

MECHANICAL MAINTENANCE TRAINING PROGRAM

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ABSTRACT

The Mechanical Maintenance training program at Point Lepreau Generating Station has been designed to complement our practice of hiring Journeyman trades people. The program content, the work group training needs and the individual training needs were identified through consultation with subject matter experts, including the Supervisor and Foremen, from the Mechanical Maintenance Department. A categorized list of all skills included in the training program and a matrix identifying the training needs for each maintainer were produced. These lists are the tools used for planning and scheduling of Mechanical Maintenance training. Resources to deliver the training are drawn from the Training Department, the Mechanical Maintenance Department and outside training sources.

1.0 DEFINITIONS

- Skill - the ability to use one's knowledge and dexterity in the performance of work functions.
- Task - discrete item of work which requires the application of one's skills.
- Course - a training session which, through a series of learning activities (ie. lectures, demonstration, practice, etc.), leads the student to the knowledge and dexterity to perform related tasks.
- Training Needs - courses required by an individual maintainer or groups of maintainers to assist them in performing their assigned tasks.
- Program - the plan for Mechanical Maintenance training including a listing of courses, identification of individual training needs and the resources to provide for them.

2.0 TRAINING PHILOSOPHY

The hiring practices at Point Lepreau require that all maintainers hired hold a Journeyman's certificate or equivalent in one of the mechanical trades. This high entry level certification ensures that the maintainers are able to perform many of the tasks normally assigned to a Mechanical Maintainer and eliminates the need for an apprenticeship type of training program.

The Mechanical Maintenance training program concentrates on cross training maintainers. With limited staff in the maintenance shop it is essential that each maintainer be able to perform a variety of functions. Cross training can provide this versatility by equipping maintainers with the skills and knowledge needed to be effective in more than one discipline. There are two major benefits to this approach:

- The maintainer is able to perform new skills developing a sense of pride, increased job satisfaction and improved morale.
- Maintainers are able to do complete tasks. This reduces total hours spent on the task and enhances personnel scheduling flexibility.

The ability to perform the various tasks that are assigned to mechanical maintainers is further enhanced with station systems training. This plant knowledge, combined with experience and skills in more than one mechanical discipline, will produce well rounded maintainers who can effectively maintain station mechanical equipment.

To enable the capability described above, the training program for the Mechanical Maintainers consists of courses intended to **upgrade, update** or **refresh** the skills of an experienced group of maintainers.

Upgrade training is training that is required to provide an adequate level of ability for skills which fall outside the mechanical discipline for which the maintainer is already qualified. This will include the general skills and

knowledges required to function in the Mechanical Maintenance shops (ie. Administrative Procedures, Information Systems, Safety Training, Science and Principles, described in section 4.0 Program Content). It will also include skills from other mechanical disciplines to provide a measure of cross training required for each maintainer.

Update training is training which is provided as a result of changes to equipment or systems that the maintainer is required to work on. Update training may also be provided if existing training has proved to be incomplete or when new methods or procedures are introduced.

Refresher training is training that refreshes the knowledge or skill of the maintainer. Refresher training is required for skills where on-the-job exposure does not maintain the skill level of the maintainer. It is normally required for skills with a high level of difficulty and a low frequency of use. It may also be provided for skills which are very important and critical for the safety of personnel or to the continuing and safe operation of the plant.

Any course in the program may be used to upgrade, update or refresh the knowledge and skills of maintainers. For upgrade training the full course will be delivered. For update training the portion of the course which contains new or updated material will be used. For refresher training the course will be used to provide training on the more critical and/or often forgotten aspects of the skill. For each type of training, testing will be carried out to ensure mastery of the knowledge and skill requirements.

3.0 PROGRAM IDENTIFICATION

The identification of the Mechanical Maintenance Training Program was a two phased approach consisting of a job analysis and a needs analysis. It was accomplished through consultation between the Training Group and the Mechanical Maintenance Group.

3.1 Job Analysis

The Mechanical Maintenance Training Program was initiated by a job analysis process. A group of subject matter experts from the Mechanical Maintenance Department and a Training Supervisor met for the purpose of identifying all of the skills required by the Mechanical Maintenance Group. This was accomplished by identifying the tasks performed within the work group and the skills required to perform them. The result was a listing which included relevant maintenance skills as well as supervisory and administrative skills. This list of skills was then subdivided into major categories and each skill assigned to a category. A brief description of the content of each category will be given in section 4.0, Program Content.

