



What We've Learned from Training 10,000 Operators

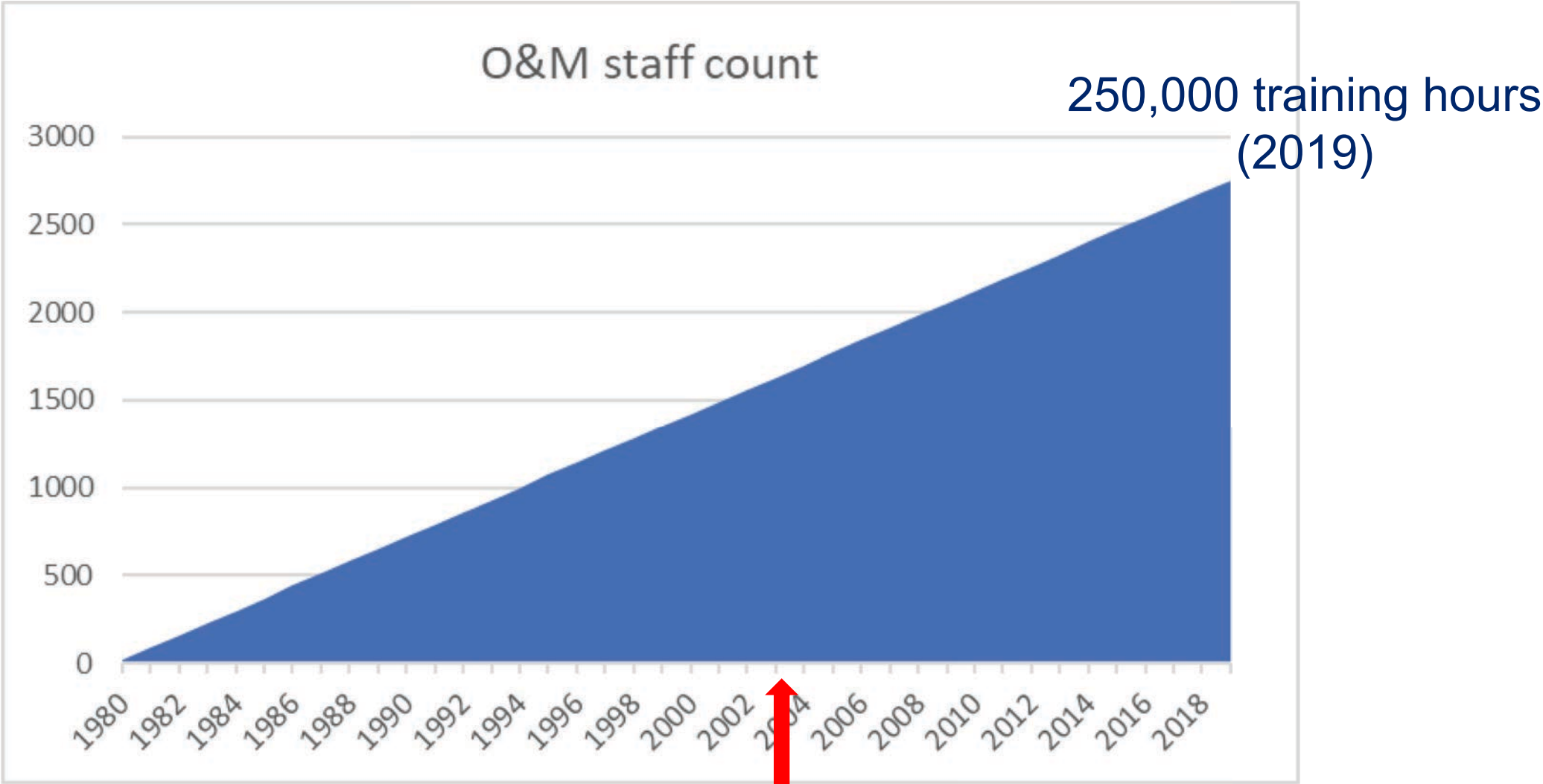
John H. Rickermann, PE

NEWEA Workforce Development Conference, 14 November 2019

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O&M Division Staff Count History



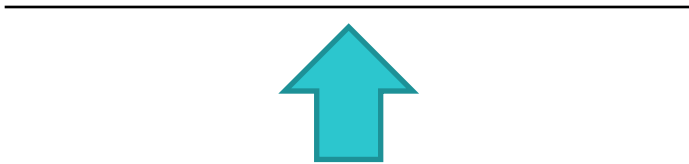
Lessons Learned After 40 Years of O&M Staff Training

- Why is training such a big deal?
- What methods work the best for knowledge transfer?
- How do we know what classes are a priority?
- When is a class a success?

Why is Training So Important?

You Are Required to Provide It

- Because the lawyers tell us it is...
 - HR requirements
 - Regulatory/compliance
 - Safety
- Operator and lab certifications



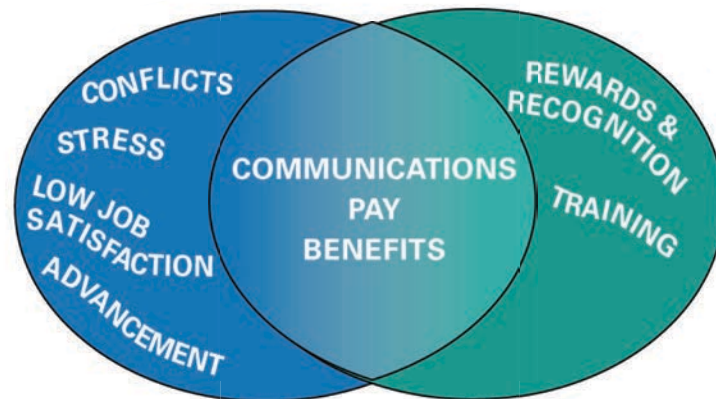
Your Organization Needs It

- Specific technical activities/functions/tools
- Mechanic, biosolids, C&D certifications
- Soft skills, management/leadership
- Culture, morale and team building



Why is Training So Important?

- Turnover related to employee investment
 - Expensive! HBR says ~1.5x salary
 - Only applies to staff that add value
 - Only applies if your staffing level is “right sized”
 - Only applies if other things are already in place (pay/benefits, morale, etc)
- OMI University pause = 25% turnover rate, low survey scores



What Methods Have Worked Best for O&M Training?

