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Work involving varied tasks: An ergonomic analysis process for MSD prevention

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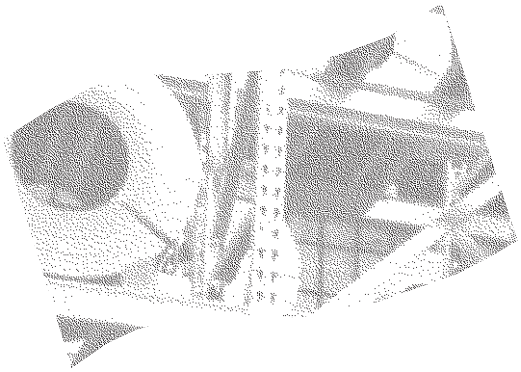

STUDIES AND RESEARCH PROJECTS

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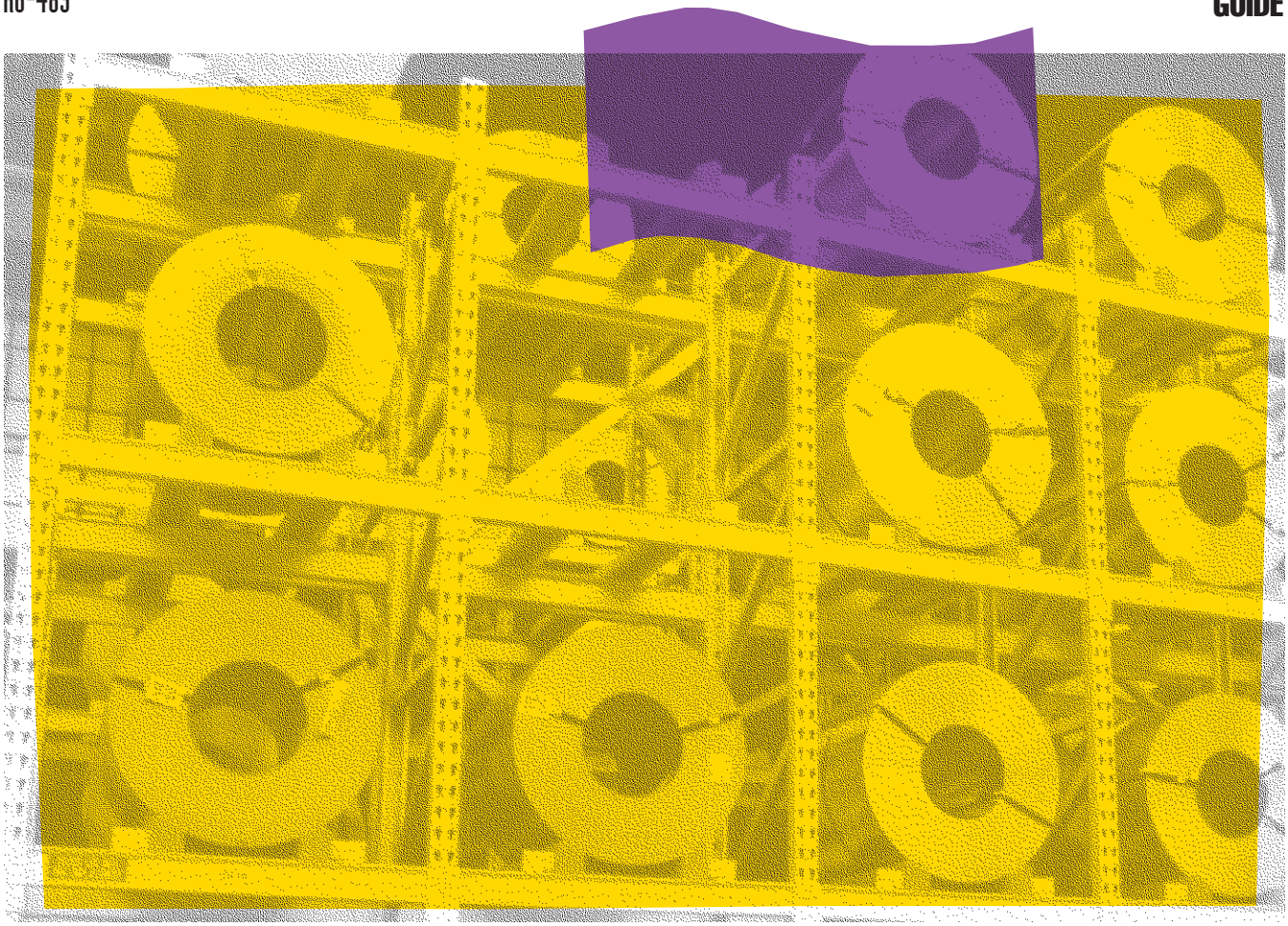

