ORCA Health & Safety

Exposure Control Plans

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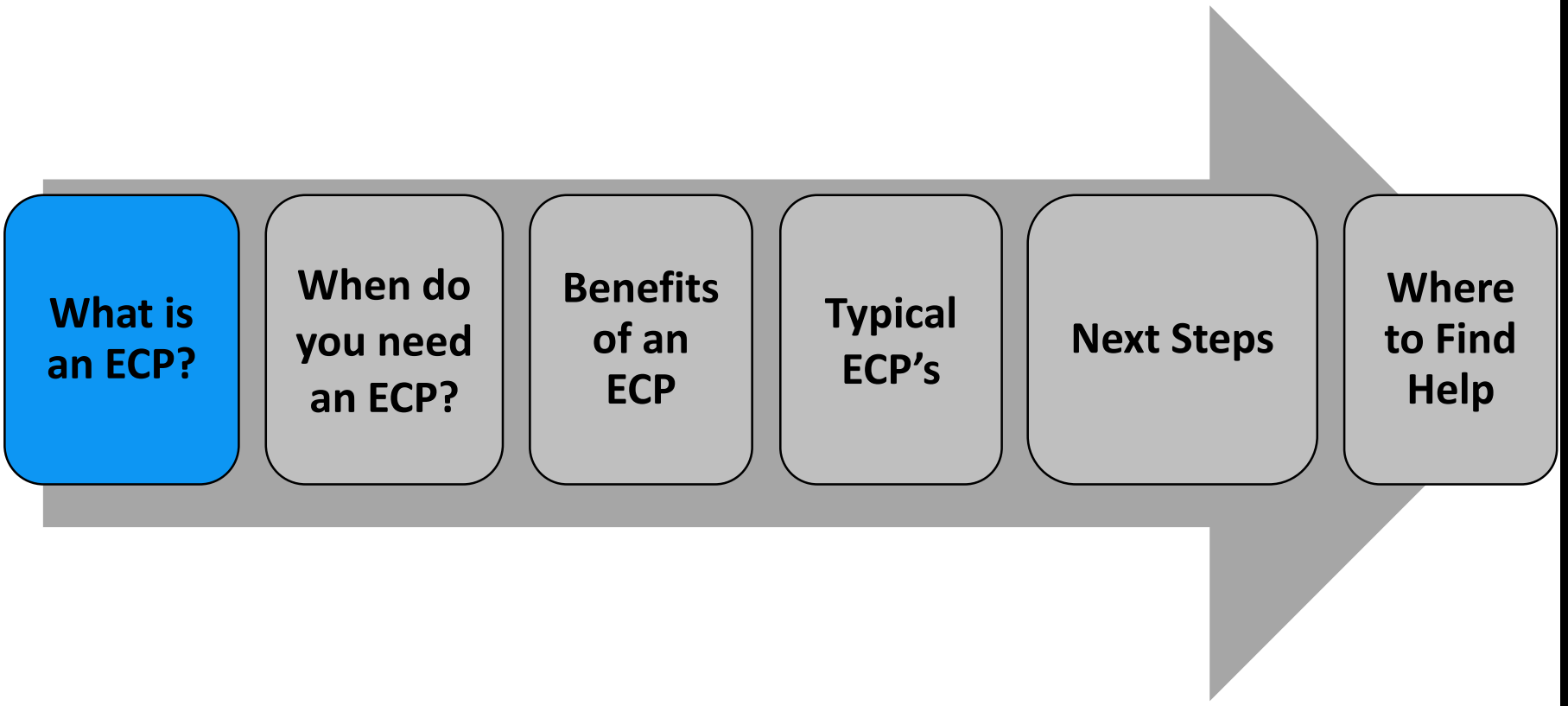
Learning Objectives

1. What is an Exposure Control Plan (ECP)?
2. When do you need an ECP?
3. Benefits of an ECP
4. Typical ECP's in Municipalities
5. Implementing the ECP
6. Where to find help

Let's get started!



Exposure Control Plans (ECP)

- ECP's = **mini programs**
- Pull together many components of "the hazard" together
- **Tailored** to your companies specific situation!
  - i.e. Quantities/ Location/ SWP's/ Resources

Components of an ECP – Reg. 5.54

(a) A statement of purpose and responsibilities

(b) Risk identification, assessment and control

(c) Education and training

(d) Written work procedures, when required

(e) Hygiene facilities and decontamination procedures, when required

(f) Health monitoring, when required

(g) Documentation, when required

a) Statement of Purpose & Responsibilities

1.2 Policy

- It is the policy of XXXX is to prevent occupational exposure to asbestos-containing material by:
  - Identifying all asbestos prior to moving a house (using a qualified person to collect samples and complete lab analysis);
  - Ensure any asbestos in the immediate work zone of Belton Brothers is removed prior to work starting by a qualified abatement contractor and;
  - To ensure any vermiculite in the house is safely removed by a qualified contractor prior to moving or razing a building.

1.3 Purpose

- The purpose of this Exposure Control Plan is to identify activities that may put a worker at risk for exposure to asbestos-containing material, and describe the controls that are put into place to avoid this exposure. This plan will discuss the following:
  - Relevant OHS Regulation and related information;
  - Roles and Responsibilities;
  - Hazard Identification;
  - Hazard Controls;
  - Records and Paperwork;
  - Qualifications and Training.

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Tailored Wording & Approach

a) Statement of Purpose & Responsibilities

1.2 Roles and Responsibilities

Employer will:

- Ensure materials (i.e. tools, equipment, personal protective equipment [PPE]), and other resources (i.e. worker training) are readily available to fully implement and maintain this ECP.
- Ensure supervisors and workers are educated in the hazards of ammonia exposure and trained to work safely.
- Ensure effective gas monitoring systems for ammonia are provided and calibrated as per manufacturers requirements.
- Establish and maintain written records of:
  - Training (i.e. proper use of respirators)
  - Respirator fit tests
  - Crew talks
  - Emergency Drills
  - Inspections (i.e. of equipment).
- Coordinate work with contractors and other employers to ensure a safe work environment.
- Initiate immediate investigations into reports of symptoms or exposures to find route causes.
- Ensure workers follow the requirements of the Occupational Health and Safety Regulation and the *Workers Compensation Act*.

Chief Engineer/ Supervisor will:

- Ensure adequate instruction and training is provided to workers on ammonia hazards and required controls.
- Authorize plant work by contractors and maintenance personnel.
- Scheduling of maintenance per manufacturer specs.
- Maintain records, log books for all Plant testing, inspections and any corrective actions carried out in accordance with the plans.
- Recommend any improvements and upgrades to monitoring, equipment, training or documentation.