Ask Fred





Classroom



Field



Written

Operations Procedure		
Procedure Title: Check UV Lamp Power While in Use		
1. Check the Power Status of UV Lamps	Position	Complete
STATUS: UV reactor is required to be placed in STAND mode from normal operation.		
1.1 On the filter check that the UV reactor 180A switch is in ST (STAND) position.	OP	
1.2 Using the hand-held FLUORIMETER, check that there is power to all the lamps on the reactor.		
1.2.1 Power up the FLUORIMETER, at power is functioning properly the white tip should flash red.	OP	
NOTE: To reach all lamps a ladder or portable stair will need to be used.		
1.2.2 In the filter cabinet check the power of the tubes by placing the meter on top of the outside black circular fitting (see image below).	OP	
		
1.2.3 If there is power to the lamp the meter tip will be solid red in colour (see image below).	OP	
		

Video

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DRY TONS

Solids = 3100 lbs/day
day per week = 4
hours per day = 8

Solids (lbs/day) = $\frac{\text{solids (initial)} \times 7}{\text{days/week}} = \frac{3100 \times 7}{4} = 5425 \text{ lbs/d}$

... in lbs/hour = $\frac{\text{Solids (lb/d)}}{\text{h/d}} = \frac{5425}{8} = 678.125$

3:38 0:55

eLearning

Learn More About Us

Pump Series

With an understanding of the pump series, you will be able to understand the pump series and its components. This will help you to understand the pump series and its components.

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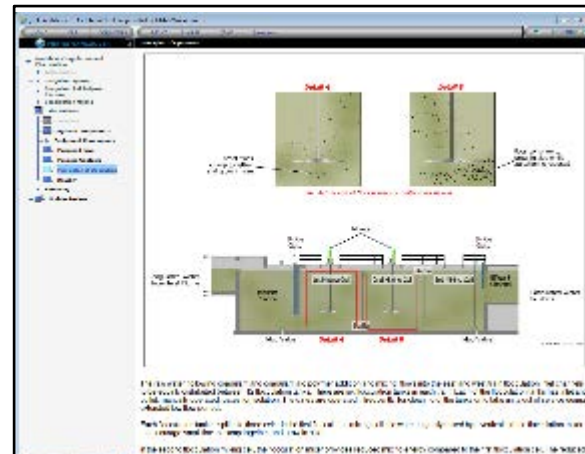
Video Procedures



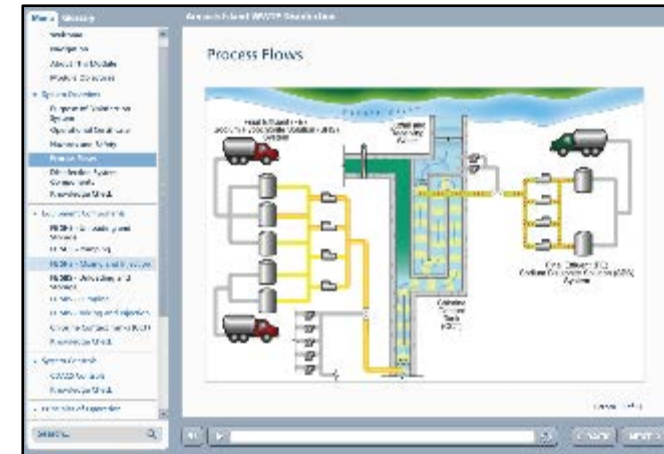
E-Learning Modules



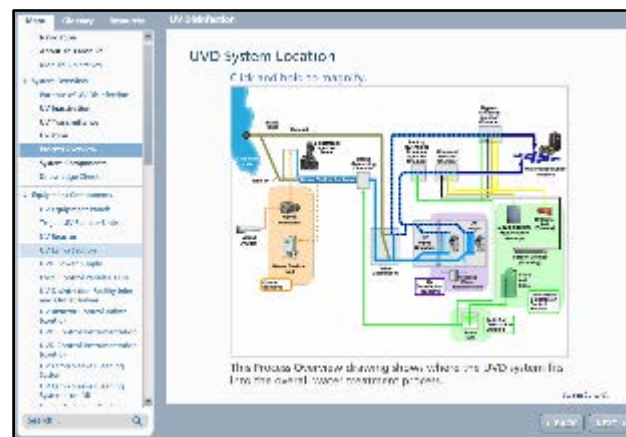
Menu



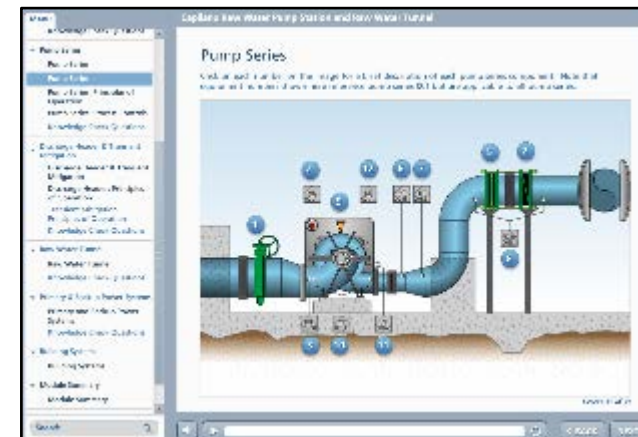
Coagulation & Flocculation



Final Effluent Disinfection



UV Disinfection



Raw Water Pump Station

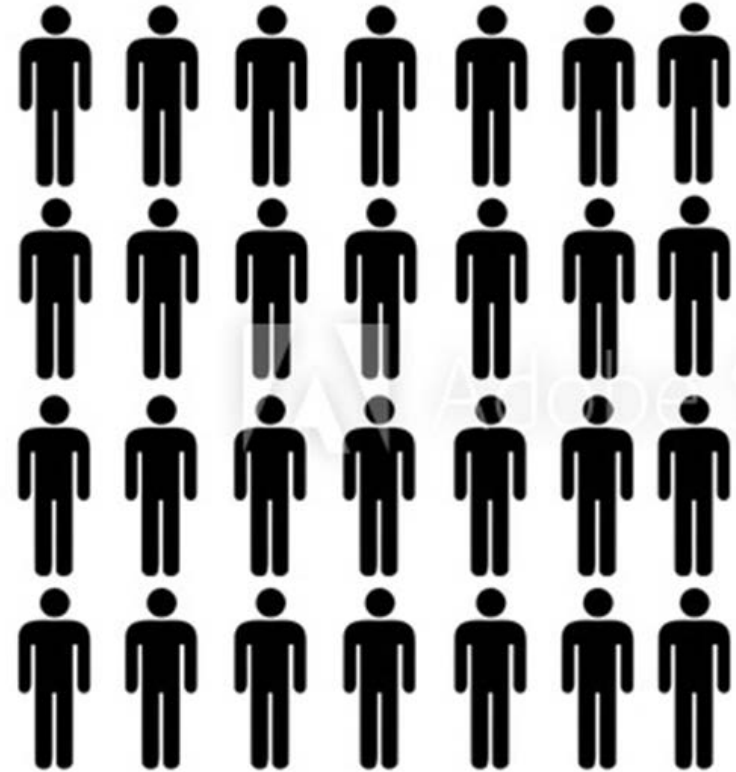
What Methods Have Worked Best for O&M Training?

