Project Title:	Smart Meter Infrastructure (Customer Meter)		Socket	A Base	A Base
Project Short Name:		Self-Contained Meter	1 Phase	✓	
Project Manager:	[redacted]		3 Phase	✓	
		CT Meter	1 Phase (5K)	✓	
			3 Phase (40K)	✓	✓

s.22

HAZARD ORGANIZATION			ACCIDENT SEQUENCE				RISK ANALYSIS										RESIDUAL RISK ANALYSIS									CONTROL MEASURE MONITORING				
Hazard ID No.	Hazard Type (select)	Equipment / Area / System	Undesirable Event / Failure Modes	Cause	Consequence	Current Control Measures	Worker Severity Level (select)	Worker Freq. (select)	Worker Risk Level (auto)	Public Severity Level (select)	Public Freq. (select)	Public Risk Level (auto)	Enviro Severity Level (select)	Enviro Freq. (select)	Enviro Risk Level (auto)	Proposed Control Measures Under Consideration	Worker Residual Severity Level (select)	Worker Residual Freq. (select)	Worker Residual Risk (auto)	Public Residual Severity (select)	Public Residual Freq. (select)	Public Residual Risk (auto)	Residual Enviro Severity Level (select	Enviro. Freq. (select from list)	Enviro Risk Level (auto)	Control Measure Status (select)	Next Action Date	Type of Completed Control Measures (select)	Risk Reduction Comments / Documentation	Control Owner (name / group)
Existing Hazards : Design																														
Electronic Self-Contained (1Ph & 3 Ph) Socket Type Meter: Design																														
1	System Failure: (Electrical) Equipment Failure	Electronic Self Contained (1Ph & 3Ph) Socket Type Meter (<=200A, 600V)	- Explosion of meter (Catastrophic failure of MOV-Metal Oxide Varistor) - Projectiles off of the explosion hit a member of the public	High energy surge overloads meter caused by BCH system - Contact of transmission lines (i.e. 69kV) to distribution line (i.e. 25kV or 12kV), or vice versa, caused by MVA, fallen tree, etc	Public Injury Property damage Public nm# 79529 [2009] - Digital CIS type meter blackened & blown from meter bases. Electrical mechanical meter no issue. Customer digital equipment damaged and power outlet blackened (potential fire) -Mtg Aug 24, 2012 (No fires or injuries)	None Identified				S6 - Fatality	L2 - 1 / 100,000 years	4				Perform studies on incidents at Mission - perhaps there is type of meter that is more prone to failure										No Longer Required		System Controls - Competence		
1																Better meter design - MOV more tolerant to high energy				S6 - Fatality	L1 - 1 / 1,000,000 years	3				In Service		Engineered Controls - Dissipate	ITRON meters have better over-voltage / surge protection design (need specification / test report)	
1																Better meter design - Contain explosion with barrier				S5 - Permanent disability	L2 - 1 / 100,000 years	3				Not Selected		Engineered Controls - Contain	Not practical	
1																Better meter design - Dissipate explosion with a break-off plate (directs explosion)				S6 - Fatality	L1 - 1 / 1,000,000 years	3				Not Selected		Design Controls - Substitute	There was a plug (weak spot) in sensitive area that could be used as "pressure relieff" or "sacrifical part" but Measurement Canada disallowed such plug and it is now welded shut	
																Minimize Distribution Underbuild Design				S6 - Fatality	L1 - 1 / 1,000,000 years	3				In Service		Design Controls - Minimize	Need confirmation [redacted]	
1																System/ primary surge arresters - Distribution surge arrester (ZnO) failure rate at 0.1%, while high voltage is even lower (ref. *INMR Vol. 11 No. 1, January-February 2003*)				S6 - Fatality	L0 - 1 / 10,000,000 yrs	2				In Service		Engineered Controls - Dissipate	s.22 Need confirmation [redacted] s.22	
1																Individual home surge arresters				S6 - Fatality	L0 - 1 / 10,000,000 yrs	2				Not Selected		Engineered Controls - Dissipate	Non-effective, typical home surge arresters are for short duration surge, this type of fault will have longer duration	
1																Fuse on secondary transformer				S6 - Fatality	L0 - 1 / 10,000,000 yrs	2				Not Selected		Design Controls - Eliminate	Not a BCH or North American practice	