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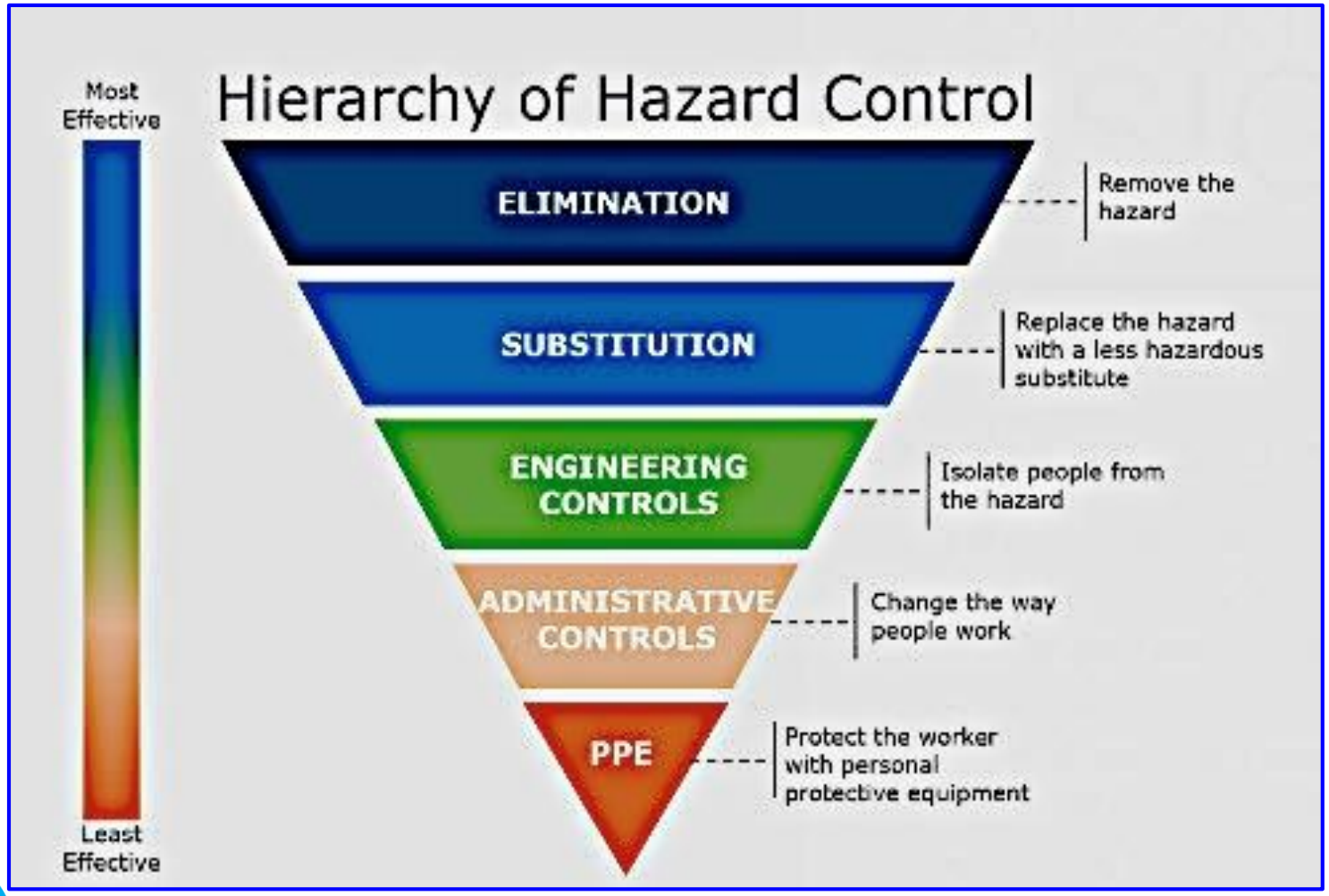
b) Risk Identification & Assessment

- Based on:
  - Sample findings
  - Amount of product on site (i.e. tonners vs. 150 lb. cylinder)
  - Hazard level of product (i.e. severe corrosive vs. irritant)
  - Location of facility & use/storage of product
  - Ease of access to product
  - Training requirements for handling (i.e. certified operators vs. general employees)
  - Risk to public/ Population density

Controls - Hierarchy

Hierarchy of Controls Required



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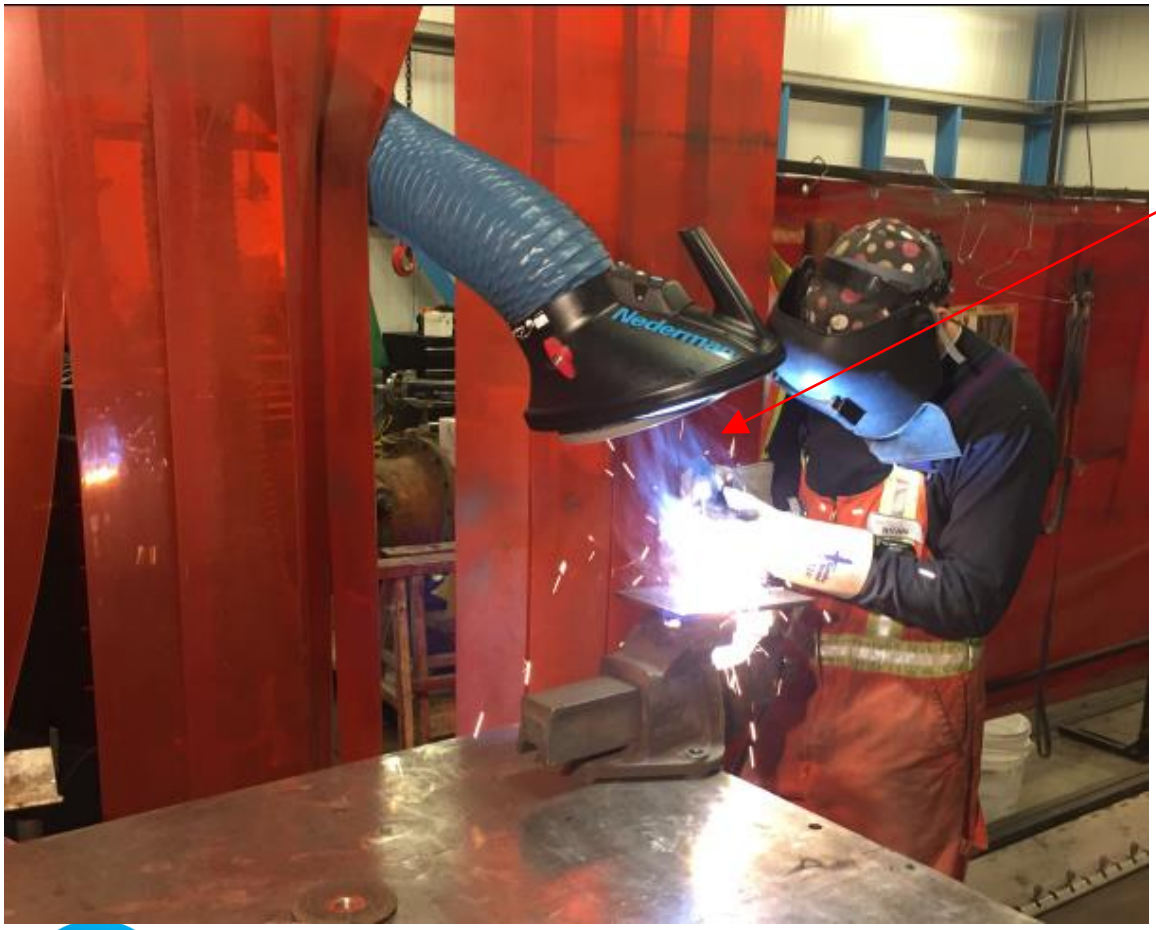
b) Controls - Ventilation

Options:

- Interlocked with gas monitoring
- Continuously running
- Manual turn off/ on

b) Controls – Local Exhaust Ventilation (LEV) – Control at the Source

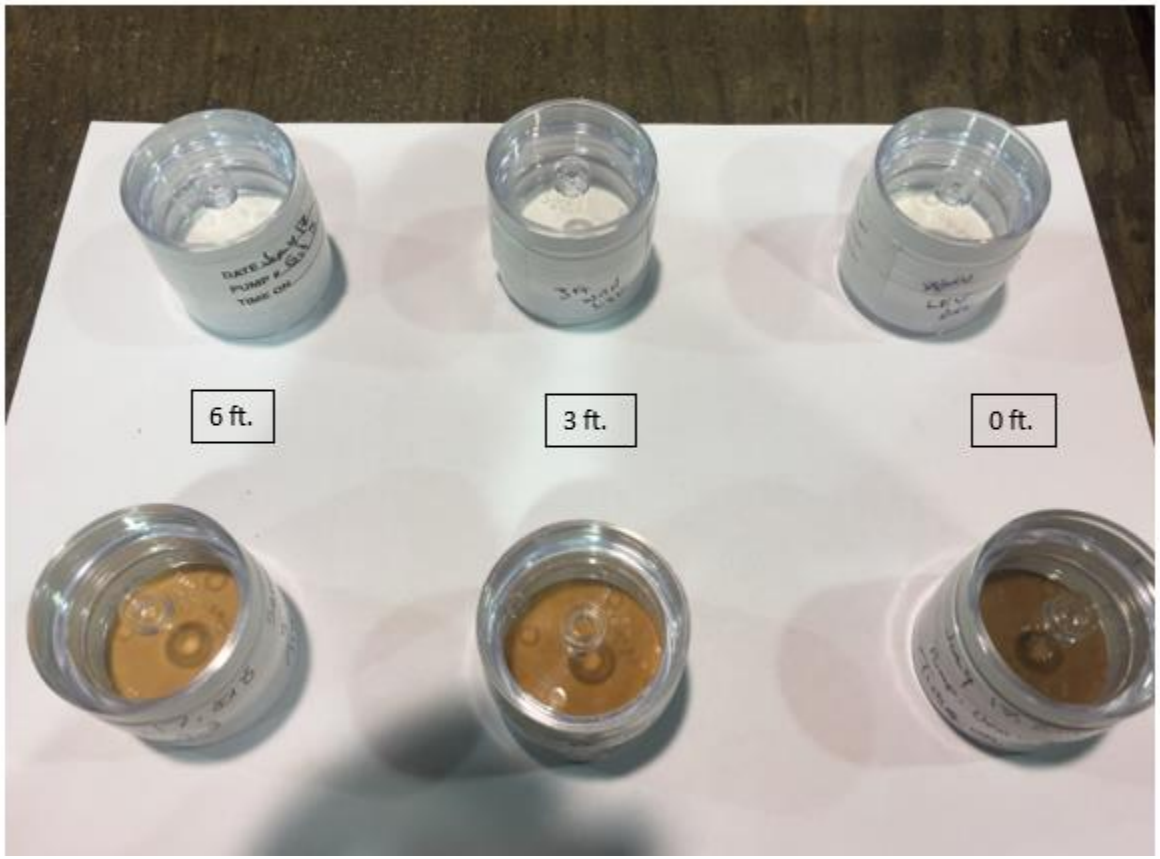


- Good capture
- LEV well positioned
- Overwhelming evidence for use of LEV

b) Controls – LEV Not Capturing

- LEV not positioned well

Sampling With & Without LEV - LEV Works!!



Results – No LEV vs. LEV

Metal	004 – Field Blank (mg/m³)	005 Welder A – Occupational, No LEV (mg/m³)	006 Welder A – 3ft Area, No LEV (mg/m³)	007 Welder A – 6ft Area, No LEV (mg/m³)	008 Welder B – Occupational, With LEV (mg/m³)	009 Welder B – 3ft Area, With LEV (mg/m³)	010 Welder B – 6ft Area, With LEV (mg/m³)	WSBC TWA (8hr) EL - July 3, 2018 (mg/m³)	WSBC TWA (10hr) EL (mg/m³)	WSBC TWA (12hr) EL (mg/m³)
Aluminum (Al)	ND	0.003300	ND	ND	ND	ND	ND	1	0.7	0.5
Antimony (Sb)	ND	ND	ND	ND	ND	ND	ND	0.5	0.35	0.25
Arsenic (As)	ND	ND	ND	ND	ND	ND	ND	0.01	0.007	0.005
Barium (Ba)	ND	0.000164	0.000065	0.000046	0.000098	0.000060	0.000065	0.5	0.35	0.25
Beryllium (Be)	ND	ND	ND	ND	ND	ND	ND	0.00005	0.000035	0.000025
Boron (B)	ND	0.000310	ND	ND	ND	ND	ND	10	7	5
Cadmium (Cd)	ND	ND	ND	ND	ND	ND	ND	0.002	0.0014	0.001
Calcium (Ca)	0.0035	0.186000	0.057400	0.042500	0.024500	0.012600	0.019900	2	1.4	1
Chromium (Cr) (VI)	ND	0.001220	0.000370	ND	0.000310	ND	0.000410	0.01	0.007	0.005
Cobalt (Co)	ND	ND	ND	ND	ND	ND	ND	0.02	0.014	0.01
Copper (Cu)	ND	0.003480	0.001030	0.000450	ND	ND	ND	0.2	0.14	0.1
Iron (Fe)	ND	0.724000	0.254000	0.124000	0.021500	0.007360	0.008360	5	3.5	2.5
Lead (Pb)	ND	ND	ND	ND	ND	ND	ND	0.05	0.035	0.025
Magnesium (Mg)	0.00047	0.002160	0.001140	0.000880	0.001410	0.000920	0.001210	3	2.1	1.5
Manganese (Mn)	ND	0.097300	0.035500	0.022700	0.000511	0.000224	0.000298	0.02	0.014	0.01
Molybdenum (Mo)	ND	ND	ND	ND	ND	ND	ND	3	2.1	1.5
Nickel (Ni)	ND	0.001190	ND	ND	ND	ND	ND	0.05	0.035	0.025
Phosphorus (P)	ND	ND	ND	ND	ND	ND	ND	0.1	0.07	0.05
Potassium (K)	ND	0.245000	0.072800	0.054000	ND	ND	ND	-	-	-
Selenium (Se)	ND	ND	ND	ND	ND	ND	ND	0.1	0.07	0.05
Silver (Ag)	ND	ND	ND	ND	ND	ND	ND	0.01	0.007	0.005
Sodium (Na)	ND	0.075300	0.034000	0.021600	0.005300	0.004200	0.004700	-	-	-
Strontium (Sr)	ND	0.000136	0.000049	0.000039	0.000092	0.000059	0.000078	0.0005	0.00035	0.00025
Sulphur (S)	ND	0.007800	0.004700	0.004000	0.003700	0.002700	0.003000	2	1.4	1
Tin (Sn)	ND	ND	ND	ND	ND	ND	ND	0.1	0.07	0.05
Titanium (Ti)	ND	0.013300	0.005560	0.002220	ND	ND	ND	10	7	5
Vanadium (V)	[illegible]	ND	ND	ND	ND	ND	ND	0.05	0.035	0.025

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b) Controls – Preventive Maintenance

Ammonia

- Annual inspection of ammonia refrigeration plant
  - Scheduled inspections
  - Verification of safety and operating controls
- Servicing ammonia or brine leaks
- Compressor inspections and overhauls
- Replacement or repair of failed components
- Replacement of relief valves
- Monthly testing of all fans, sensors (ammonia, toxic gas etc.), proofing and remote monitoring is required

SO_2

Preventive maintenance for SO_2 include:

- SO_2 storage vessel inspection and NDT testing
- Calibration of levels and pressure gauges to manufacturers specs
- Safety relief inspections and testing
- Caustic A Tank scrubbing of vents
- Preventive maintenance program on rail cars

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b) Controls – Gas Detection

b) Gas Detection

Fixed automatic H_2S gas detection sensors and alarms are located in the following areas with the potential for an H_2S leak:

H_2S Fixed Gas Monitors (Equipped with Light & Horn)			
	Loop Number	Area	Location
1	706-AI-205	Waste Treatment	RST Deck
2	706-AI-275	Waste Treatment	Roof RST Deck
3	706-AI-276	Waste Treatment	Operating (S. Press Deck)
4	706-AI-277	Waste Treatment	Basement (E. Basement)
5	706-AI-278	Waste Treatment	Operating (N. Press Deck)
6	708-AI-219	Waste Treatment	Primary Clarifier Tunnel
7	753-AI-006A	Waste Treatment	SET Pumphouse
8	753-AI-006B	Waste Treatment	SET Pumphouse Exit
9	753-AI-040	Power Boiler	Recovery Acid Skid Ground Floor
10	753-AI-027	PM 9/PM 10	Wet End Basement
11	753-AI-043	PM 10	TMP Refiner
12	753-AI-007	PM 11	Wet End Basement North

See Appendix 11.3 for a diagram of all fixed gas sensors, lights and horns.