- Engagement in the training
 - Document what field staff already knows and does well
 - Formalize OJT with Field Guides or video SOPs
 - Knowledge checks/quizzes
 - If culture building, executive engagement is a must



What Methods Have Worked Best for O&M Training?

- Leverage your in-house experts and outside resources

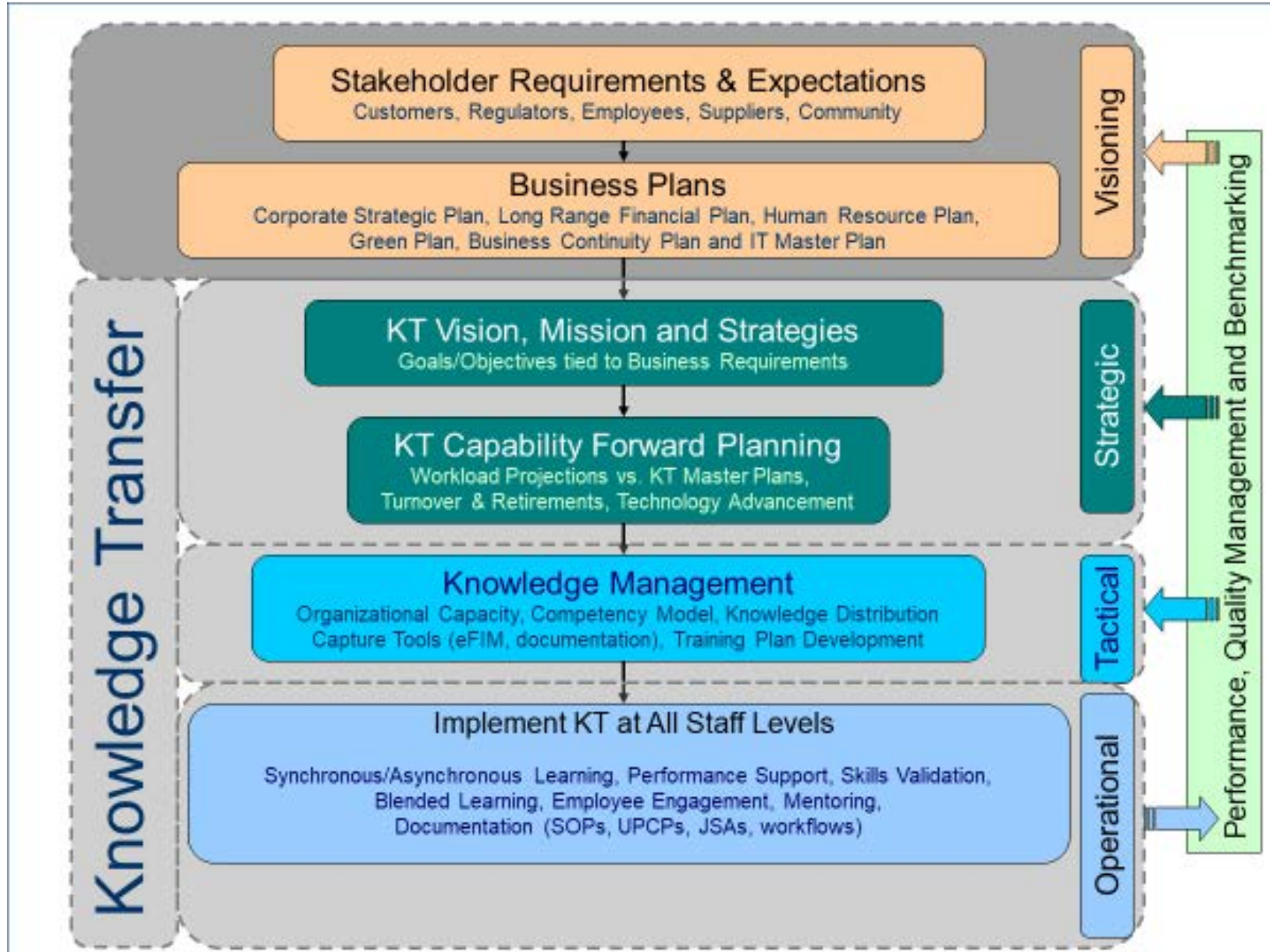


What Methods Have Worked Best for O&M Training?

