td></tr>
</table>

Notes:
· entry into this space is not expected to occur. Inspection and cleaning can occur from outside the hatches using long-handled tools without the need for entry.
· exposure to ammonia, while ever possible due to its presence in piping under pressure, is highly unlikely to occur. The presence of ammonia in air is an indication of failure of containment.

Sunshine Coast Regional District		**Confined Space Identification and Hazard Assessment**		**Septic Tank**	
Owner: Sunshine Coast Regional District		**Location:** northwest corner, Sunshine Coast Arena		**Assessed by:** Neil McManus, CIH, ROH, CSP NorthWest OH&S **Tel:** 604-980-8512 **Date:** 2010-10-19	
underground working?	enclosed or partially enclosed?	designed/ intended for continuous human occupancy?	limited or restricted entry or exit?	large enough and configured for entry to perform work?	**Confined Space?** **Yes** ▲
No	**Yes**	**No**	**Yes**	**Yes**	≈ All entries **bold**?
Description: in-ground, cast-in-place concrete structure measuring about 3.5 m long by 2.5 m wide and 2.5 m deep.		**Access/Egress:** manhole about 0.5 m in diameter		**Contents:** sewage, rainwater and contents of surface run-off, leaves and other organic debris, sand, unclassified debris, organic solvents possible, sharps possible, infiltration by groundwater, insects and spiders	
		Adjacent Spaces: influent pipe, effluent pipe		**Equipment:** not applicable	
		Function/Use: collect wastewater for primary treatment		**Process:** aerobic and anaerobic digestion possible	
External Surroundings: off-street location, outside the building about 5 m from the wall		**Downgrading Conditions:** exhaust gases from vehicles		**Potential Impact on Work Activity:** overexposure to exhaust gases	

Notes:
· entry into this space is not expected to occur. Inspection and cleaning can occur from outside the hatches using long-handled tools and vacuum equipment without the need for entry.
· In the event of need for entry, refer to documents prepared for the Sunshine Coast Regional District, sanitary system for guidance.