Ammonia Gas Monitoring - ECP

4.2.1 Gas Monitoring

Continuous gas monitoring for ammonia is present in the compressor room. The gas levels read out on the LED located in the vestibule.

Gas Level	Alarm Setting	Color on LED	Alarm Type
Low	35		Strobe & Siren
Medium	70		Strobe & Siren
High	300		Strobe & Siren

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b) Controls – Water

Without Water

With Water

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b) Controls – Safe Work Procedures

- a1 Asbestos - Gasket removal- 2015.doc
- a2 Asbestos - Working in or on cable trays-2015.doc
- a4 Asbestos - Damaged light fixture heat shield removal - 2015.
- a5 Asbestos - Garage - 2015.doc
- a6 Asbestos - Bulk sample collection- 2015.doc
- a7 Asbestos - Cable Coating Removal - 2015.doc
- a10 Asbestos - Heat shield removal from light fixture - 2015.doc
- a11 Asbestos - Pipe insulation removal-2015.doc
- a12 Asbestos - Working on switchgear with asbestos - 2015.doc
- a14 Asbestos - Material repair 2015.doc
- AC Bulk Sample Collection.docx

Can be listed under controls but must be listed under section (d) Written Work Procedures.

b) Controls – Personal Protective Equipment

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c) Education and Training

- **Determines:**
  - Exact topics to be covered
  - Frequency of training/ refresher
  - Drills to be completed

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d) Written Work Procedures

4.2 Summary of Administrative Controls

a) Safe Work Procedures (SWP's)

The following procedures have been developed:

1. Entry Protocol for Affected Area's – Appendix 11.2.1
2. Leak Investigation and Control – Appendix 11.2.2
3. Gas Excursion Events – Appendix 11.2.3
4. Emergency Response Sequence Flowchart – Appendix 11.4

2. **Don PPE:** Employees within Asbestos Work Zone to put on the following PPE:
   - ½ face respirator with P100 cartridges (straps underneath hood)
   - Laceless boots or steel toes with booties duct taped at ankles
   - Disposable gloves (i.e. nitrile)
   - Tyvek suit with hood, duct taped at wrists and ankles
   - Hardhat
   - Eye protection
   - Hearing protection (as required)
   - Consider the use of other PPE based on location and site-specific hazards (i.e. fall protection/ harness)

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d) Containment/ Barriers

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e) Hygiene Facilities

- Tyvek coveralls with hood
- Shower/ wash prior to all breaks/ end of day
- HEPA vacuums
- Wet methods (misting)
- Tool wipe down
- Any disposable materials removed and disposed of at the end of the task.

Mold - Hygiene Facilities Example

Workers required to handle mold will be provided with full wash-up facilities equivalent to:

Risk Level	Contamination Defined	Requirements	
		PPE	Washing/ Decontamination
Small	< 10 ft^2 or < 1m^2	Tyvek with full hood & ½ face respirator with P100 cartridges	2 buckets of water with rags
Medium	10-100 ft^2 or 1-10 m^2	Tyvek with full hood & ½ face respirator with P100 cartridges	2 buckets of water with rags
Large	>100 ft^2 or >10 m^2	Tyvek with full hood & full face or PAPR with P100 cartridges • Respirator choice based on type of mold and size of contamination.	Shower with three stage decontamination.

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f) Health Monitoring

Heavy Metals/ Lead

Based on ACGIH (2015) the following Biological Exposure Index (BEI) testing is to be completed at the end of the shift at the end of the workweek:

Chemical	Sampling Time	BEI	Notations
Cadmium	Not Critical	Urine – 5 µg/g creatine Blood – 5 µg/L	B
Chromium (VI)	End of shift at end of workweek Increase during shift	Urine – 25 µg/L Urine – 10 µg/L	For newly exposed workers or workers returning to work after an extended absence, their BEI is expected to be lower (7 µg/L).
Cobalt	End of shift at end of workweek	Urine – 15 µg/L	Ns
Fluorides	Prior to shift End of shift	Urine – 2 mg/L Urine – 3 mg/L	B, Ns B, Ns
Lead	Not critical	Blood – 30 µg/100 ml	Women of childbearing potential should not exceed 10 µg/dl.

Asbestos

7.0 Health Monitoring

For all employees who handle asbestos regularly as part of their work, annual Lung Function Tests will be completed.

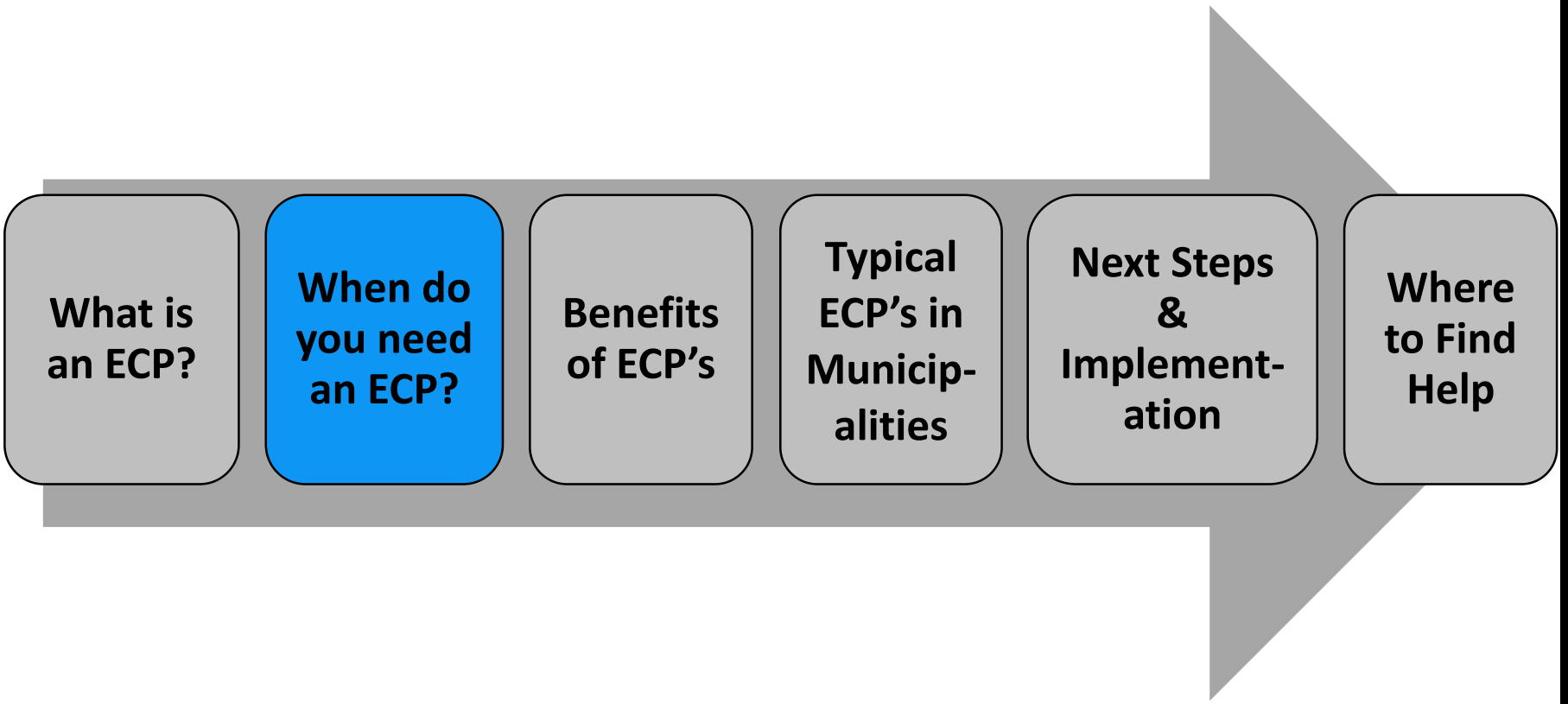
All records will be maintained by the Health and Safety department.

