

SUSTAINABLE REGION INITIATIVE . . . TURNING IDEAS INTO ACTION

O&M Technical Training Program Design and Analysis



San Francisco Public Utilities Commission (SFPUC) Workforce Development Site Visit




www.metrovancouver.org

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Agenda

- Training Needs Analysis
- Critical Task Analysis process and examples
- Competency Matrices process and examples
- Q & A
- Exercise

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Training Needs Analysis

- Analogous to the design phase in construction
- Subject Matter Expert involvement
- Internal or consultant-led
- Deliverables
 - Task Lists
 - Competency Maps
 - Critical Task Analysis
 - Table of Contents
 - Curriculum
 - Reference Material Analysis
 - Development Plan





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Competency Mapping AWWA Model




- Business and safety training already in place
- Focused on MV Specific:
 - Knowledge
 - Technical
 - Management


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Competency Mapping – Process

- Generate a list of all job positions in the organization
- For each position, identify all tasks performed
- Group related tasks into roles
- Start with entry-level positions and work up to management




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7. Occupational Specific Technical


Role	Task	Asst. Project Eng.	Project Eng.	Sr. Project Eng.
System Operation	define terms of agreement for water quality		X	X
	assist in developing CM&S manuals for select facilities		X	X
System Operation/System Control	assist in development of procedures	X		
	provide technical expertise (as requested) in review and development of procedures.	X	X	X
	assist in development of select LCO procedures with field staff	X		
	direct implementation of daily operating plan		X	
	support implementation of daily operating plan	X	X	
	direct drum date control operation		X	X
	participate in facility/equipment inspections.	X	X	X
Review approaches to water quality		X	X	
Troubleshooting & Analysis	Extract and analyze data from PI and Delta V.	X		
	Identify issues and solutions.	X	X	X
	assist with resolution of pressure/flow issues in municipalities that may be due to MV operations	X		
	extract data from PI		X	X
	provide technical expertise on pressure/flow issues with municipalities			X
	provide support for field staff as required for non-complex system failures.	X		
	provide WT&SC expertise to assist with troubleshooting remote operation (e.g. dams, pump stations)	X	X	X
	provide support and direction for field staff as required for non-complex system failures.	X	X	X
	perform post-failure analysis of system	X	X	X
	analyze field test data	X	X	X
	perform post-failure analysis of water treatment facilities	X	X	X
	collect system control and/or water treatment material and information to assist with failure analysis and resolution.	X	X	X
	assist with response to complex failures	X		
Collect, review, and analyze system control and/or water treatment material and information to assist with incident analysis and resolution.			X	

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Critical Task Analysis (CTA)

- Purpose – prioritize procedure and training material development
- Use amalgamated task list from Competency Matrices
- Evaluation team and process
- Evaluate Criticality
- Customize criteria to suit your organization
- Other information to gather




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CTA - Process




Likelihood × Consequence = Criticality



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CTA - Sample

Task Name	Likelihood (1-5)		Consequence (1-5)				Criticality
	Task Complexity	Probability of Error	Health/Safety	Public Disruption	Environmental	Economic	
Asset tagging	3	5	4	3	2	3	20
Alarm Testing - PM	3	2	3	4	3	3	12
HVAC Filters Inspections	1	1	1	1	1	4	4



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CTA - Likelihood









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CTA – Likelihood


Rating	Likelihood Criteria	
	Task Complexity	Probability (use historical data if possible)
5	<ul style="list-style-type: none"> • Unfamiliar, highly complex • Immediate response • Troubleshooting and analysis required 	Possibility of repeated incidents (once or more per year)
4	<ul style="list-style-type: none"> • Highly complex • Prompt response • Knowledge and analysis required 	Possibility of isolated incidents (once every 5 years)
3	<ul style="list-style-type: none"> • Complex • Some time to respond • Knowledge required 	Possibility of occurring sometimes (once every 10 years)
2	Less complex but has potential for human error	Not likely to occur (once every 25 years)
1	Common, familiar, and non-complex tasks	Practically impossible (once every 100 years)



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CTA - Consequences






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CTA - Consequences


Rating	Consequence Criteria (ALWAYS ASSESS CRITERIA FIRST!)			
	Health/Safety	Public Disruption	Environmental	Economic
5	Loss of life	Extensive service disruption: • Arterial road out • Major line break / out • Region-wide boil water advisory	Extended incident: public notification required • Full-scale emergency response required • Ecosystem failure possible	Loss > \$250,000
4	Permanent disability Loss of body part	Major service disruption: • Feeder road out • Minor line break / out • Localized boil water advisory	Major incident: reporting required • Fines/citations probable • Emergency response required • Significant threat to ecosystem	Loss between \$25,000 and \$250,000
3	• Lost time injury • Illness without permanent disability	Significant service disruption: • Local road out • Localized turbidity, no boil water • Localized noise	Moderate incident: reporting required • Minor response required • Minor threat to ecosystem	Loss between \$5,000 and \$25,000
2	• Minor injury • Illness without lost time	Minor service disruption: • Localized low pressure	Minor incident: reporting required • No response required	Loss < \$5,000
	No injury or illness	No service disruption	Minor incident: no reporting required	No loss