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foreword

Work involving varied tasks: an ergonomic analysis process for WMSD prevention

Prevention of musculoskeletal disorders (WMSDs) associated with work involving varied or long-cycle tasks poses a major challenge for ergonomists and for the Health and Safety network practitioners. Analyzing this type of work is relatively complex, due in part to the greater number of tasks performed by the same operator and to their organization, which varies according to production needs. Aware of the difficulties encountered by practitioners and faced with a lack of analytical methods adapted to their needs, we decided while conducting our research to develop and validate an ergonomic analysis process for work involving varied tasks. Our research involved two companies in the metal products manufacturing sector.

This guide is based on the expertise acquired in our research, and continues the work undertaken in two previous guides produced in collaboration with ASP Métal Électrique. The first guide, "Work-Related Musculoskeletal Disorders (WMSDs) – a better understanding for more effective prevention" deals with musculoskeletal disorders, their characteristics, their causes and the means of preventing them. The second guide, "ERGO groups – a tool for WMSD prevention", intended for industries faced with the problem of work-related musculoskeletal disorders (WMSDs), presents a participatory ergonomic approach designed to prevent musculoskeletal disorders and improve working conditions.

This third guide offers ergonomists an ergonomic analysis process in which the field of application focuses on work activities characterized by long cycles or varied tasks. To some extent, it completes the previous process -- described in the second guide -- that applies to repetitive work involving short cycles.

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presentation

The process

Each stage of the process is described in one of the sections of Chapter 2. At the beginning of each of these sections, there is a synoptic table of the stage, including the goals pursued, the action plan and the know-how.

The explanations regarding the process are organized according to the goals pursued in each stage. The attainment of these goals depends on implementation of the proposed action plan. However, to materialize the action plan and assist in its implementation, we provide ergonomists with know-how arising from our experience in companies. They can adapt this know-how to the context of their own interventions to obtain the expected results.

The know-how is presented in boxes, beginning with the tools specific to the process, which were validated during the research projects. In the body of the text, these tools also serve as illustrations of how they can be used. Their complete versions are found in the "Tools" section at the end of the document. The know-how is also presented in less formal guises, such as lists of criteria to assist in decision-making, quick references, questions and examples derived from our practice.

introduction

Work involving varied tasks: an ergonomic analysis process for WMSD prevention

Musculoskeletal disorders (MSDs), mainly those of the upper limbs, have long been associated with short-cycle tasks repeated over a long shift period. They were therefore called repetitive strain injuries (RSI). However, musculoskeletal disorders related to the various body regions have also been found in other types of work, involving varied tasks or longer cycles.

Long-cycle tasks and work involving varied tasks

Long-cycle tasks are characterized by the presence of a work cycle, meaning that there is a beginning and an end to the sequence of operations and that all of these operations repeat over time. However, in the case of long cycles, the operations are not always the same and do not always occur in the same order. The work cycle may extend over several hours or several days. This type of work is carried out by industrial process and machine operators.

Work involving varied tasks is distinguished by a wide variety of tasks that are part of the operator's expertise and know-how. For example, it is encountered in trades (electricians, mechanics) and machinery maintenance workers. This type of work involves a set of tasks that each of which underlies a large number of operations that are not always organized in a specific work cycle. These tasks can be performed at locations that vary considerably from one another. For example, a mechanic is required to perform different tasks, such as maintaining and repairing equipment throughout the plant.

Purpose of this guide

This guide presents an ergonomic analysis process for preventing WMSDs and safety problems associated with varied or long-cycle tasks. It is not designed to analyze the activities of workers involved in several jobs in rotation.

Who will use this guide?

The guide is intended for ergonomists responsible for work analysis. It can also be used by business and healthcare network stakeholders and by decision-makers who will be involved in an intervention.