Further testing can be provided at the request of your family doctor or specialist.

g) Documentation

Due Diligence… proving what you've done

- Updating of documents as needed (i.e. SWP's)
- Retention of sampling/ health monitoring documents
- Communication of hazards/ risks
- Training document retention
- Photos of drills/ training


What is an ECP?
When do you need an ECP?
Benefits of ECP's
Typical ECP's in Municip-alities
Next Steps & Implement-ation
Where to Find Help

Determining “The Hazard”

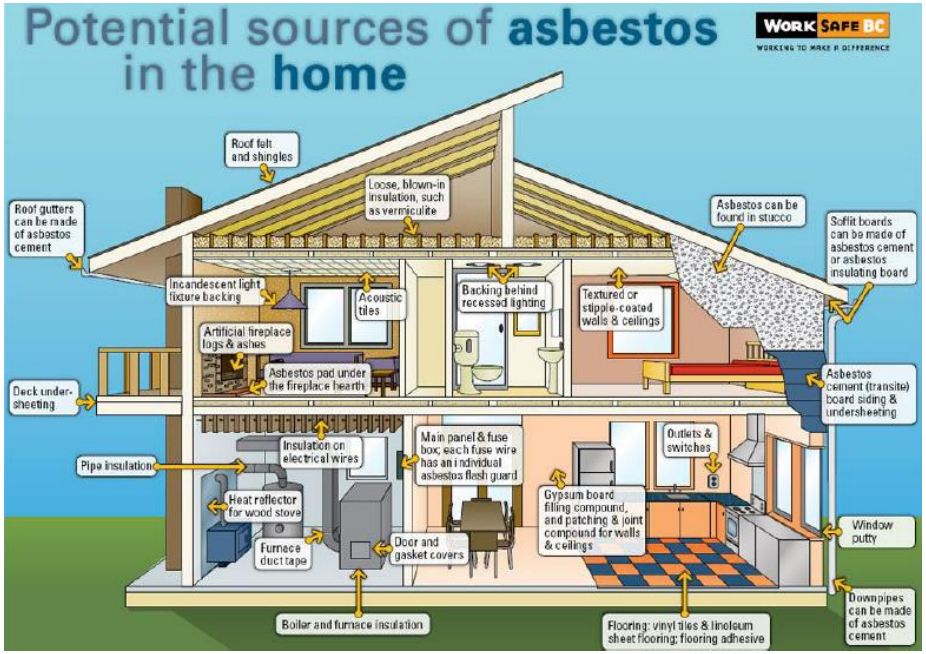
1. Sampling…
   - Over 50% of the Occupational Exposure Limit (OEL) requires an ECP
   - Anytime you can’t sample low enough to determine 50% OEL
2. Historical Events
3. The Obvious
   - 3 tonners of liquid chlorine always onsite? Significant potential for exposure is present.
   - First aiders & blood borne pathogens

Sampling Strategies

- Sample the concern & compare to known Occupational Exposure Limits (OEL)
- NO_2 sampling of excavations vs. WSBC OEL

Nitrogen dioxide [10102-44-0	C 1 ppm

Asbestos Sampling – Building Materials



Silica Sampling

- Backhoe Operator Sampled August 2018

Sampling of Silica - OEL 0.025mg/m3

Client ID: UB9124-STEWART-BACKHOE OPERATOR
Lab ID: 004A
Matrix: PVC 5 Filter, MW

Date Sampled: 8/13/2018
DateReceived: 8/23/2018
Air Vol.(L): 464.1

Analyte	Concentration (µg)	Concentration (mg/m³)	Reporting Limit (µg)	Test Method	Date Analyzed / Analyst
Cristobalite	<5	<0.011	5	NIOSH 7500	08/27/2018 MJB
Quartz	20	0.044	5	NIOSH 7500	08/27/2018 MJB
Tridymite	<10	<0.022	10	NIOSH 7500	08/27/2018 MJB

Client ID: UB9123-RANDY-GROUNDS KEEPER LAWN MOVING
Lab ID: 003A
Matrix: PVC 5 Filter, MW

Date Sampled: 8/13/2018
DateReceived: 8/23/2018
Air Vol.(L): 470.9

Analyte	Concentration (µg)	Concentration (mg/m³)	Reporting Limit (µg)	Test Method	Date Analyzed / Analyst
Cristobalite	<5	<0.011	5	NIOSH 7500	08/27/2018 MJB
Quartz	13	0.028	5	NIOSH 7500	08/27/2018 MJB
Tridymite	<10	<0.021	10	NIOSH 7500	08/27/2018 MJB