HAZARD ORGANIZATION			ACCIDENT SEQUENCE				RISK ANALYSIS										RESIDUAL RISK ANALYSIS									CONTROL MEASURE MONITORING				
Hazard ID No.	Hazard Type (select)	Equipment / Area / System	Undesirable Event / Failure Modes	Cause	Consequence	Current Control Measures	Worker Severity Level (select)	Worker Freq. (select)	Worker Risk Level (auto)	Public Severity Level (select)	Public Freq. (select)	Public Risk Level (auto)	Enviro Severity Level (select)	Enviro Freq. (select)	Enviro Risk Level (auto)	Proposed Control Measures Under Consideration	Worker Residual Severity Level (select)	Worker Residual Freq. (select)	Worker Residual Risk (auto)	Public Residual Severity (select)	Public Residual Freq. (select)	Public Residual Risk (auto)	Residual Enviro Severity Level (select	Enviro. Freq. (select from list)	Enviro Risk Level (auto)	Control Measure Status (select)	Next Action Date	Type of Completed Control Measures (select)	Risk Reduction Comments / Documentation	Control Owner (name / group)
2	System Failure: (Electrical) Equipment Failure	Electronic Self Contained (1Ph & 3Ph) Socket Type Meter (<=200A, 600V)	Fire at customer home initiated at meter (outside of house)	High energy surge overloads meter caused by BCH system - Contact of transmission lines (i.e. 69kV) to distribution line (i.e. 25kV or 12kV), or vice versa, caused by MVA, fallen tree, etc	Public Injury Property damage Public nm# 79529 [2009] - Digital CIS type meter blackened & blown from meter bases. Electrical mechanical meter no issue. Customer digital equipment damaged and power outlet blackened (potential fire)	None identified				S6 - Fatality	L3 - 1 / 10,000 years)	4				System/ primary surge arresters - Distribution surge arrester (ZnO) failure rate at 0.1%, while high voltage is even lower (ref. *INMR Vol. 11 No. 1, January-February 2003*)				S6 - Fatality	L0 - 1 / 10,000,000 yrs	2			In Service		Engineered Controls - Dissipate	Need confirmation [redacted] s.22	s.22
																Minimize Distribution Underbuild Design				S6 - Fatality	L0 - 1 / 10,000,000 yrs	2			In Service		Design Controls - Minimize	Need confirmation [redacted]	
2																Individual home surge arresters				S6 - Fatality	L0 - 1 / 10,000,000 yrs	2			Not Selected		Engineered Controls - Dissipate	Non-effective, typical home surge arresters are for short duration surge, this type of fault will have longer duration	
2																Fuse on secondary transformer				S6 - Fatality	L0 - 1 / 10,000,000 yrs	2			Not Selected		Design Controls - Eliminate	Not a BCH or North American practice	
2																Use non-flammable material in the meter				S6 - Fatality	L2 - 1 / 100,000 years	4			In Service		Design Controls - Minimize	ITRON meters have UL XXX Flammability rating Meters are not UL / CSA certified, but this may change to consider ANSI stds as equivalent	
2																Establish safety inspection programs on all meters periodically to ensure installations are still compliant to codes (i.e. Area around outlet must be cleared to 1 m to minimize fuel for burning (i.e. vegetation))				S6 - Fatality	L2 - 1 / 100,000 years	4			Still in Review		Design Controls - Minimize	s.22 [redacted]	
3	System Failure: (Electrical) Equipment Failure	Electronic Self Contained (1Ph & 3Ph) Socket Type Meter (<=200A, 600V)	Fire inside customer home initiated at home outlet (in house)	High energy surge overloads meter caused by BCH system - Contact of transmission lines (i.e. 69kV) to distribution line (i.e. 25kV or 12kV), or vice versa, caused by MVA, fallen tree, etc	Public Injury Property damage Public nm# 79529 [2009] - Digital CIS type meter blackened & blown from meter bases. Electrical mechanical meter no issue. Customer digital equipment damaged and power outlet blackened (potential fire)	None identified				S6 - Fatality	L4 - 1 / 1,000 years	5				System/ primary surge arresters - Distribution surge arrester (ZnO) failure rate at 0.1%, while high voltage is even lower (ref. *INMR Vol. 11 No. 1, January-February 2003*)				S6 - Fatality	L1 - 1 / 1,000,000 years	3			In Service		Engineered Controls - Dissipate	s.22 Need confirmation [redacted] s.22	