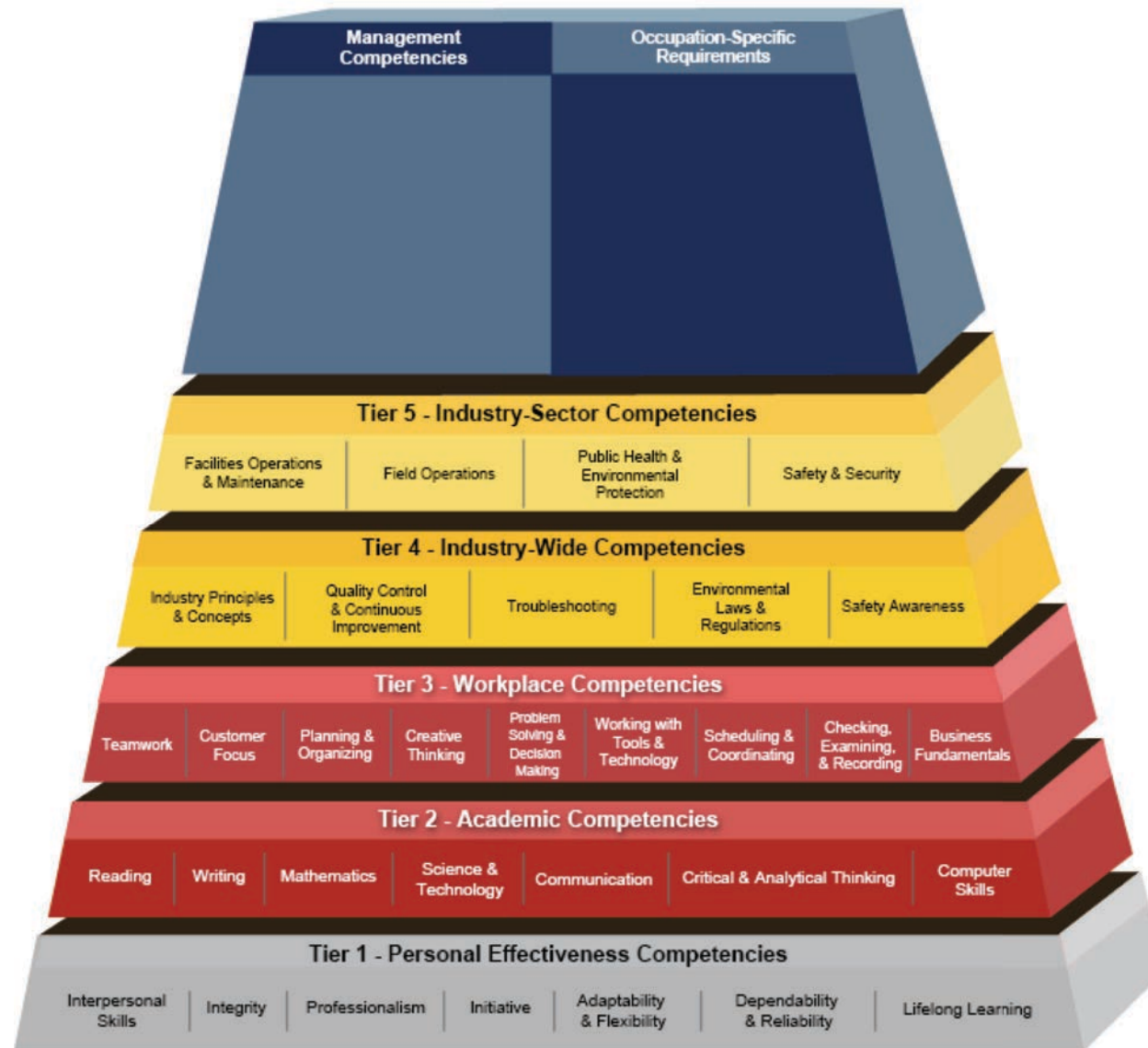
- WIIFM
 - Recognition, Insider or Branding
 - Certifications
 - Pay band increases or bonus
 - Promotion opportunities
 - Skills



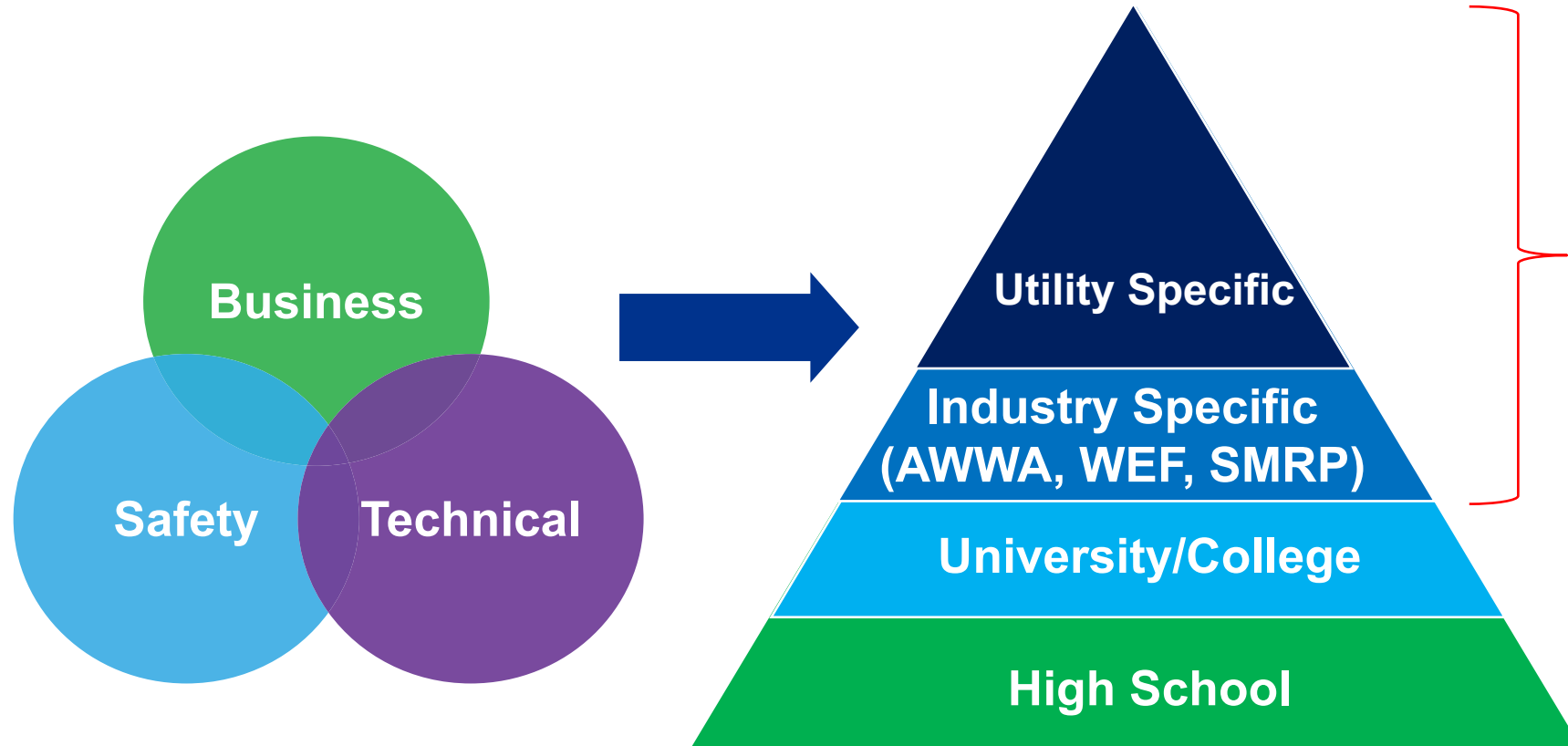
How Can You Know What Training is Needed?