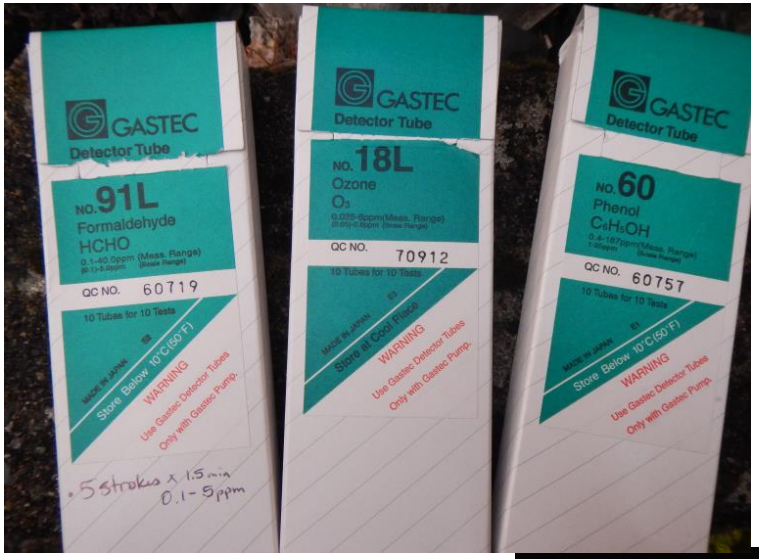
Silica Sampling – Occupational vs. Area

		Amount Found	Limit (8)
Respirable Silica	NA	<0.045	0.025 mg/m³

Gastec Tube Sampling

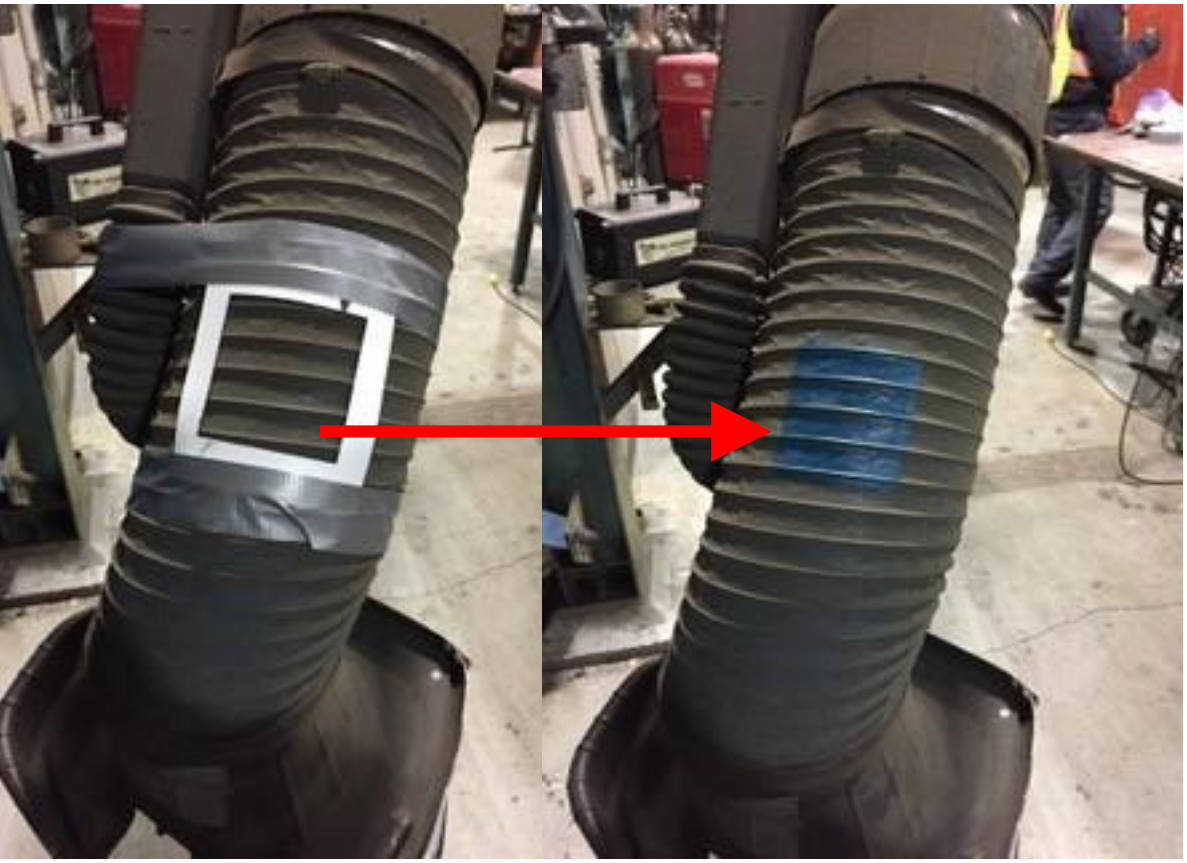
- Foundry work – parts making

	016 - Mixing	Melting & Pour	Breaking Mould	TWAs (ppm)
Formaldehyde (HCHO)	.05 ppm	.07 ppm	>1.0 ppm	0.3 ppm C 1 ppm



Heavy Metals Sampling

Wipe Sample vs. Air Sample



Wipe & Air Results – Shows Where to Focus Attention

METAL	Sandblaster (µg/ft²)	LEV (µg/ft2)	Drill Press (µg/ft2)	LEV (µg/ft2)	Oven (µg/ft²)
Aluminum (Al)	2964	12913	23690	26198	182.1
Antimony (Sb)	ND	ND	120	345	ND
Arsenic (As)	22	46	76	122	ND
Barium (Ba)	205	1366	1440	1979	21.2
Beryllium (Be)	ND	ND	ND	ND	ND
Boron (B)	333	705	1245	1914	15.9
Cadmium (Cd)	55	28	25	17	ND
Calcium (Ca)	32515	60385	59456	54811	5,295.3
Chromium (Cr)	2545	11520	32051	44964	784.1
Cobalt (Co)	126	216	503	626	14.1
Copper (Cu)	2908	3735	3047	3149	307.5
Iron (Fe)	156072	549968	741342	ND	23,968.2
Lead (Pb)	216	427	916	1449	21.4
Magnesium (Mg)	2964	3614	8556	6234	393.9
Manganese (Mn)	1477	6865	10033	17651	285.2
Molybdenum (Mo)	323	1319	3502	5704	95.7
Nickel (Ni)	1728	7878	23225	33723	493.3
Phosphorus (P)	966	1514	2230	2016	161.6
Potassium (K)	2759	8937	13378	16072	1,839.4
Selenium (Se)	ND	ND	41	104	ND
Silicon (Si)	3930	10219	19323	19045	690.2
Silver (Ag)	ND	ND	13	ND	ND
Sodium (Na)	12727	12634	15700	15886	2,164.6
Strontium (Sr)	192	403	756	901	42.2
Sulphur (S)	6568	15143	22482	21646	1,161.3
Tin (Sn)	142	103	104	152	ND
Titanium (Ti)	203	2332	2945	5825	76.3
Vanadium (V)	40	172	242	289	6.1
Zinc (Zn)	4208	16443	14864	18116	1,198.4
Zirconium (Zr)	11	47	92	146	ND

Lead Sampling

Total Particulate (PNOC) Sampling - Welder

Particles (Insoluble or Poorly Soluble) Not Otherwise Classified (PNOC)	10 mg/m^3 (N)

Mold Sampling → Plumbing Leak in Office

Ammonia Sampling – Indoor Composting Facility

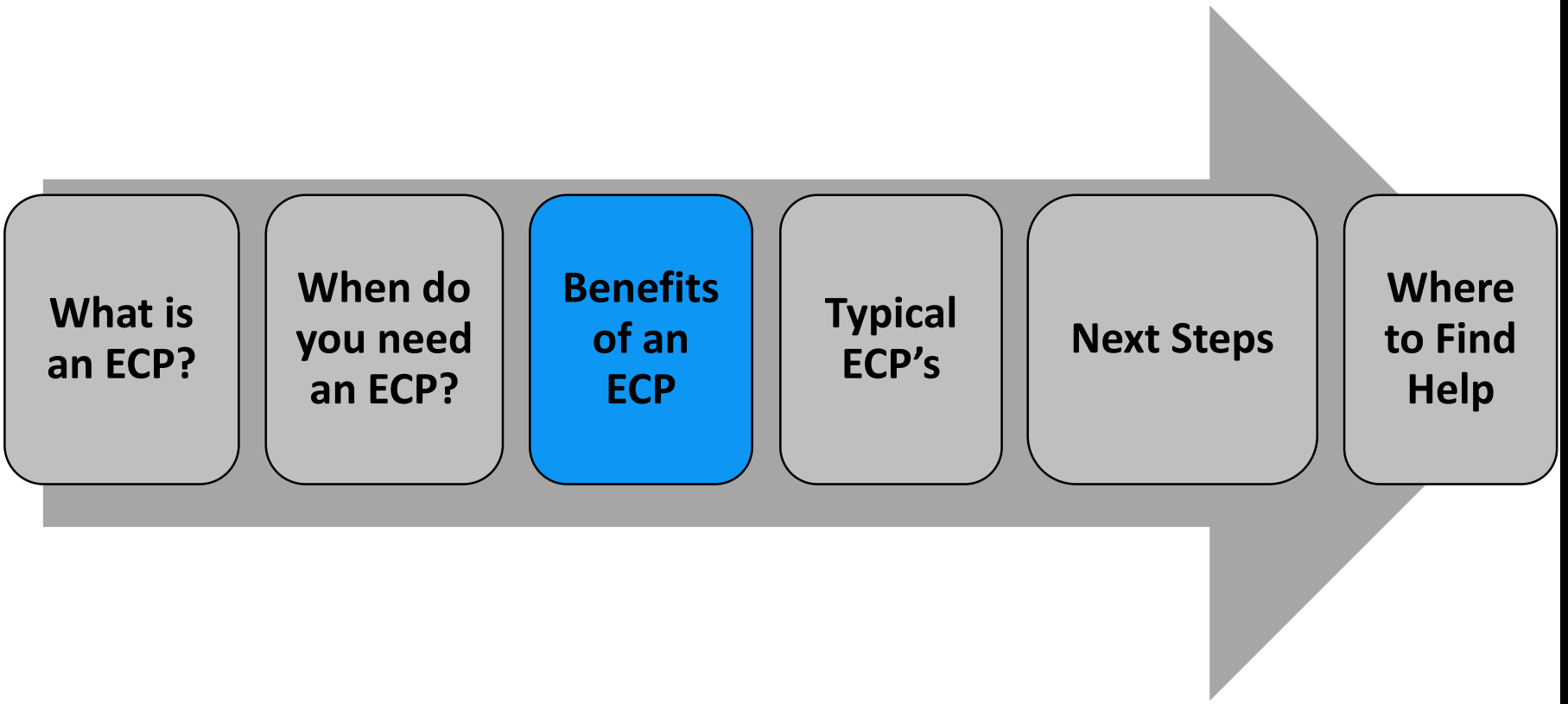
Table 2 – Area 1 - Compost Bld. Readings with Controls
(Testing performed with ventilation turned on, Bob Cat operating and Roto Mixer operating)