																Minimize Distribution Underbuild Design				S6 - Fatality	L0 - 1 / 10,000,000 yrs	2			In Service		Design Controls - Minimize	Need confirmation [redacted]	
3																Individual home surge arresters				S6 - Fatality	L1 - 1 / 1,000,000 years	3			Not Selected		Engineered Controls - Dissipate	Non-effective, typical home surge arresters are for short duration surge, this type of fault will have longer duration	
3																Fuse on secondary transformer				S6 - Fatality	L1 - 1 / 1,000,000 years	3			Not Selected		Design Controls - Eliminate	Not a BCH or North American practice	

HAZARD ORGANIZATION			ACCIDENT SEQUENCE				RISK ANALYSIS									RESIDUAL RISK ANALYSIS								CONTROL MEASURE MONITORING				
Hazard ID No.	Hazard Type (select)	Equipment / Area / System	Undesirable Event / Failure Modes	Cause	Consequence	Current Control Measures	Worker Severity Level (select)	Worker Freq. (select)	Worker Risk Level (auto)	Public Severity Level (select)	Public Freq. (select)	Public Risk Level (auto)	Enviro Severity Level (select)	Enviro Freq. (select)	Enviro Risk Level (auto)	Proposed Control Measures Under Consideration	Worker Residual Severity Level (select)	Worker Residual Freq. (select)	Worker Residual Risk (auto)	Public Residual Severity (select)	Public Residual Freq. (select)	Public Residual Risk (auto)	Residual Enviro Severity Level (select	Enviro. Freq. (select from list)	Enviro Risk Level (auto)	Control Measure Status (select)	Next Action Date	Type of Completed Control Measures (select)	Risk Reduction Comments / Documentation	Control Owner (name / group)
3																Establish safety inspection programs on all meters periodically to ensure installations are still compliant to codes (i.e. Area around outlet must be cleared to 1 m to minimize fuel for burning (i.e. vegetation))				S6 - Fatality	L3 - 1 / 10,000 years)	4				Still in Review		Design Controls - Minimize	s.22	[redacted]
4	System Failure: (Electrical) Equipment Failure	Electronic Self Contained (1Ph & 3Ph) Socket Type Meter (<=200A, 600V)	- Fire/ Propagation of fault to meter or meter base	Other system faults (i.e. pole transformer failures, UG cable fault, etc) nm #65974 [2006], 73937 [2007]	Public Injury Property damage	None identified				S6 - Fatality	L4 - 1 / 1,000 years	5				System/ primary surge arresters - Distribution surge arrester (ZnO) failure rate at 0.1%, while high voltage is even lower (ref. *INMR Vol. 11 No. 1, January-February 2003*)				S6 - Fatality	L1 - 1 / 1,000,000 years	3				In Service		Design Controls - Minimize	Need confirmation [redacted] s.22	
																Minimize Distribution Underbuild Design				S6 - Fatality	L0 - 1 / 10,000,000 yrs	2				In Service		Design Controls - Minimize	Need confirmation [redacted]	
5	Work Environment: High Electrical Potential	Electronic Self Contained (1Ph & 3Ph) Socket Type Meter (<=200A, 600V)	Fire in meter	Meter measuring on the line side and fault current for this line can reach above 10,000A, which can damage the meter Nowhere in design shows that it has considered fault current in designing meter location	Worker injury	Only Self Contained meter that is rated 300V or less and current 200A or less with fault current less than 10,000A can be wired hot Ref: *Requirement for Secondary Voltage Revenue Metering (730V and less), Jan.28, 2010*				S6 - Fatality	L3 - 1 / 10,000 years)	4				Perform through fault testing(20 to 25kV) with meters				S1 - Near miss	L4 - 1 / 1,000 years	1				In Service			s.22 @ 2 to 3 kA, disconnect switch become fused @ extreme fault levels, testing is inconclusive Need test report / documentation	
																Meters are designed to ANSI standards which can withstand 10,000A for 4 cycles (breakers would activate within 1 cycle) - EXCEPT IN DOWNTOWN VICTORIA				S1 - Near miss	L4 - 1 / 1,000 years	1				In Service			s.22 Need documentation from [redacted]	