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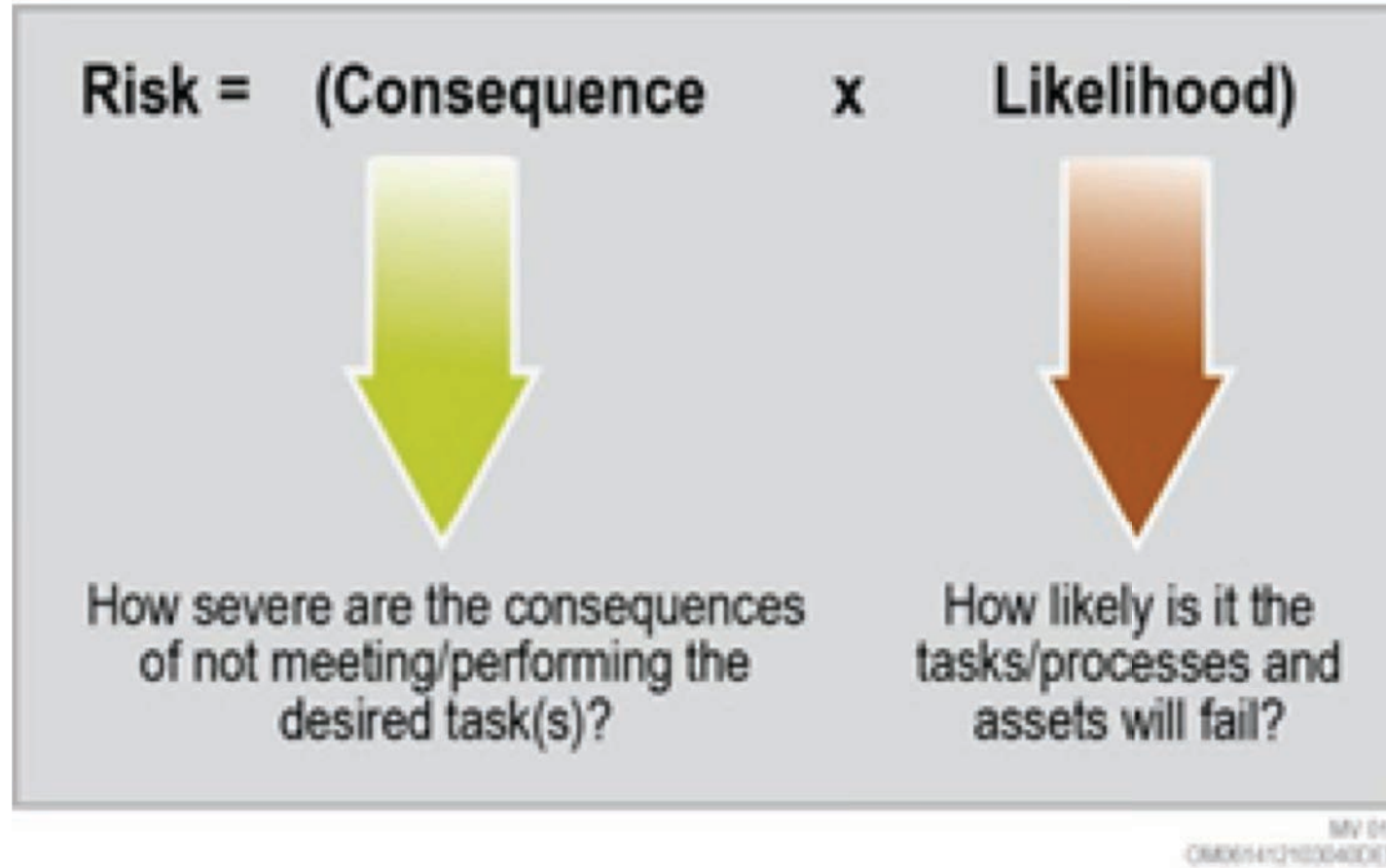
How Can You Know What Training is Needed?



How Can You Know What Training is Needed?