Contents of the guide

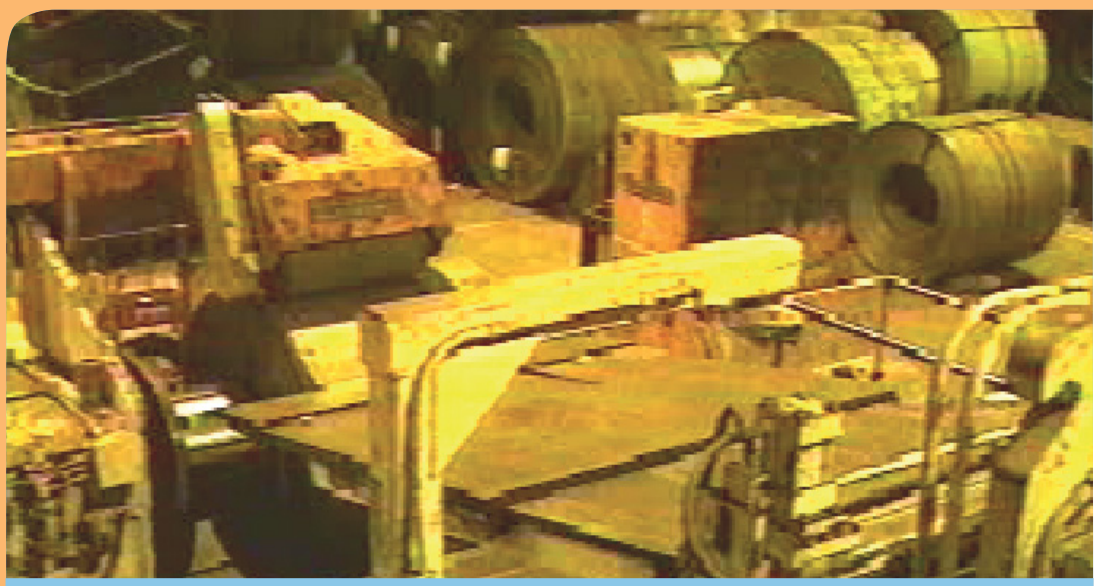
Chapter 1 explains the context in which the process applies and how to adapt it to different modes of intervention.

Chapter 2 describes each stage of the process in detail.

Chapter 3 guides the practititioner in assessing the intervention

chapter 1

Context for using the process



The purpose of the process set out in this guide is to facilitate ergonomic analysis of work involving varied or long-cycle tasks involving WMSD risk factors. We should specify from the start that ergonomic analysis involves a complete intervention. This means that it begins with documentation of the problems (interviews, observation, identification of the problems). It ends when the work has been transformed (seeking and implementing solutions) and when there has been follow-up on the changes introduced at the workstation.

Thus, this process bears a certain similarity to the process dedicated to ergonomic analysis of short-cycle tasks, which we published in a previous guide: "ERGO groups – a tool for WMSD prevention". The basic stages of both processes are similar. However, the basic concepts and the tools used in the previous process have been revised and adapted to work involving varied or long-cycle tasks.

When should this process be used?

This process should be used in a work environment involving varied or long-cycle tasks associated with musculoskeletal disorders. The process will be used successfully only if there is a will to solve the problem and if the company is willing to invest the required energy and resources.

Does the company have an WMSD problem?

It is important to position musculoskeletal disorders (WMSDs) in time and map them throughout the production process. Are the work-related WMSD problems observed at multiple workstations or does the problem affect only a specific workstation? Similarly, are the problems observed in one work activity or sector of the company, or in several? Is the emergence of WMSDs due to a recent change in the plant or has the problem set in gradually? If this assessment is not done, it is preferable to opt for tools targeting the workstations at risk, such as questionnaires focusing on WMSD symptoms.

Do I have an WMSD problem?

How to determine

- In-depth accident analysis
- At what workstations has the company had the most accidents or WMSDs?
- Do operators report pain related to their work? If so, at what workstations?
- Is absenteeism or staff turnover higher at certain workstations? If so, at what workstations and why?

After determining the scope of the WMSD problem, the company is ready to decide how it wishes to and will intervene. It must establish intervention goals and set up a schedule. The final assessment will validate whether these goals have been achieved.

Assessment of WMSD problems

Can the company satisfy the requirements of the process?

The process requires three levels of involvement by the company's management: participation on the steering committee of a company officer and his/her union counterpart; leaves for the operators of the position being analyzed, the supervisor and the technical specialists whose expertise is required at certain stages of the analysis; allocation of a budget to implement solutions.

An ergonomic analysis process always involves management support and participation of company personnel. In our experience, if the company's management believes that the analysis is necessary and expects results, the process will be credible and promote cooperation by all involved. In addition, the participation of the plant's operators and technical personnel is essential to the development and implementation of the solutions. The tremendous knowledge these people possess is indispensable.