Location	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12	#13
Oxygen %	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9
LEL %	0	0	0	0	0	0	0	0	0	0	0	0	0
Carbon Monoxide ppm	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen Sulfide ppm	0	0	0	0	0	0	0	0	0	0	0	0	0
Methane ppm	200	200	100	0	0	0	0	0	0	0	100	100	100
Nitrogen Dioxide ppm	1.8	0.1	0	0	0	0	0	0	0.5	2.4	0	0	0
Ammonia ppm	0	0	0	4	4	5	4	5	4	7	25	6	3

NO_2 Sampling – Indoor Composting Facility

Table 2 – Area 1 - Compost Bld. Readings with Controls
(Testing performed with ventilation turned on, Bob Cat operating and Roto Mixer operating)

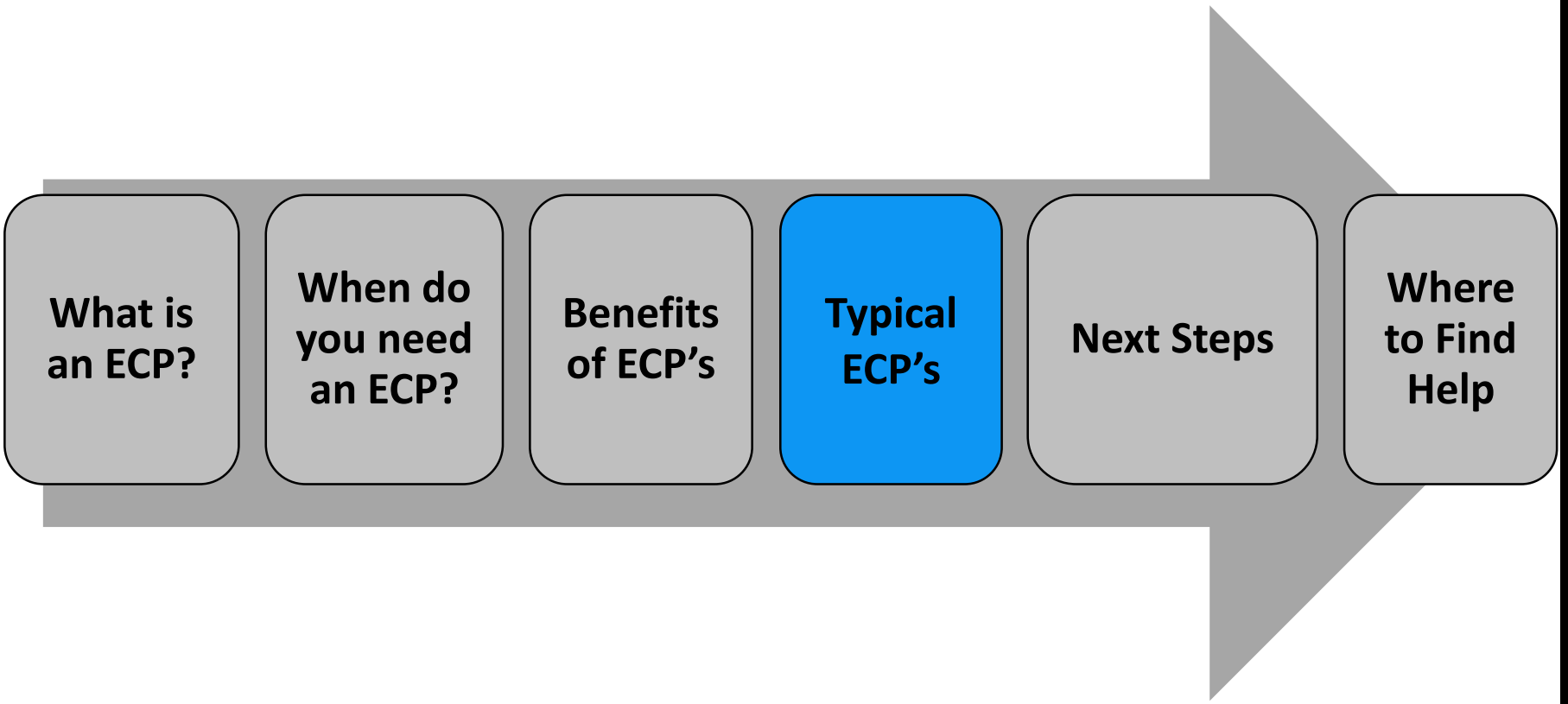
Location	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12	#13
Oxygen %	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9	20.9
LEL %	0	0	0	0	0	0	0	0	0	0	0	0	0
Carbon Monoxide ppm	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen Sulfide ppm	0	0	0	0	0	0	0	0	0	0	0	0	0
Methane ppm	200	200	100	0	0	0	0	0	0	0	100	100	100
Nitrogen Dioxide ppm	1.8	0.1	0	0	0	0	0	0	0.5	2.4	0	0	0
Ammonia ppm	0	0	0	4	4	5	4	5	4	7	25	6	3


What is an ECP?
When do you need an ECP?
Benefits of an ECP
Typical ECP's
Next Steps
Where to Find Help

ECP's Provide:

1. **Framework** for accountability, identification, assessment, training and expectations (controls)
2. All documents and information in one place
3. Clear expectations for supervisors & managers (standardization)
4. Where to go for help/ resources
5. Direction in unplanned events

