

ELECTRICAL SAFETY ESSENTIALS

PRESENTATION BY:



INTRODUCTION

MY FIRST INSIGHT TO THE IMPORTANCE OF A COMPLIANT ELECTRICAL SAFETY PROGRAM WAS THE DISCOVERY OF MAXED OUT PROTECTIVE RELAY SETTINGS ON A SWITCHGEAR LINEUP. *THIS CONSISTED OF A DRY-TYPE TRANSFORMER, A MAIN BREAKER, AND HALF A DOZEN OR MORE FEEDER BREAKERS.*

- WE WONDERED IF A POTENTIAL ELECTRICAL FAULT WOULD BE SEEN BY THE MAXED OUT BREAKERS, AND IF A SERIOUS ARC-FLASH OR BLAST EVENT WOULD OCCUR UNDER A FAULT CONDITION
- IF BREAKERS ARE SET ABOVE THEIR CALCULATED SHORT-CIRCUIT VALUES, THEY WON'T SEE AN ELECTRICAL FAULT. ARCS IONISE THE AIR (*ELECTRIFYING IT, THE SAME WAY A LIGHTNING BOLT IONISES THE AIR, LETTING IT GROW AND TRAVEL*); THE ARC BECOMES UNRESTRAINED VERY QUICKLY
- WE REDUCED BREAKER SETTINGS TO REDUCE ARC-FLASH RISKS AND COORDINATED THE SYSTEM FOR RELIABILITY
- MONTHS LATER AN ELECTRICAL FAULT OCCURRED; A FEEDER BREAKER TRIPPED, AND A SINGLE BUILDING WAS AUTOMATICALLY ISOLATED, AS INTENDED

INTRODUCTION

- A MANAGER ASKED A WORKER TO REENERGISE THE BUILDING; AND THAT SAME BREAKER BLEW UP AS THE WORKER CLOSED IN ON THE ELECTRICAL FAULT; MANY MORE BUILDINGS TRIPPED
- WE DID A CALCULATION TO SEE THE RESULT OF NOT REDUCING THE MAXED OUT SETTINGS. IT REVEALED THE MAIN BREAKER WOULD NOT HAVE SEEN THAT FAULT, AND AN ARC-FLASH (OR BLAST) WITH 10X HIGHER ENERGY WOULD HAVE EXPOSED THE WORKER TO EXTREME TEMPERATURES — *NEARLY TWICE HIS PPE RATING*. IT IS EXPECTED THERE WOULD HAVE BEEN AT LEAST A LOST-TIME INJURY
- THE LEARNINGS REVEALED THAT MAINTENANCE WORKERS MAY ALTER BREAKER SETTINGS — *PUTTING OPERATORS AND OTHER ELECTRICAL WORKERS AT HIGHER RISK; MANAGEMENT MAY DEMAND A RESET WITHOUT INSPECTION; AND THERE WERE NO WRITTEN SAFETY PROCEDURES ON HOW TO HANDLE A TRIPPED BREAKER*. THANKFULLY SAFETY TRAINING WAS PROVIDED PRIOR TO THE INCIDENT AND THE WORKER WORE PPE AND WAS NOT HARMED
- THIS EVENT PUT US ON THE PATH OF DEVELOPING ADEQUATE SAFE WORK PROCEDURES AND TRAINING — *ESPECIALLY FOR NON-ELECTRICAL WORKERS WHOSE ELECTRICAL KNOWLEDGE IS USUALLY LIMITED TO JUST FINDING THE ELECTRICAL ROOM*
- SINCE THEN ELECTRICAL SAFETY STANDARDS HAVE GROWN A LOT AND BECOME MANDATORY



Electrical Safety Program Overview



ELECTRICAL SAFETY STANDARDS

THE TRILOGY OF STANDARDS (*CSA Z460, Z462, Z463*) ARE INTENDED TO BE USED TOGETHER AND RESULTS IN ACHIEVING THE LOWEST RISK TO WORKERS AND HIGHEST RELIABILITY FOR ELECTRICAL SYSTEMS.

- **Z460** IS USED WHEN SOMEONE WANTS THE EQUIPMENT ISOLATED (*OR DEENERGISED*) AND LOCKED OUT TO ELIMINATE THE HAZARDS. QSR OFFERS A PROCEDURAL POLICY COVERING HOW TO DO THAT. WE ALSO OFFER RECORD AND AUDIT FORMS, AND TRAINING AS NEEDED
- **Z462** ESTABLISHES THE SAFE WORK PRACTICES POLICY NEEDED WHEN YOU CANNOT ISOLATE OR DEENERGISE POWER FOR THINGS LIKE SWITCHING, TESTING AND TROUBLESHOOTING — *AND POSSIBLY A LIVE REPAIR OR MODIFICATION*. YOU NEED POWER TO TAKE MEASUREMENTS, OR TO OPERATE THE EQUIPMENT; SO SAFE WORK PROCEDURES ARE DESIGNED TO CONTROL AND MINIMISE THESE RISKS