																Special Distribution instructions to install NETWORK meters, and not typical meters for Downtown Victoria				S1 - Near miss	L5 - 1 / 100 years	1				In Service			s.22 Need reference to DI from [redacted]	
Common to ALL Existing CT Meters: Design																														

HAZARD ORGANIZATION			ACCIDENT SEQUENCE				RISK ANALYSIS									RESIDUAL RISK ANALYSIS									CONTROL MEASURE MONITORING				
Hazard ID No.	Hazard Type (select)	Equipment / Area / System	Undesirable Event / Failure Modes	Cause	Consequence	Current Control Measures	Worker Severity Level (select)	Worker Freq. (select)	Worker Risk Level (auto)	Public Severity Level (select)	Public Freq. (select)	Public Risk Level (auto)	Enviro Severity Level (select)	Enviro Freq. (select)	Enviro Risk Level (auto)	Proposed Control Measures Under Consideration	Worker Residual Severity Level (select)	Worker Residual Freq. (select)	Worker Residual Risk (auto)	Public Residual Severity (select)	Public Residual Freq. (select)	Public Residual Risk (auto)	Residual Enviro Severity Level (select	Enviro. Freq. (select from list)	Enviro Risk Level (auto)	Control Measure Status (select)	Next Action Date	Type of Completed Control Measures (select)	Risk Reduction Comments / Documentation	Control Owner (name / group)
6	System Failure: (Electrical) Equipment Failure	1 phase & 3 phase CT Meter	- Fire caused by excessive heat due to overcurrent in the meter	High energy surge overloads meter caused by BCH system - Contact of transmission lines (i.e. 69kV) to distribution line (i.e. 25kV or 12kV), or vice versa, caused by MVA, fallen tree, etc	Public Injury Property damage Public nm# 79529 [2009] - Digital CIS type meter blackened & blown from meter bases. Electrical mechanical meter no issue. Customer digital equipment damaged and power outlet blackened (potential fire)	None Identified				S6 - Fatality	L4 - 1 / 1,000 years	5				Perform studies on incidents at Mission - perhaps there is type of meter that is more prone to failure										No Longer Required		System Controls - Competence		
6																System/ primary surge arresters - Distribution surge arrester (ZnO) failure rate at 0.1%, while high voltage is even lower (ref. *INMR Vol. 11 No. 1, January-February 2003*)				S6 - Fatality	L1 - 1 / 1,000,000 years	3				In Service		Engineered Controls - Dissipate		
6																Individual home surge arresters				S6 - Fatality	L1 - 1 / 1,000,000 years	3				Not Selected		Engineered Controls - Dissipate		
6																Fuse on secondary transformer				S6 - Fatality	L1 - 1 / 1,000,000 years	3				Not Selected		Design Controls - Eliminate		
6																Use non-flammable material in the meter				S6 - Fatality	L3 - 1 / 10,000 years)	4				Still in Review		Design Controls - Minimize		
Existing Electronic CT (1Ph) Socket Type Meter: Design																														
Existing Electronic CT (3Ph) A-Base Type Meter: Design																														
Existing Hazards : Operation and Maintenance																														
Electronic Self-Contained (1Ph & 3 Ph) Socket Type Meter: Operation & Maintenance																														
7	System Failure: (Electrical) Equipment Failure	Electronic Self Contained (1Ph & 3Ph) Socket Type Meter (<=200A, 600V)	Worker exposed to arc flash	Installing / pulling meter under load nm # 83004 [2010] - installing meter, arc flash - PLT sustained burns on forearm	Worker injury	Customers are instructed to have their main switch OPEN prior to meter connection (customers may not comply) More a problem for disconnect. PPE (safety glasses, rubber gloves)	S3 - Temporary disability	L5 - 1 / 100 years	3							Energy (Not Demand) Smart meters - Option to use disconnect switch to disconnect meter from any possible load connections before pulling or installing meter. (although the normal practice is to request customer to open their main switch) - there are other logistics problems with using the disconnect switch ~~- Similarly for installation, can install meter with disconnect switch OPEN.~~	S0 - Near miss	L5 - 1 / 100 years	1							Still in Review		Design Controls - Minimize		