The company should be serious in this endeavour and make a commitment to implement some of the solutions that will be developed following the workstation analysis. Otherwise, this is a waste of time for everyone and creates greatly demotivates the operators.

It is important to plan realistic deadlines, because the adoption of this process takes time. Sometimes it is necessary to meet suppliers, perform tests and trials, wait for a production shutdown, and consider the vacation period. Implementing solutions may often take several weeks.

Suggestions to reduce delays

In the case of very complex tasks, such as those of an electrician, determine whether it is possible to split the analysis according to his principal tasks. However, this can be done only if the work involves tasks that are relatively independent and if the problem is clearly associated with a specific context (location, equipment, task, etc.).

If several workstations have to be analyzed, do not wait for all the solutions to be implemented at the workstation studied before starting analysis of another workstation.

Choosing the intervention mode

The company chooses the appropriate intervention mode according to the urgency of its needs, its internal expertise in prevention and its financial means. To facilitate participation by the company's personnel, we propose two intervention modes: the ERGO group and the workstation committee. Given the complexity of work involving varied tasks, it is essential that the intervention be accompanied by an expert trained in ergonomics.

The ERGO group, as defined in the previous guide, is relevant if there are several workstations to be analyzed, because it favours taking responsibility for WMSD problems over the long term. It has the advantage of involving and training company personnel. Consequently, the expertise acquired by the ERGO group participants in workstation analysis stays within the company.

The workstation committee is quicker, because the ergonomist alone performs the stages of data gathering. However, if one is concerned about both efficiency and speed, the ergonomist cannot implement all the stages unassisted. It is essential to create a workstation committee to benefit from the unique expertise of the plant's workers. The participants in the workstation committee are integrated into the analysis during identification of the problems (stage 3 of the process) and participate in seeking solutions. This workstation committee is provisional and is dissolved at the end of the intervention.

To facilitate selection of the intervention mode, the following table compares the two intervention modes and the role the ergonomist must play in each mode.

Comparison between the two intervention modes and the ergonomist's role

ERGO group	**Workstation committee**
Permanent group	Provisional committee for 1 workstation
Group receives initial training on the entire process	Committee receives shorter training
Participants in the group collaborate in every stage of the process.	Participants intervene during the stages of identifying the problems and seeking solutions
Longer workstation analysis	Quicker workstation analysis
All stages of the process benefit from the group's expertise	Less leave time for operators, technical specialists
Expertise is created within the company	Committee dissolved, expertise lost
Ergonomist's role	**Ergonomist's role**
Provides basic training to the group Coordinates production of the analysis and is responsible for the group's operation Contributes to development of the group's autonomy Represents the group and presents the results of the analysis to the steering committee	Responsible for the analysis and the workstation committee Carries out the data gathering stages and coordinates the stages of diagnosis, implementing solutions and follow-up Presents the results of the analysis to the steering committee

Structures to be set up

After selecting the intervention mode appropriate to its needs, the company moves on to the next stage – setting up the committees that will carry out and provide support for the analysis.