CSA Z462 – WORKPLACE ELECTRICAL SAFETY

Z462 COVERS:

- QUANTIFYING THE ELECTRICAL HAZARDS
 - *ARC-FLASH: STUDY DONE EVERY 5 YEARS*
 - *SHOCK: LIMITS OF APPROACH BOUNDARIES*
- UNDERSTANDING ELECTRICAL HAZARDS (*SAFETY TRAINING*)
- SAFE WORK PRACTICES POLICY (*UPDATED EVERY 3 YEARS*)
- WORKER QUALIFICATIONS AND TRAINING REQUIREMENTS (*UPDATED EVERY 3 YEARS*)
- TEMPORARY GROUNDING
- TOOLS AND TEST EQUIPMENT
- JOB PLANNING
- RISK ASSESSMENTS
- MAINTENANCE REQUIREMENTS; *THESE ARE THE MAIN ESSENTIALS*

CSA Z462 – WORKPLACE ELECTRICAL SAFETY

- WITHOUT DOCUMENTED SAFE WORK PRACTICES IT IS VERY DIFFICULT TO ENFORCE WORKER SAFETY TRAINING, AND YOU WOULD BE RELYING ON THE WORKER TO MANAGE THE ELECTRICAL RISKS, AND THE PRESSURES OF THE WORK ENVIRONMENT. A POLICY APPROVED BY MANAGEMENT IS A STEP IN THE RIGHT DIRECTION FOR DUE DILIGENCE AND WORKER SAFETY
- Z462 RECOGNISES THAT IF EQUIPMENT IS NOT MAINTAINED OR SUFFICIENT TESTS DONE, BREAKERS MAY NOT OPERATE AS EXPECTED WHICH INCREASES ELECTRICAL SAFETY RISKS
- ALL COMPANIES MUST HAVE AN UP-TO-DATE ELECTRICAL SAFETY PROGRAM, PROVIDE TRAINING, QUALIFY THEIR WORKERS (*BOTH ELECTRICAL AND NON-ELECTRICAL THAT OPERATE EQUIPMENT*), PERFORM FIELD AUDITS, AND ALL BE MANAGED BY H&S. *AN ARC-FLASH STUDY IS RECOMMENDED TO QUANTIFY ARC-FLASH RISKS*

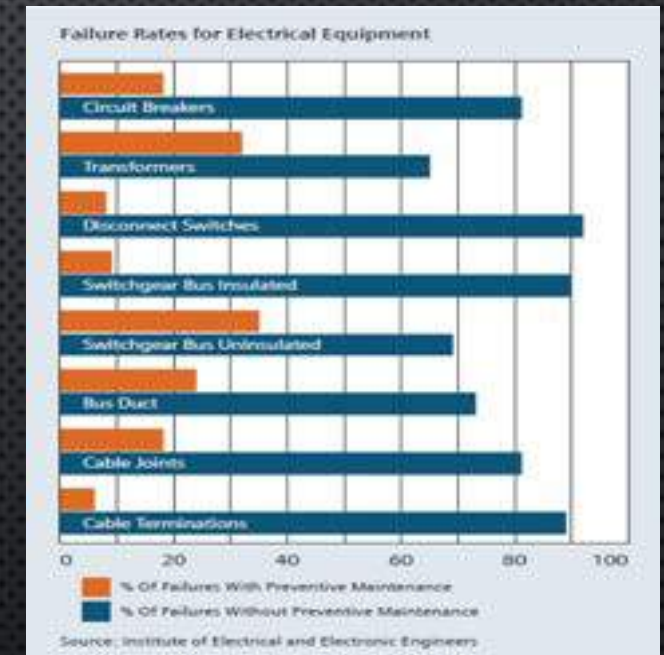
CSA Z463 – MAINTENANCE FOR ELECTRICAL SYSTEMS

- **Z463** AIMS TO PREVENT INADEQUATE OR INCOMPLETE MAINTENANCE OF ELECTRICAL EQUIPMENT AND SYSTEMS. CSA Z463 AND Z462 BOTH REQUIRE ELECTRICAL POWER SYSTEMS BE PROPERLY DESIGNED, INSTALLED AND MAINTAINED TO BE CONSIDERED SAFE
- MAINTENANCE IS DIRECTLY RELATED TO *ELECTRICAL SAFETY, ENVIRONMENTAL PROTECTION, OPERATIONAL RELIABILITY AND FINANCIAL LOSSES*. WHILE MAINTENANCE CANNOT TOTALLY GUARANTEE AN ABSENCE OF ELECTRICAL FAILURES AND INCIDENTS, AN ELECTRICAL SAFETY PROGRAM LAYS OUT THE MANDATED FRAMEWORK FOR COMPLIANT MAINTENANCE TO MITIGATE SUCH FAILURES
- FAILURE OF ELECTRICAL EQUIPMENT MAY EXPOSE WORKERS TO THE RISKS OF SHOCK AND ARC-FLASH
- THE MOST COMMON ERROR TESTING SAFETY CRITICAL BREAKERS IS ISOLATING THEM MANUALLY PRIOR TO THE TEST. OPERATING IT LUBRICATES AND CLEANS IT; SO WHEN YOU TEST IT ON A BENCH, IT USUALLY PASSES; BUT IF YOU TRIP-TEST IT *AS YOU FIRST ISOLATE IT*, YOU MAY FIND IT STICKS MECHANICALLY AND SLOWS DOWN THE TRIP TIME; IF IT TAKES TWICE AS LONG TO TRIP (*WHICH MAY JUST BE AN EXTRA 1/10 OF A SECOND*), IT NOW CONTAINS TWICE THE HEAT ENERGY – *SERIOUS IF YOUR PPE IS NOT RATED*