To identify the skills that require training, the Skills Training Group and the Mechanical Maintenance Supervisory Group (Supervisor and Foremen) met to review the original job analysis. Each skill was examined and a decision, on whether or not to train, was made. The frequency of use, difficulty and importance of the skill were considered. Many of the skills listed during the original analysis were considered very basic, not requiring training and were removed from the list. It was decided that training on some other skills would be more effective if several skills were combined into one course. As a result of this revision the skills list was accepted by the Mechanical Maintenance Supervisor as the skills requirements for Mechanical Maintainers. This skills list is attached as figure 1.

A general set of objectives was then prepared for each skill on the list. These objectives provide a guideline for the development of the course material on the skill. As courses are prepared more detailed objectives are prepared and evaluated in conjunction with the work group to ensure that the end product meets their specific needs. Figure 2, the general objectives for machining techniques is attached as an example.

This completed the job analysis phase, the product of which was a categorized listing of skills (figure 1) required to perform the tasks normally carried out by the Mechanical Maintenance Department. The Mechanical Maintenance training program is based on this analysis.

3.2 Needs Analysis

The next step was to identify the extent of training required by the Mechanical Maintenance Group. Each skill on the list was reviewed by the Mechanical Maintenance Supervisory Group to determine how many maintainers needed the skill. This decision was based on the amount of work done by Mechanical Maintainers which required the skill, the importance of the skill to the maintenance of the plant and the need for scheduling flexibility within the group to provide adequate coverage for maintenance activities. As a result of this process some skills were identified as required by all maintainers and designated "mandatory". Other skills were identified as required by only a limited number of maintainers and designated "limited". A decision on the appropriate number of maintainers required to have each "limited" skill was made. A few of the skills were designated "optional". Optional courses will be provided at the discretion of the Mechanical Maintenance Supervisor when it is considered beneficial for ongoing or future work activities.

To identify individual training needs, the Mechanical Maintenance Supervisor and Foremen evaluated each maintainer's ability to use "mandatory" skills and each

assigned "limited" skill. Decisions on whether or not the maintainer required further training on any particular skill were made. These decisions were based on past educational and training background, journeyman status, experience, observed abilities on work assignments and aptitude. The product of this activity was a matrix which lists training needs for each maintainer. It is kept by the Training Department and used by Mechanical Maintenance for scheduling maintainers for training. This list is reviewed by the Mechanical Maintenance Training Officer and the Mechanical Maintenance Supervisor on an annual basis to determine the training needs to be met over the next year. Maintenance problems experienced in the past and planned future work will be considered when determining the training needs.

The result of completing the Program Identification process was that skills deficiencies were better understood and the training to be developed and delivered was identified.

4.0 PROGRAM CONTENT

The Mechanical Maintenance Training Program must provide the training, both knowledge and performance based, to allow the Mechanical Maintainer to perform the various tasks associated with maintaining a Nuclear Power Plant. To enable this performance, training is provided in the following categories:

- Administrative Procedures and Documentation
- Information Systems
- Safety Fundamentals
- Science Fundamentals
- Fitting Techniques
- Pipe Fitting Techniques
- Machining Techniques
- Welding Techniques
- Plant Equipment Maintenance
- Special Processes and Equipment

Training in each category includes courses on skills which are designated either "Mandatory", "Limited", or "Optional". Statements made in the following paragraphs regarding the relevance of courses for the various classifications of personnel in the Mechanical Maintenance Department apply to the majority of the courses in the category. To determine the actual designation of the course refer to figure 1.

Administrative Procedures and Documentation

Courses in this category cover the initial orientation to the station for new hires, the use of various codes and standards, and application of plant documents, procedures and forms used by the Mechanical Maintenance Department. These courses provide the knowledge of

plant procedures and documents required to administer the Mechanical Maintenance activities in the plant. This training is relevant for Foremen, Senior Maintainers and maintainers who assess work orders.

Information Systems

Courses in this category cover the computerized information system, mechanical maintenance procedures, work order assessment and training for QA certified maintainers. These courses provide knowledge of the information available to the maintainers and how to access it in order to do their work. This training is relevant for all maintainers.

Safety Fundamentals

Courses in this category cover the basic knowledge requirements of Electrical, Mechanical, Chemical and Thermal Safety. Courses with both knowledge and practical content are provided on the Plant Work Permit System, First Aid, Fire Fighting and Radiation Protection which includes industrial safety. These courses provide knowledge on working safely, how to respond in emergency situations and instruction on the use of safety equipment and plant safety procedures (e.g. Work Permit System). This training is relevant for all mechanical maintenance personnel.