Steering committee

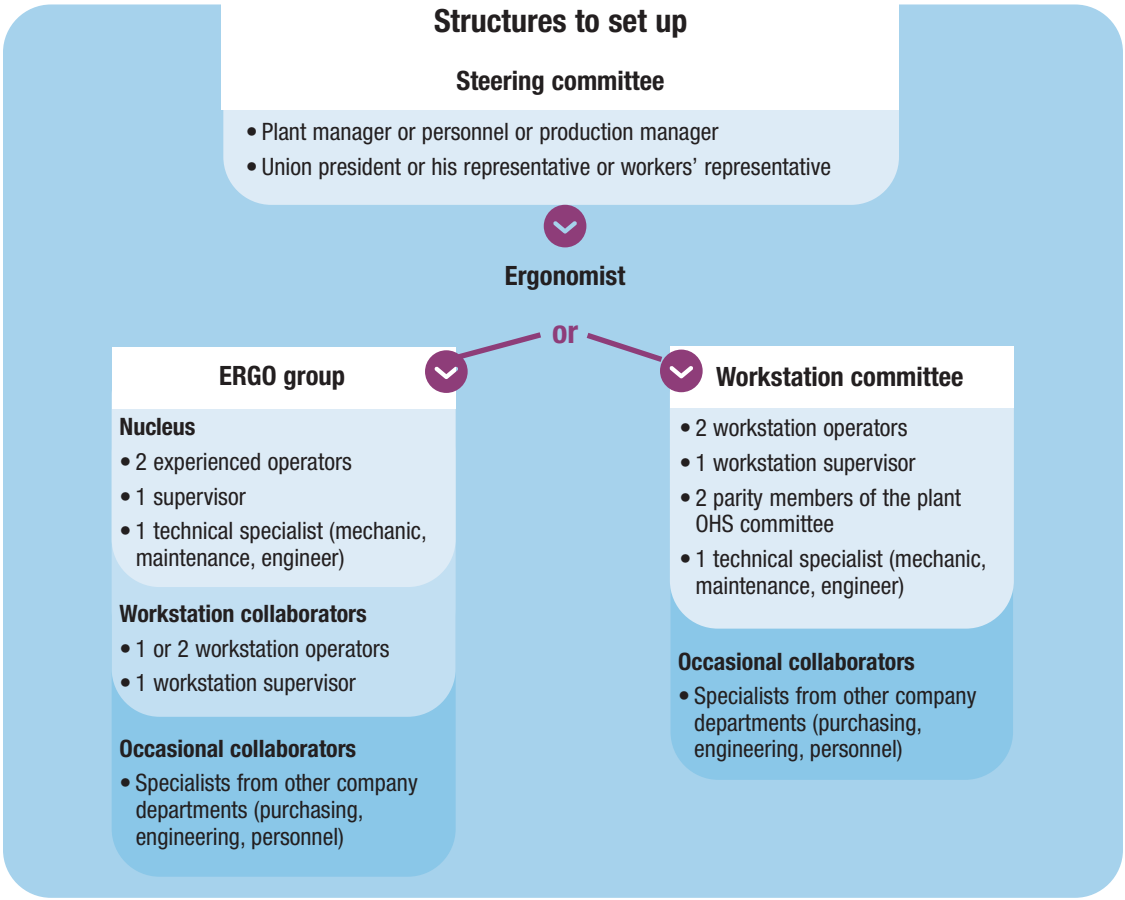
The parity steering committee is composed of a management representative (plant manager, personnel manager), a union representative (union president or his/her representative) or a worker representative (as the case may be), and the ergonomist in charge of the analysis. Its mandate is to support the ERGO group or the workstation committee in its work, make the decisions that will facilitate the analysis (leave for operators, technical specialists, access to information) and allocate a budget for implementation of the solutions it will have accepted. The steering committee is the decision-making structure for the intervention.

ERGO group

The ERGO group is created at the beginning of the intervention and is coached by the ergonomist. It is composed of a nucleus to which workstation collaborators and occasional collaborators are attached (see following figure). The ERGO group retains the same nucleus as long as possible so that its members acquire more expertise and autonomy. For more information on setting up an ERGO group, see Chapter 1 of the previous guide "ERGO groups – a tool for WMSDs prevention".

Workstation committee

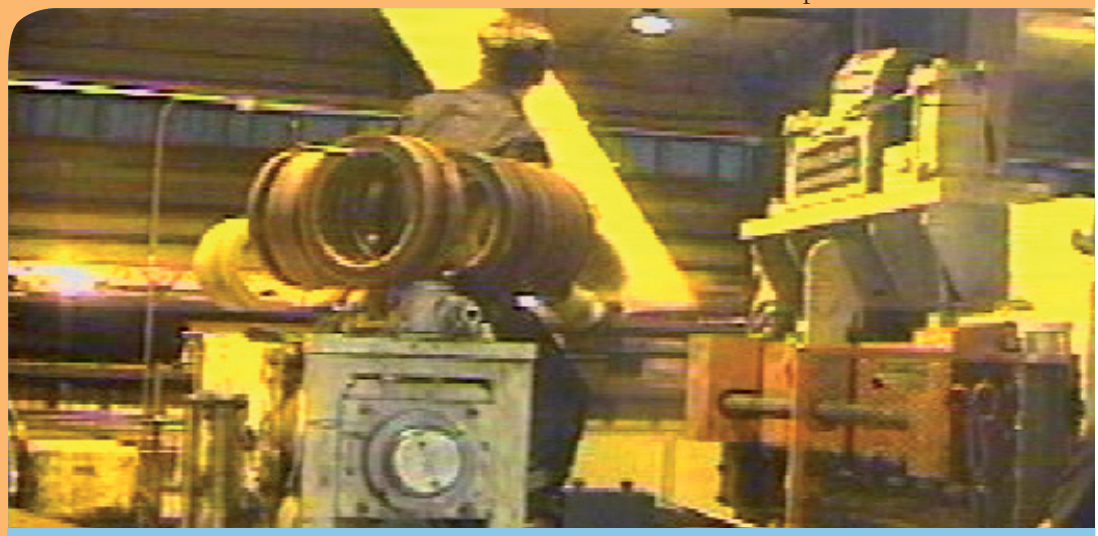
The ergonomist creates the workstation committee at the beginning of the problem identification stage (stage 3 of the process). The committee should not have less than five participants. As in the case of the ERGO group, company experts participate in certain committee meetings as occasional collaborators, depending on the type of problems encountered during the analysis. The advantage of this committee is that it is disbanded at each workstation, thus reducing its members' involvement. On the other hand, the expertise acquired by the participants does not play a role in the analysis of other workstations.