CSA Z463 – MAINTENANCE FOR ELECTRICAL SYSTEMS

THE ELECTRICAL MAINTENANCE PROGRAM CONSISTS OF THE FOLLOWING:

- RISK MANAGEMENT PROCESS FOR ELECTRICAL EQUIPMENT FAILURES
- DETERMINING EQUIPMENT FAILURE MODES
- DETERMINING MAINTENANCE STRATEGIES, TASKS AND FREQUENCY
- PLANNING OF MAINTENANCE SHUTDOWN AND PRIORITIZING TASKS
- ROUTINE INSPECTIONS
- THOROUGH REVIEW OF THE INSPECTION REPORTS SO CORRECTIVE MEASURES CAN BE PRESCRIBED
- INVENTORY OF SPARE PARTS FOR CRITICAL COMPONENTS
- ELECTRICAL EMERGENCY PREPAREDNESS



MOL INVESTIGATION...

AN INVESTIGATOR WILL:

- DETERMINE SCOPE OF WORK
- DETERMINE LICENCE REQUIRED (*MAINTENANCE OR CONSTRUCTION*)
- DETERMINE IF PERMIT WAS TAKEN OUT
- REVIEW WORKERS TRAINING RECORDS
- REVIEW H&S ELECTRICAL SAFETY PROGRAM AND POLICIES
- DETERMINE IF REASONABLE PRECAUTIONS WERE TAKEN
- DETERMINE WHETHER TO CHARGE THE WORKER OR EMPLOYER

MOL INVESTIGATION...

DO YOU HAVE DOCUMENTATION “QUALIFYING” WORKERS?

- THE TERM “COMPETENT WORKER” IS GONE – REPLACED BY “QUALIFIED WORKER”. QUALIFICATIONS REQUIRE TRAINING, DOCUMENTATION, MEASURING AND MONITORING WORKERS UNDERSTANDING OF HAZARDS AND POSSIBLE INJURY

HAVE WORKERS DEMONSTRATED AN ABILITY TO PERFORM DUTIES SAFELY?

- IS THIS DOCUMENTED?

HAVE WORKERS READ AND UNDERSTOOD THEIR SAFE WORK PRACTICES AND IS THIS DOCUMENTED?

- IS THE ELECTRICAL SAFE WORK PRACTICES POLICY COMPLIANT WITH THE LATEST CSA Z462 STANDARD?

CLOSING

- *QSR WISHES TO HELP FULFILL EMPLOYERS ELECTRICAL SAFETY NEEDS AND REDUCE WORKER OCCUPATIONAL RISKS AND INJURY. PLEASE CAREFULLY CONSIDER THIS INFORMATION AND THE ASSOCIATED BENEFITS*
- *QSR WOULD BE HAPPY TO AUDIT YOUR ELECTRICAL SAFETY PROGRAM AND PROVIDE AN ESTIMATE FOR A COMPLIANT ELECTRICAL SAFETY PROGRAM AND WORKER TRAINING. THANK YOU*
- *IN ONTARIO, THE MOST COMMONLY CITED CAUSE OF AN ELECTRICAL-RELATED FATALITY IS: IMPROPER INSTALLATION OR PROCEDURE, AND LACK OF HAZARD ASSESSMENT, ACCOUNTING FOR 70% OF FATALITIES*

SOURCE: ONTARIO ELECTRICAL SAFETY REPORT

CLOSING



Nick Wallace, P.Eng.
Owner / QSR Electrical Engineering

PO Box 2804 SARNIA, ON N7T 7W1
C: 519.328.1335 • T: 519.491.9902
E: nick@QSRelectrical.com • QSRelectrical.com

Engineering Services

- Electrical studies
- Arc-flash analysis, report and labels
- Electrical safety programs, policies, and procedures
- Electrical maintenance programs for safety and risk reduction
- Hazardous area classification studies
- Electrical engineering services

Training & Auditing Services

- Electrical awareness (*electrical workers*)
- Electrical awareness (*non-electrical workers*)
- Contact Release (*and volt testing review*)
- Electrical Safety Program and Policies Roll-out training
- Auditing workers understanding and compliance of safety procedures
- See available courses next page