i.e. Vermiculite breach from electrician pulling electrical cable in attic.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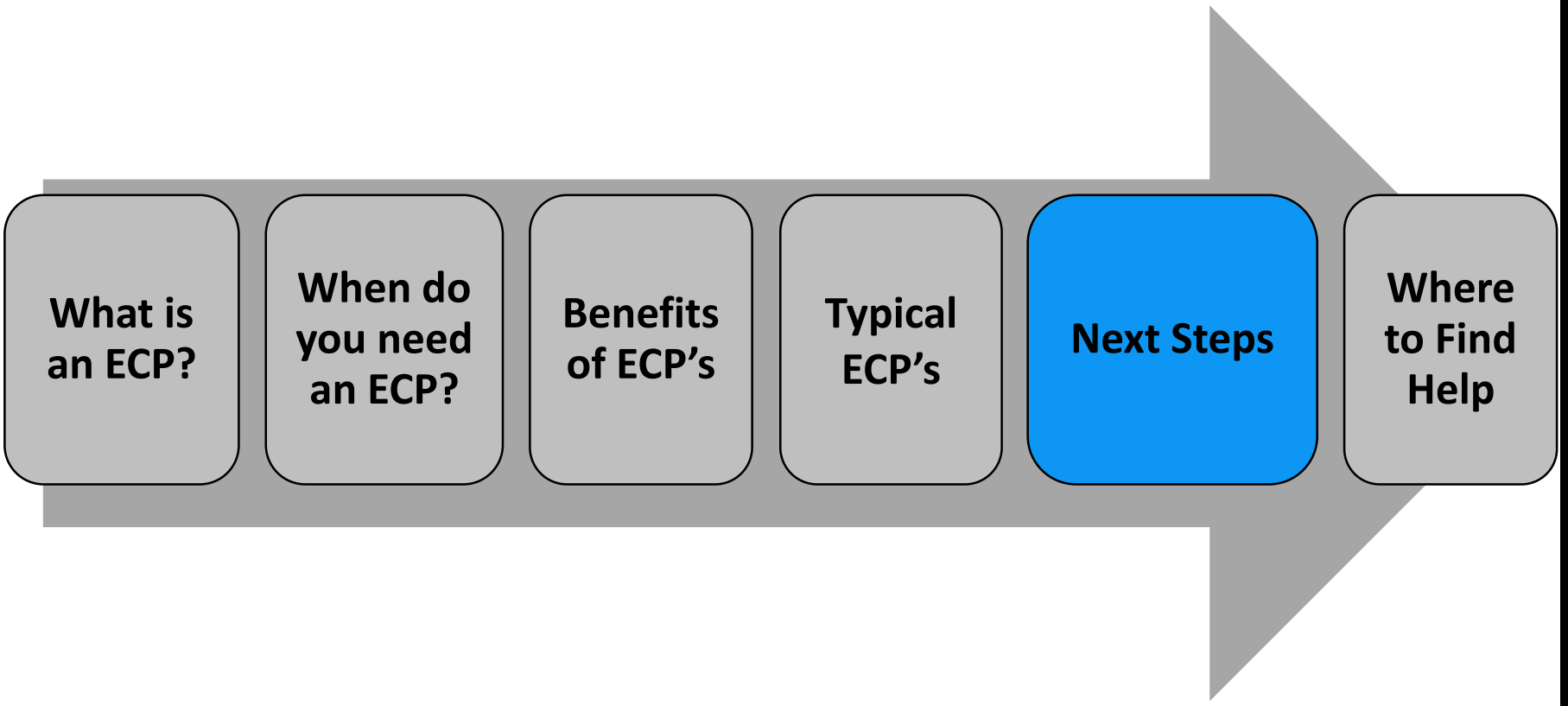
Typical ECP's for Municipalities

Hazard	Tasks
Silica	Bricks/ Landscaping/ Backhoe / Drilling & Cutting concrete/ Mowing Lawns (Dry season only)
Biohazards	Wastewater/ Needles/ Homeless Camps/ First Aid Persons
Asbestos	AC Pipe & Building Materials (i.e. drywall/ flooring)
Chlorine gas	Water Treatment
Ammonia	Arenas/ Composting facilities (indoor)
H_2S	Sewers/ Landfill/ Composting Facilities
Lead	Lead Coatings & Paint → Machinery/ Roadways/ Buildings
Sodium Hypochlorite	Pools & water treatment
Mold	As needed
Heavy Metals	Hot work/ Welding/ Grinding/ Zip Cutting
Diesel Exhaust/ NO_2	Diesel Equipment/ Composting Facilities (Indoor Equip)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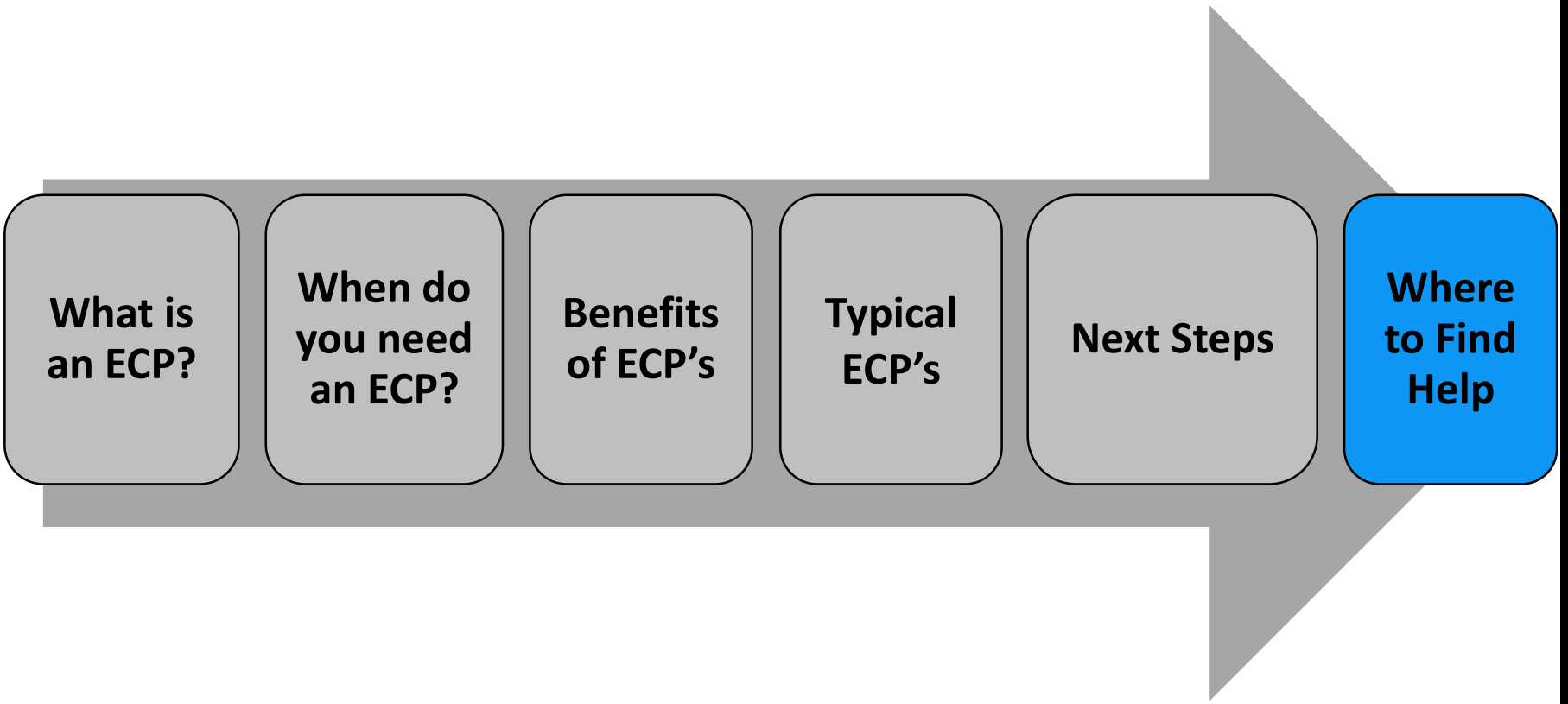
Implementation Steps

1. Find out where your risks are
2. Prioritize your risks – don't tackle them all at once
3. Develop ECP based on your specifics
   - Roles and Responsibilities
   - Amount of product onsite(s)
   - Available resources and control methods
4. Train various levels of your organization to their roles and Responsibilities → Hold them accountable
5. Implement controls based on "Hierarchy of Controls"… don't jump to PPE first
6. Develop needed Safe Work Procedures/ Emergency response plans
7. Complete drills annually or as required.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Where to Get Help

- **Your Team** – Supervisors, Employees, Safety Committee → They typically know their system the best… ask for feedback, input
  - You need to tailor your documents… this is the best starting place!
- **Google** → Get the basics/ templates/ general facts
- **Consultants** → buyer beware
- **WorkSafeBC**
  - www.worksafebc.com
  - 1-888-621-7233

Summary

- Ensure your ECP is supported by evidence and tailored to your company
- Don’t put anything into your ECP’s that you’re not prepared to complete in full
- Follow through with the program and ensure it’s implemented to the best of your abilities
- Get help if you need it


Questions?