	Course Title	Training Hrs		Course Title	Training Hrs		Course Title	Training Hrs		Course Title	Training Hrs
Maintenance			Compliance and Reporting			Safety					
Maintenance	Backup Generators	1	Compliance and Reporting	Compliance and Ethics	2	Safety	Confined Space Entry	6	Safety	8 Hour Hazardous Waste Supervision Training	8
Maintenance	Lubrication basics	4	Compliance and Reporting	Little Ways to get in Big Trouble	1	Safety	Excavation Safety Training	4	Safety	8-Hour Hazardous Waste Refresher Training	8
Maintenance	Laser Alignment	4	Compliance and Reporting	Biosolids Land Application	1	Safety	Fall Protection	4	Safety	Awareness Training: Petroleum Storage	2
Maintenance	Vibration and Ultrasound Analysis	4	Compliance and Reporting	Part 503 Biosolids Rules	1	Safety	NFPA 70E Risk Cat 2 (Limited) Qual Person 2012	24	Safety	Awareness Training: Waste Management	2
Maintenance	ABC Need to Know - Blowers, Clarifiers, Dewatering, Headworks	2	Compliance and Reporting	Sampling	1	Safety	Electrical Safety Awareness	2	Safety	Fire Extinguishers	1
Maintenance	ABC Need to Know - Maintenance (I, II)	2	Compliance and Reporting	Understanding Your NPDES Permit	1	Safety	Lockout/Tagout	4	Safety	Process Safety Management	2
Maintenance	ABC Need to Know - Maintenance (III, IV)	2	Compliance and Reporting	ABC Need to Know - Laboratory (I, II)	4	Safety	New Contingent Worker Safety Orientation Training	2	Safety	Remediation Waste Training	2
Maintenance	ABC Need to Know - Pumps and Valves	2	Compliance and Reporting	ABC Need to Know - Laboratory (III, IV)	4	Safety	Smith System Small Vehicle Forward Motion	2	Safety	Traffic Control	2
Maintenance	Pump Repairs	4	Compliance and Reporting	Lab Safety	1	Safety	Smith System-Small Vehicle Backing	2	Safety	Vinyl Chloride	1
Maintenance	CMMS Planning and Scheduling	8	Compliance and Reporting	Operator and Lab Log Books	1	Safety	Positive mental health	3	Safety	Waste Management	2
Maintenance	CMRT Exam Prep	4	Compliance and Reporting	Standards	1	Safety	Blood borne Pathogens	1	Safety	AED Training 2 year	2
Maintenance	Maintenance Troubleshooting 1	2	Compliance and Reporting	Chain of Custody - Wastewater	0.5	Safety	Confined Space Awareness	1	Safety	Aerial Lifts	1
Maintenance	Maintenance Troubleshooting 2	2	Compliance and Reporting	Chain of Custody - Water	0.5	Safety	New Employee Safety Orientation	2	Safety	Awareness Training: Chemical Mgmt. at Constr Sites	2
Maintenance	Thermography	4	Compliance and Reporting	Ammonia	0.5	Safety	Personal Protective Equipment	2	Safety	CPR 2 Year	3
Maintenance	CMRP Exam Prep	8	Compliance and Reporting	BOD Test 1	0.5	Safety	Scaffold Safety	4	Safety	Drug Free Workplace Training	1
Maintenance	<i>Maintenance Connection</i> User Basics	16	Compliance and Reporting	BOD Test 2	0.5	Safety	Stairways and Ladders	2	Safety	Forklift Safety	1
Maintenance	Predictive Maintenance Basics	4	Compliance and Reporting	Supporting State Compliance Inspections	0.5	Safety	Beyond Zero	3	Safety	HSE Employee Commitment Statement	0.5
Maintenance	CRL Exam Prep	24	Compliance and Reporting	Dilutions	0.5	Safety	Back Safety	1	Safety	Scissor Lift	1
			Compliance and Reporting	MDL Studies	1	Safety	Field Awareness Safety Training	2	Safety	Sunburns	1
WW Treatment and Process Control			Compliance and Reporting	Auditor Skills	2	Safety	First Aid (Red Cros)	3	Safety	16 Hour Asbestos O & M Course	16
Operations	ABC Need to Know - Disinfection	2	Compliance and Reporting	Fluoride	0.5	Safety	H2S Awareness	1	Safety	2 Hour Asbestos Pipe Repair Refresher	2
Operations	Operator Rounds - WWTP	2	Compliance and Reporting	ortho-Phosphate	0.5	Safety	Hand Safety	1	Safety	4 Hour Asbestos Building Inspector Refresher	4
Operations	Chlorine Dosage and Residual	1				Safety	Laboratory Safety	4	Safety	4 Hour Asbestos O & M refresher	4
Operations	ABC Need to Know - Secondary/Tertiary Treatment	2	Other Technical Topics			Safety	Manual Lifting	1	Safety	8 Hour Asbestos Abatement Supervisor Refresher	8
Operations	ABC Need to Know - Solids Handling	2	Other Technical Topics	Cybersecurity	1	Safety	Ontario Awareness Training - Supervisor	3	Safety	8 Hour Asbestos Training Refresher	8
Operations	Operator Rounds - Pump Stations	2	Other Technical Topics	Math for Operators (I, II)	4	Safety	OSHA 502 Course - Update for Construction Trainers	4	Safety	Asbestos Awareness	1
Operations	Wasting Rate Calculations and Control	2	Other Technical Topics	Math for Operators (III)	4	Safety	OSHA 503 Course - Update for Gen Ind Trainers	4	Safety	Drum Handling	1
Operations	ABC Need to Know - Preliminary and Primary Treatment	2	Other Technical Topics	Math for Operators (IV)	4	Safety	Safety Coordinator Construction	4	Safety	Hazard Communication	1
Operations	Aeration Basins	1	Other Technical Topics	ABC Need to Know - Administration (I, II)	2	Safety	Safety Coordinator Construction Refresher	2	Safety	Benzene	1
Operations	Chemical Feed Dosage Math	1	Other Technical Topics	ABC Need to Know - Administration (III, IV)	2	Safety	Safety Coordinator/Hazardous Waste	4	Safety	Awareness Training: Air Compliance	1
Operations	Odor Control	1	Other Technical Topics	Commissioning	1	Safety	Safety Coordinator/Hazardous Waste Refresher	2	Safety	Dangerous Goods Shipping	1
Operations	Primary Clarifiers	1	Other Technical Topics	Operability Design Reviews for O&M Staff	2	Safety	Welding/Hot work	4	Safety	Lead	1
Operations	Screening and Grit Removal	1				Safety	WHMIS	2	Safety	Awareness Tra: Constr Site Storm Water Runoff Mgmt	2
Operations	Secondary Clarifiers	1	Frontline Management			Safety	Ergonomics Awareness	1	Safety	Awareness Training: Environmental Program	1
Operations	Trickling Filter Operation and Control	1	Management	Ethics and reporting (regulatory)	3	Safety	Initial Safety Coordinator Course	4	Safety	Awareness Training: Natural & Cultural Resources	1
Operations	Dewatering	1	Management	Ethics (corporate)	1	Safety	Noise/ Hearing Conservation	1	Safety	Battery Recycling Training	0.5
Operations	<i>Hach WIMS</i> User Basics	4	Management	Hiring and onboarding	2	Safety	Ontario Awareness Training - Worker	3	Safety	Bear Awareness Trainings	0.5
Operations	Membrane Bioreactor Operation and Control	1	Management	Leading effective teams	2	Safety	OSHA 10-hr Construction Safety Awareness	10	Safety	Behavior Based Loss Prevention System (BBLPS)	1
Operations	Sampling - grab, composite, online	1	Management	Discipline and termination	1.5	Safety	OSHA 10-Hr General Industry Course	10	Safety	Globally Harmonized System (GHS)	1
Operations	Sludge Digestion	1	Management	Advanced project accounting	4	Safety	OSHA 30-hr Construction Course	30	Safety	Safe Behavior Observation Training	1
Operations	Tertiary Filters	1	Management	Purchasing and procurement	2	Safety	OSHA 30-Hr General Industry Course	30			
Operations	Anaerobic Digestion	1	Management	Managing CBAs	4	Safety	OSHA 510 Construction Course	8			
Operations	Belt Filter Press Optimization	1	Management	Conflict management and resolution	3	Safety	24-Hour Hazardous Waste	24			
Operations	Biological Nutrient Removal - Nitrogen	1	Management	Project accounting 1	2	Safety	40-Hour Hazardous Waste	40			
Operations	Meter Calibration - pH, DO	2	Management	Project accounting 2	2	Safety	40-Hour Hazardous Waste - OJT	40			
Operations	Microscopes and Microbiology	4	Management	Consious Inclusion	4						
Operations	Polymer Jar Testing and Dose Calcs	2	Management	Staff development 1	4						
Operations	Process Control Trending	2	Management	Staff development 2	4						
Operations	Sequencing Batch Reactor Operation and Control	1	Management	Annual reports	1						
Operations	Anoxic Zones	1	Management	Culture building and team dynamics	4						
Operations	Biological Nutrient Removal - Phosphorus	1	Management	Presentation skills workshop	16						
Operations	Optimization and Sustainability	2	Management	MBTA personality profiling (managers)	6						
Operations	You Can't Improve What You Don't Measure	1	Management	BEST personality profiling (staff)	2						
Operations	Chemically Enhanced Primary Treatment	1	Management	Abundance model	3						