Science Fundamentals

Included in this category are basic science courses, principles courses on Instrumentation and Control and Mechanical Equipment, Fundamentals of Weld Technology and Visual Weld Inspection. These courses are provided, when required by the Mechanical Maintenance Department, to upgrade a maintainer's knowledge and understanding of how and why plant processes work as they do. Letter and Report Writing and Station Systems Training are also listed in this category and are given to all Maintainers.

Fitting Techniques

Courses in this category cover the use of measuring tools and devices, torquing techniques and the application of practical fitting techniques used in the installation and maintenance of mechanical seals, bearings and coupling alignments. These are essential skills for the Industrial Mechanic and Millwright, and are provided as upgrade training for maintainers from other mechanical disciplines.

Pipe Fitting Techniques

Courses in this category cover the installation of piping including welded and threaded pipe, fiberglass pipe, gasket joints, and tubing specifically with Swagelok fittings.

This is basic training and is provided to non-pipefitters so they can assist in piping installation when required.

Machining Techniques

Courses in this category cover the use of lathes, milling machines, band saws, surface grinders, lapping machines, abrasive wheels and the press brake and shear. This training is intended to provide a level of skill which will allow the non machinist to perform basic machining operations. In the case of more specialized operations such as the milling machine and surface grinder, the number of maintainers trained will be limited.

Welding Techniques

Courses in this category cover the various welding, brazing, soldering, burning and cutting techniques required by the Mechanical Maintenance Department. The major emphasis is on meeting the requirements of welders to maintain their Department of Labour certificates (14 certificates required). To reduce the work load on high pressure welders, some maintainers will be trained on structural welding, which will allow them to do tack welding and other non pressure welds required in the course of their work. To permit flexibility in scheduling and expedite the completion of work, training will be provided to all maintainers on heating, burning and soft soldering techniques.

Plant Equipment Maintenance

Courses in this category provide the general knowledge and skills training required for maintaining most of the pumps, valves, compressors, power transmissions and fans in the plant. Also included in this category is training specific to Point Lepreau plant equipment, including: reactivity mechanisms, diesel engines, turbine generator, large and/or special purpose pumps and the replacement of fuel channels. In this category the list is not comprehensive and courses on specific equipment will be included as the need for training on the equipment arises.

Special Processes and Equipment

Courses in this category cover various processes and equipment which do not fit into the previously described categories. Due to the extensive use of cranes and rigging techniques in many maintenance activities training is provided for all Mechanical Maintainers. Training on the basic and advanced vibration techniques, safety valve test bench, non-destructive testing fundamentals and the operation of the Varian Mass-spectrometer is provided to selected maintainers based on shop needs.

5.0 RESOURCES

The personnel resources for the development and delivery of the training described above will be drawn from several sources.

The Mechanical Maintenance Training Officer will develop and deliver plant specific training within his/her areas of proficiency. The Training Officer will organize and coordinate the efforts of other individuals and organizations who are contracted to provide training for Mechanical Maintenance.

Mechanical Maintenance personnel from the work group are also a source of expertise which can be called upon to produce and deliver training. The availability of this resource is essential if all the required training on plant specific equipment is to be provided.

The New Brunswick Community College (NBCC) provide training contract on some of the generic skills. They have currently deliver courses on Pipefitting Techniques and Basic Machining Techniques. These courses are effective and we will continue to use NBCC instructors and facilities when appropriate.

Equipment manufacturers provide training on the equipment which they supplied. Instructors from the manufacturer have a great deal of experience and expertise which trainees can draw on to solve maintenance problems. This training is effective when it is organized to meet specific objectives.

6.0 SUMMARY

This paper has described the content of the Mechanical Maintenance training program and the job analysis used to identify the skills which make up the program. It has discussed the process of needs analysis used to identify work group and individual training needs and indicated that needs analysis is a continuous activity with comprehensive review on a yearly basis. Lastly, the paper identifies the resources that are and will continue to be used for the development and delivery of the Mechanical Maintenance Training Program.

The Mechanical Maintenance training program provides training which supplements the skills and knowledge of journeyman tradesmen with respect to their jobs at Point Lepreau. Presently, development and delivery of the training program are proceeding simultaneously.