																Standard procedure is to ask customer to open their main switch (remove the load), do the work with the meter, and then reinstate the load gradually	S0 - Near miss	L5 - 1 / 100 years	1							In Service		System Controls - Competence		

HAZARD ORGANIZATION			ACCIDENT SEQUENCE				RISK ANALYSIS										RESIDUAL RISK ANALYSIS									CONTROL MEASURE MONITORING				
Hazard ID No.	Hazard Type (select)	Equipment / Area / System	Undesirable Event / Failure Modes	Cause	Consequence	Current Control Measures	Worker Severity Level (select)	Worker Freq. (select)	Worker Risk Level (auto)	Public Severity Level (select)	Public Freq. (select)	Public Risk Level (auto)	Enviro Severity Level (select)	Enviro Freq. (select)	Enviro Risk Level (auto)	Proposed Control Measures Under Consideration	Worker Residual Severity Level (select)	Worker Residual Freq. (select)	Worker Residual Risk (auto)	Public Residual Severity (select)	Public Residual Freq. (select)	Public Residual Risk (auto)	Residual Enviro Severity Level (select	Enviro. Freq. (select from list)	Enviro Risk Level (auto)	Control Measure Status (select)	Next Action Date	Type of Completed Control Measures (select)	Risk Reduction Comments / Documentation	Control Owner (name / group)
																Another standard practice is to ask PLT to disconnect from the primary or secondary side if necessary	S0 - Near miss	L5 - 1 / 100 years	1							In Service		System Controls - Competence		
7																Wear face shield	S2 - Treatment by medical professional	L5 - 1 / 100 years	2							In Service		PPE - Personal Barrier		
7																Use meter puller to pull meter (adds distance between worker and flash)	S2 - Treatment by medical professional	L5 - 1 / 100 years	2							In Service		System Controls - Competence		
Common to ALL Existing CT Meters: Operation and Maintenance																														
8	Work Environment: High Electrical Potential	1 phase & 3 phase CT Meter	Worker exposed to electric potential	Meter was not shorted before removal causing a build up of voltage on the terminals	Worker injury	Red label on meter noting that this is a CT meter PPE (rubber gloves)	S4 - Permanent disability	L5 - 1 / 100 years	3							Self shorting meter socket (meter will automatically be shorted when meter is being pulled from the socket)	S4 - Permanent disability	L2 - 1 / 100,000 years	2							Still in Review		Design Controls - Eliminate		
8																Lock mechanism to secure meter and prevent meter from detaching if meter has not been shorted	S4 - Permanent disability	L2 - 1 / 100,000 years	2							Still in Review		Design Controls - Eliminate		
9	Work Environment: Poor Accessibility	1 phase & 3 phase CT Meter	Delayed Emergency Response	CT meters located at a low traffic area of the building (i e. if worker working alone, no one may notice for days if worker is injured)	Worker injury	Call check	S3 - Temporary disability	L4 - 1 / 1,000 years	2							None required														
10	Work Environment: High Electrical Potential	1 phase & 3 phase CT Meter	Worker contacts line voltage while working with test block	~6 transformer meters in the system were not equipped with potential transformer, hence, worker would be working with primary voltage (347/600V) on the test block while expecting secondary voltage (120/240V)	Worker injury	None identified	S5 - Fatality	L1 - 1 / 1,000,000 years	2							Smart meter - Standardize and replace all meters	S0 - Near miss	L0 - 1 / 10,000,000 yrs	1							Still in Review		Design Controls - Eliminate		
10																Work procedure: Double check voltages before commencing job (make sure hand-held meter can take 347/600V input)	S5 - Fatality	L0 - 1 / 10,000,000 yrs	1							Still in Review		System Controls - Competence		