Keeping Your Training Programs Alive – Setting Priorities



Keeping Your Training Programs Alive - Priorities

Subject Area	Priority Measures
Safety	Recordable incident statistics, near miss data, lethality, OSHA data
Laboratory/Compliance	Internal audit findings, regulator focus, new rules
Operations	Process control measures, certification exam requirements
Maintenance	Key performance metrics, repair costs, retention
Soft Skills	HR records, employee surveys
Culture	Organizational goals
Management	Policy changes, internal logistical issues, legal

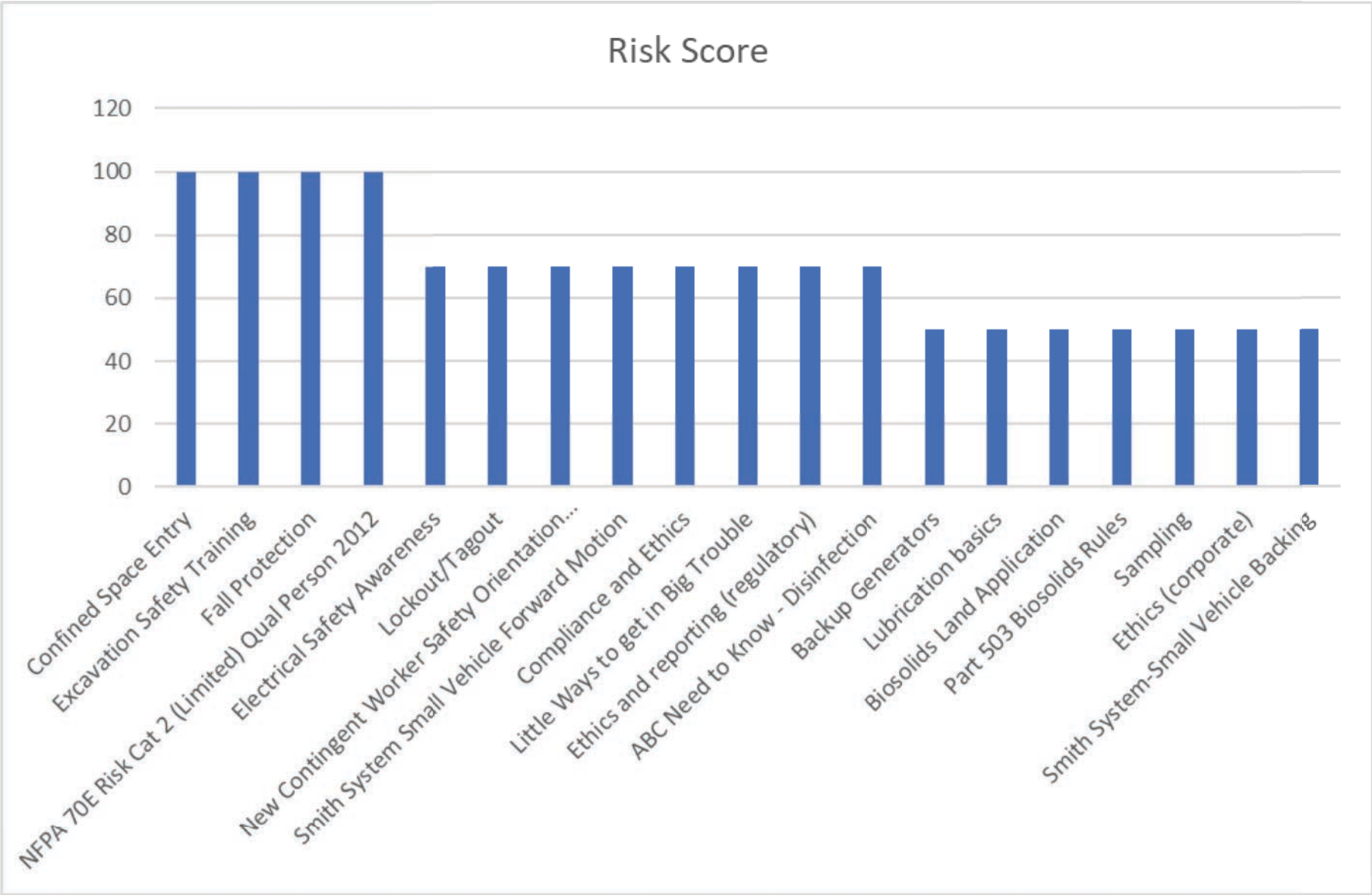
Example Risk Scoring for Training Courses

	Course Title	Training Hrs	Likelihood 1-10	Consequences 1-10	Risk Score 1-100	Verification Method
Maintenance						
Maintenance	Backup Generators	1	5	10	50	course quiz
Maintenance	Lubrication basics	4	5	10	50	certification test
Maintenance	Laser Alignment	4	7	7	49	certification test
Maintenance	Vibration and Ultrasound Analysis	4	5	7	35	certification test
Maintenance	ABC Need to Know - Blowers, Clarifiers, Dewatering, Headworks	2	5	5	25	certification test
Maintenance	ABC Need to Know - Maintenance (I, II)	2	5	5	25	certification test
Maintenance	ABC Need to Know - Maintenance (III, IV)	2	5	5	25	certification test
Maintenance	ABC Need to Know - Pumps and Valves	2	5	5	25	certification test
Maintenance	Pump Repairs	4	7	3	21	instructor sign-off
Maintenance	CMMS Planning and Scheduling	8	5	3	15	instructor sign-off
Maintenance	CMRT Exam Prep	4	3	5	15	certification test
Maintenance	Maintenance Troubleshooting 1	2	3	5	15	instructor sign-off
Maintenance	Maintenance Troubleshooting 2	2	3	5	15	instructor sign-off
Maintenance	Thermography	4	3	5	15	certification test
Maintenance	CMRP Exam Prep	8	3	3	9	certification test
Maintenance	<i>Maintenance Connection</i> User Basics	16	3	3	9	online quiz
Maintenance	Predictive Maintenance Basics	4	3	3	9	instructor sign-off
Maintenance	CRL Exam Prep	24	1	3	3	certification test