MECHANICAL MAINTENANCE											
NAME											
A ADMIN-ORIENTATION TO MEPC											
1	M-8HRS	2	L-40HRS	3	L-40HRS	4	L-24HRS				
B INFORMATION SYSTEMS											
1	M-16 HRS	2	M-8HRS	3	M-4HRS	4	L-24HRS				
C SAFETY REGULATIONS											
1	M-8HRS	2	M-24 L-40HRS	3	M-8HRS	4	M-24HRS	5	M-8HRS	6	M-12 L-40HRS
D SCIENCE FUNDAMENTALS											
1	M-8 L-24	2	O-40 HRS	3	O-40HRS	4	O-40HRS	5	O-40HRS	6	L-40HRS
E FITTING TECHNIQUES											
1	M-8HRS	2	M-16HRS	3	M-16HRS	4	M-8HRS	5	M-16HRS	L-40HRS	
F PIPE FITTING TECHNIQUES											
1	M-4HRS	2	M-8HRS	3	M-4HRS	4	M-8HRS	5	M-8HRS	6	M-8HRS
G MACHINING TECHNIQUES											
1	M-16HRS	2	M-40HRS	3	M-8HRS	4	M-40HRS	5	L-8HRS	6	M-2HRS
H WELDING TECHNIQUES											
1	M-4HRS	2	L-40HRS	3	L-40HRS	4	L-40HRS	5	L-120HRS	6	L-8HRS
I INSTALL AND MAINTAIN EQUIPMENT											
1	M-16HRS	2	M-16HRS	3	M-16HRS	4	M-16HRS	5	M-16HRS	6	L-40HRS
J SPECIAL PROCESSES AND EQUIPMENT											
1	M-3HRS	2	O-16HRS	3	M-5HRS	4	L-24HRS	5	L-40HRS	6	L-24HRS
K NEW SUBSYSTEMS											
1	M-3HRS	2	O-16HRS	3	M-5HRS	4	L-24HRS	5	L-40HRS	6	L-24HRS
L LIMITED TRAINING											
1	M-3HRS	2	O-16HRS	3	M-5HRS	4	L-24HRS	5	L-40HRS	6	L-24HRS
M MANDATORY TRAINING											
1	M-3HRS	2	O-16HRS	3	M-5HRS	4	L-24HRS	5	L-40HRS	6	L-24HRS
N OPTIONAL TRAINING											
1	M-3HRS	2	O-16HRS	3	M-5HRS	4	L-24HRS	5	L-40HRS	6	L-24HRS

NOTES:

M = MANDATORY TRAINING

L = LIMITED TRAINING

O = OPTIONAL TRAINING

ALL M/W PERSONNEL RECEIVE THE MANDATORY TRAINING

MANDATORY TRAINING FOR SENIORS AND FOREMAN

TRAINING TO BE PROVIDED FOR SELECTED MAINTENANCE, SENIORS AND FOREMAN AT THE SUPERVISOR'S DISCRETION

100 HOURS REQUIRED TO COMPLETE MANDATORY TRAINING (9.55 YEARS)

100 HOURS REQUIRED TO COMPLETE LIMITED AND OPTIONAL TRAINING (1.55 YEARS)

200 HOURS REQUIRED TO COMPLETE ALL OF THE TRAINING ON THIS CHART

(1.5 YEARS)

NEW SUBSYSTEMS

ELECTRIC POWER COMMISSION

POINT LEBEAU G.S.

MECHANICAL MAINTENANCE TRAINING CHART

DEN. BY A. McARTLAND/REV. 3

Figure #1

MECHANICAL MAINTENANCE

OBJECTIVES: UPON COMPLETION OF THESE COURSES AND SKILLS THE INDIVIDUAL SHOULD BE CAPABLE OF THE FOLLOWING:

APPLY MACHINING TECHNIQUES:

1 H:	2 H:	3 H:	4 H:	5 L:	6 H:	7 L:	8 H:
SET UP & USE RADIAL ARM DRILL PRESS	SET UP & USE LATHE	SET UP & USE BAND SAW	SET UP & USE MILLING MACHINE	SET UP & USE SURFACE GRINDER	SET UP & USE PRESS BRAKE & SHEAR	SET UP & USE LAPPING MACHINE	SELECT & USE ABRASIVE WHEELS
1: EXPLAIN BASIC THEORY OF OPERATION AND APPLY ALL SAFETY REQUIREMENTS 2: SELECT PROPER CUTTING SPEEDS FOR DIFFERENT MATERIALS 3: SELECT PROPER CUTTING FLUIDS 4: PROPERLY SHARPEN TOOL DRILLS 5: PERFORM HOUSEKEEPING AND OILING TASKS VARIAS ASSOCIATED WITH OPERATING AN ARM DRILL PRESS 6: OBTAIN DESIRED ACCEPTABLE RESULTS AS PER SPECS.	1: IDENTIFY AND APPLY ALL SAFETY REQUIREMENTS APPLICABLE TO THE OPERATE ACCORDINGLY TO MANUFACTURING INSTRUCT. 2: RECOGNIZE THE MAJOR PARTS OF THE LATHE AND THEIR FUNCTION 3: PERFORM HOUSEKEEPING TAKES ASSOCIATED WITH THE BAND SAW 4: SELECT CUTTING SPEEDS FOR VARIOUS MATERIALS 5: APPLY THE PROPER BUT WELDING TECHNIQUES TO THE VARIOUS METALS AND ADJUST LATHE ACCORDINGLY 6: OBTAIN DESIRED ACCEPTABLE RESULTS AS PER SPECS.	1: IDENTIFY AND APPLY ALL SAFETY REQUIREMENTS APPLICABLE TO THE BAND SAW 2: RECOGNIZE THE MAJOR PARTS OF THE BAND SAW AND THEIR FUNCTION 3: PERFORM HOUSEKEEPING TAKES ASSOCIATED WITH THE BAND SAW 4: SELECT CUTTING SPEEDS FOR VARIOUS MATERIALS 5: APPLY THE PROPER BUT WELDING TECHNIQUES TO THE VARIOUS METALS AND ADJUST LATHE ACCORDINGLY 6: OBTAIN DESIRED ACCEPTABLE RESULTS AS PER SPECS.	1: IDENTIFY AND APPLY ALL SAFETY REQUIREMENTS APPLICABLE TO THE MILLING MACHINE 2: RECOGNIZE THE MAJOR PARTS OF THE MILLING MACHINE AND THEIR FUNCTIONS 3: PERFORM HOUSEKEEPING TAKES ASSOCIATED WITH THE MILLING MACHINE 4: IDENTIFY HORIZONTAL AND VERTICAL MILLING 5: SELECT PROPER CUTTING SPEEDS FOR VARIOUS MATERIALS 6: OBTAIN DESIRED ACCEPTABLE RESULTS AS PER SPECS. 7: SELECT THE PROPER CUTTER 8: OBTAIN DESIRED ACCEPTABLE RESULTS AS PER SPECS.	1: IDENTIFY AND APPLY ALL SAFETY REQUIREMENTS APPLICABLE TO THE SURFACE GRINDER 2: RECOGNIZE THE MAJOR PARTS OF THE SURFACE GRINDER AND THEIR FUNCTIONS 3: PERFORM HOUSEKEEPING TAKES ASSOCIATED WITH THE SURFACE GRINDER 4: SELECT AND APPLY PROPER GRINDING WHEEL 5: SELECT AND APPLY THE PROPER TABLE TRAVEL SPEED 6: SELECT AND APPLY THE PROPER CUTTING FLUID 7: OBTAIN DESIRED ACCEPTABLE RESULTS AS PER SPECS.	1: IDENTIFY AND APPLY ALL SAFETY REQUIREMENTS APPLICABLE TO THE PRESS BRAKE, SHEAR 2: RECOGNIZE THE MAJOR PARTS OF THE PRESS BRAKE AND SHEAR AND THEIR FUNCTIONS 3: PERFORM HOUSEKEEPING TAKES ASSOCIATED WITH THE PRESS BRAKE, SHEAR 4: PERFORM SHEARING OPERATION 5: PERFORM BENDING OPERATION 6: OBTAIN DESIRED ACCEPTABLE RESULTS AS PER SPECS.	1: IDENTIFY AND APPLY ALL SAFETY REQUIREMENTS APPLICABLE TO THE LAPPING MACHINE 2: RECOGNIZE THE MAJOR PARTS OF THE LAPPING MACHINE AND THEIR FUNCTIONS 3: PERFORM HOUSEKEEPING TAKES ASSOCIATED WITH THE LAPPING MACHINE 4: PERFORM FLATNESS CHECKS ON THE TABLE 5: SELECT THE PROPER CUTTING FLUID 6: SELECT THE PROPER RUN TIME 7: OBTAIN DESIRED ACCEPTABLE RESULTS AS PER SPECS.	1: IDENTIFY AND APPLY ALL SAFETY REQUIREMENTS APPLICABLE TO THE ABRASIVE WHEELS 2: RECOGNIZE THE MAJOR PARTS OF ABRASIVE WHEELS AND THEIR PROPER APPLICATION. 3: IDENTIFY BETWEEN CUTTING SPEED IN PER MINUTE AND WHEEL RPM. 4: OBTAIN DESIRED ACCEPTABLE RESULTS AS PER SPECS.

Figure #2

FORM 6

NEW BRUNSWICK ELECTRIC POWER COMMISSION POINT LEBLANC G.S. MECHANICAL MAINTENANCE TRAINING CHART OBJECTIVES	DEVELOPED BY A. McPARDLAND REV. 2
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