Existing CT (1 Phase) Socket Type Meters: Operation and Maintenance																														

HAZARD ORGANIZATION			ACCIDENT SEQUENCE				RISK ANALYSIS										RESIDUAL RISK ANALYSIS									CONTROL MEASURE MONITORING				
Hazard ID No.	Hazard Type (select)	Equipment / Area / System	Undesirable Event / Failure Modes	Cause	Consequence	Current Control Measures	Worker Severity Level (select)	Worker Freq. (select)	Worker Risk Level (auto)	Public Severity Level (select)	Public Freq. (select)	Public Risk Level (auto)	Enviro Severity Level (select)	Enviro Freq. (select)	Enviro Risk Level (auto)	Proposed Control Measures Under Consideration	Worker Residual Severity Level (select)	Worker Residual Freq. (select)	Worker Residual Risk (auto)	Public Residual Severity (select)	Public Residual Freq. (select)	Public Residual Risk (auto)	Residual Enviro Severity Level (select	Enviro. Freq. (select from list)	Enviro Risk Level (auto)	Control Measure Status (select)	Next Action Date	Type of Completed Control Measures (select)	Risk Reduction Comments / Documentation	Control Owner (name / group)
11	Other	1 Phase Socket CT Meter	- Explosion and fire (meter faulted) - Projectiles off of the explosion	CT (1 ph, socket type) meter and normal meter can be installed into the same base inj# 75023 [2007] - worker inserted meter when CT meter should have been installed and faulted	Worker injury	Worker training CT meters have additional labelling on them Electronics will show no display due to different wiring in meters	S5 - Fatality	L3 - 1 / 10,000 years)	3							Different base/ jaw configuration between meters (i.e. CT would have 5 jaws while self-contained would have 4)	S5 - Fatality	L0 - 1 / 10,000,000 yrs	1							Still in Review		Design Controls - Minimize		
Existing CT (3 Phase) A-Base Type Meters: Operation and Maintenance																														
12	Other	3 Phase A-Base CT Meter	Worker exposed to arc flash or contact electrical potential	Worker accidentally contacted energized components or cause ph-ph fault of energized components in the meter enclosure while performing meter tests (clip onto wire) nm #75789 [2008] - PLT accidentally swung 1 metering wire into energized CTs nm #2407 [2006] - Meter tech contacted ph with other ph wire nm #1661 [2004] - test probe came loose and contacted energized part In #1105 [2001] - Meter tech contacted energized buss with uninsulated tool	Worker injury	Worker training Use of cover-ups	S4 - Permanent disability	L5 - 1 / 100 years	3							As part of SMI, convert 3-ph CT A-Base meter to socket type as well (eliminate dangling wires off meter and reduce need for any handtools during meter work)	S4 - Permanent disability	L2 - 1 / 100,000 years	2							Still in Review		Design Controls - Minimize		
13	Other	3 Phase A-Base CT Meter	- Explosion and fire (meter faulted) - Projectiles off of the explosion	Worker misconnected cables coming off the test box into the meter and energize meter	Worker injury	Worker training	S4 - Permanent disability	L3 - 1 / 10,000 years)	2							As part of SMI, convert 3-ph CT A-Base meter to socket type as well (eliminate need for connecting cables 1 by 1 during meter work)	S5 - Fatality	L0 - 1 / 10,000,000 yrs	1							Still in Review		Design Controls - Eliminate		
14	Other	3 Phase A-Base CT Meter	Worker exposed to electric potential	Switch on test box did not short the CT and worker removed meter causing a build up of voltage on the terminals	Worker injury	Worker training	S4 - Permanent disability	L5 - 1 / 100 years	3							As part of SMI, convert 3-ph CT A-Base meter to socket type as well (this helps worker to be further away from arc when pulling meter) However, this does not help with wiring jobs	S2 - Treatment by medical professional	L5 - 1 / 100 years	2							Still in Review		Design Controls - Minimize		
14																Use clip-on probes to check if the meter is actually shorted	S1 - First aid	L5 - 1 / 100 years	1							Still in Review		System Controls - Competence		
Common to ALL Existing Meters																														