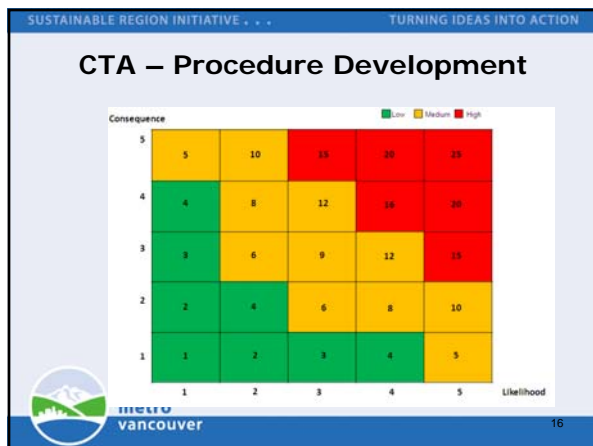


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CTA - Sample with Extras

Task Name	Task Complexity	Likelihood (1-5)	Probability of Error	Consequence (1-5)				Criticality	Task Frequency 1-5	Notes	Existing procedure?	CSE Procedure Req'd	LKO Procedure Req'd
				Health/Safety	Public Disruption	Environmental	Economic						
Asset tagging	3	5	4	3	2	3	20	3	USC (WT); cl2	y	y	n	
Alarm Testing - PM	3	2	3	4	3	3	12	3	Water/wastewater system only (not WT); Need to review criticality rating.	n	y	y	
HVAC Filters Inspections	1	1	1	1	1	4	4	5	PS checklist	n	n	n	





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Training Program Table of Contents


- Developed in a workshop
- Input from senior management and superintendents
- Group the learning material into logical topics, subtopics, and modules
- Possible groupings:
 - Geographical
 - System flows
 - Priority Weighted
- Our topics:
 - MV Utility basics
 - Water & Wastewater Industry Basics
 - Watersheds
 - Source Water Treatment Plants
 - Water Supply
 - Water Supply Process
 - Urban Drainage System
 - Waste Water Collection Infrastructure



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Table of Contents - Sample

Topic	Subtopic	Module
Water Supply	Water mains	Water Main Basics
		Types (i.e. according to sizes, materials, working pressures, etc.)
		Custody transfer points
		Pipe Connections and appertences (couplings, flanges, joint restraints)
		Knowledge check
		Procedures
		Troubleshooting
		Skills check
	Reservoirs	Reservoirs
		Under drains
		Sump pumps
		Overflow structures
		Glenmore
	Prospect	
	Greenwood	



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Curriculum

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Curriculum



Competency Matrices

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Curriculum

Modules to Assign


Assignment Criteria

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Curriculum – Sample

Topic	Subtopic	Module	SC	Surf	Senior USF	USF	
Water Supply	Water mains	Water Main Basics	x	x	x	x	
		Types (i.e. according to sizes, materials, working pressures, etc.)	x	x	x	x	
		Custody transfer points	x	x	x	x	
		Pipe Connections and appertences (couplings, flanges, joint restraints)	x	x	x	x	
		Knowledge check	x	x	x	x	
		Procedures	x	x	x	x	
		Troubleshooting	x	x	x	x	
		Skills check	x	x	x	x	
		Reservoirs	Reservoirs	x	x	x	x
			Under drains				
			Sump pumps				
			Overflow structures				
			Glenmore	x	x	x	x
			Prospect	x	x	x	x
	Greenwood	x	x	x	x		
	Sasamat	x	x	x	x		
	Little Mountain	x	x	x	x		
	Kersland	x	x	x	x		




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Reference Material Analysis & Development Plan

- Gather existing training and reference material
- Rate the quality of the material
- Organize the reference material into modules and topics from the TOC
- Assign cumulative criticality ratings to the modules
- Estimate costs
- Develop training material based on criticality and cost




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Developmet Plan Example

Topic	Subtopic	Module	Quality Of Primary resources	Number of units	Development cost	Contractor manhours	Total cost	Total MV manhours	Cumulative priority (from OTAs)
MV Utility Basics	Metro Vancouver corporate overview	Metro Vancouver corporate overview	4	1	\$0	0	\$0	0	0
		Knowledge check	4	1	\$0	0	\$0	0	0
	Utilities systems overview	Utilities overview	3	0.33	\$4,125	43	\$4,563	18	0
		Organizational overview	1	0.33	\$8,250	86	\$9,250	19	
		Utilities Geographical layout	1	0.33	\$8,250	86	\$9,250	19	
		Knowledge check	4	1	\$0	0	\$0	0	
Management Systems Fundamentals	Utilities Project Management	2	3	\$56,250	585	\$56,719	85	330	



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Training Program Design - Exercise

- Pick one of the following three positions:
 1. Cabin Boy or Girl, Pirate Galleon, 1650 Carribean
 2. Ensign (or Red Shirt), Starship Enterprise, 2432
- For this position, create:
 - Task List (10-20 tasks)
 - Competency Matrix (3-5 roles)
 - Critical Task Analysis of 5 tasks
- If time permits:
 - Table of Contents
 - Curriculum



Questions?