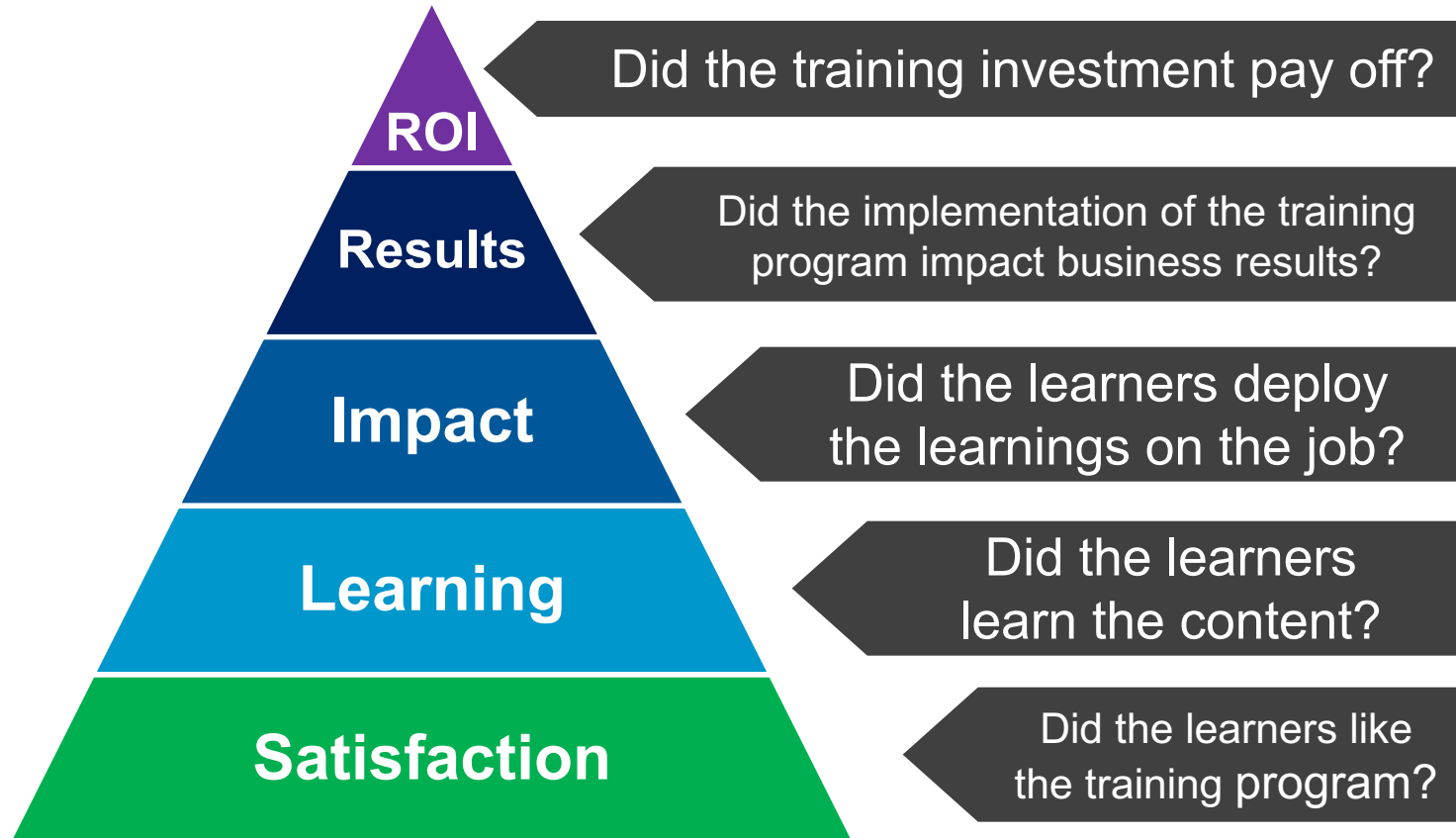
200 Training Classes (Wastewater Plants) – Not Created Equal!



Top 20 Training Classes by Priority (Wastewater Plants)



Keeping Your Training Programs Alive – Metrics Matter!



Objective Measures– Results

Topic	Modules Given	Student Attendees	Knowledge Check Pass Rate, %
Train the Trainer	2	6	NA
Grade II/III			
Math for WW Operators	4	9	58%
Laboratory Analysis	1	10	87%
Equipment Evaluation & Maintenance	2	10	89%
Equipment Operation & Process Control	4	11	66%
Security, Safety and Administrative Procedures	1	11	66%
Pretest	1	-	-
Grade IV			
Math for WW Operators	3	2	60%
Laboratory Analysis	2	6	73%
Equipment Evaluation & Maintenance	1	5	86%
Equipment Operation & Process Control	5	4	85%
Security, Safety and Administrative Procedures	1	9	85%
Pretest	1	13 (6 did not attempt)	12 passed (80% or higher)

Subjective Measures - Student Satisfaction

Question	Weighted Score (1-4 scale)
Instructor: knowledgeable of course content	3.31
Instructor: knowledgeable of WW treatment	4.00
Instructor: kept student interest	3.31
Instructor: provided examples, experiences	3.62
Instructor: answered student questions	3.69
Content: adequate time for sessions	2.38
Content: easy to understand	3.15
Content: adequate time for exercises	2.46
Content: knowledge gained	3.23
Overall: average course score	3.24

Conclusions

- Training supports multiple objectives – technical, cultural, legal
- Pay attention to teaching methods – audience driven
- Identify and prioritize classes – use risk, value, etc.
- Measure results to prove success – but beware the low bar

Thank You!

Questions?

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