chapter 2
The process

The process involves 6 stages that serve as milestones, from data gathering to diagnosis to work modification.

Data gathering	**Stage 1**	Interviews
	Stage 2	Workstation observations
Diagnosis	**Stage 3**	Identifying problems and their causes
	Stage 4	Prioritizing problems
Work modification	**Stage 5**	Seeking solutions
	Stage 6	Implementing solutions and follow-up



This chapter will employ the example of a company in the metal sector. The company's main activity consists of cutting rolls, which are composed of metal sheet wound around itself to make narrower metal strips or bands.

The roll has a standard width of 1.5 m and a weight that varies according to the quality of the metal used. It can weigh up to 23,000 kg. The equipment used to cut the rolls is a loop slitter. The first step in cutting metal is to place the roll on the reel. The reel serves to hold and unwind the roll so that the beginning of the sheet can be inserted in the slitter, because the sheet is cut lengthwise. The metal sheet is then drawn between the cutting rolls which are positioned very precisely on the chucks to determine the desired cutting widths. The last section of the slitter serves to rewind the narrower strips or rolls. At the slitter output, the strips are sorted, strapped and palletized. They are then packed and loaded directly onto trucks for shipping to customers.

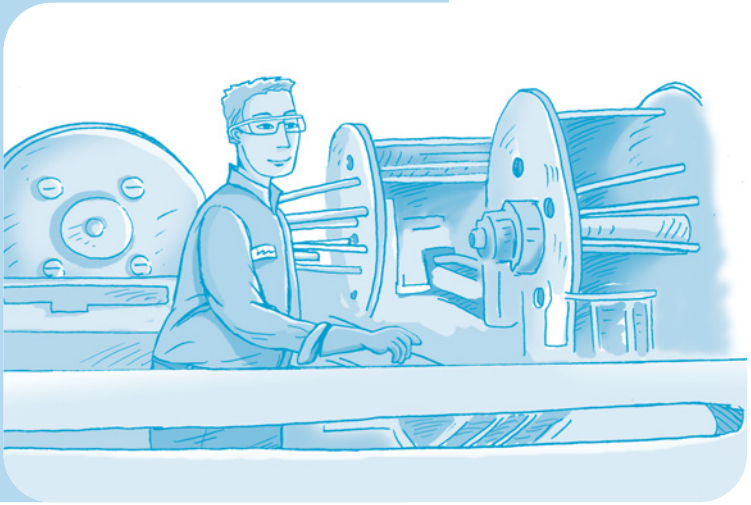
Data gathering	Stage 1	Interviews
	Stage 2	Workstation observations
Diagnosis	Stage 3	Identifying problems and their causes
	Stage 4	Prioritizing problems
Work modification	Stage 5	Seeking solutions
	Stage 6	Implementing Solutions and follow-up

Goals pursued	Action plan	= Know-how
1 **Become familiar with the work situation**	Find the operators for the interviews	Choosing operators
	Learn about the job	Workstation diagram List of operations
2 **Gather information on the work situation**	Conduct interviews	**Tool** Operator questionnaire Supervisor questionnaire
3 **Organize the gathered information**	Complete the Interview Summary	**Tool** Interview Summary

Interviews play a key role in this process, by helping to unravel, understand and target the operations, the problems or the difficulties that must be analyzed.

They are a simple and effective way to gather information. They reveal the point of view of the operators and the supervisor regarding the work situation analyzed.

In the case of long-cycle tasks, the interviews require more time – about 1 hour and 30 minutes. This cannot be avoided because there is a greater quantity of concrete information to be discussed, due to the greater number of operations, tools, etc. Also, the sequence of operations is not always repeated in the same order. It is then necessary to find out the production logic behind the sequence of operations and discover the variation factors.

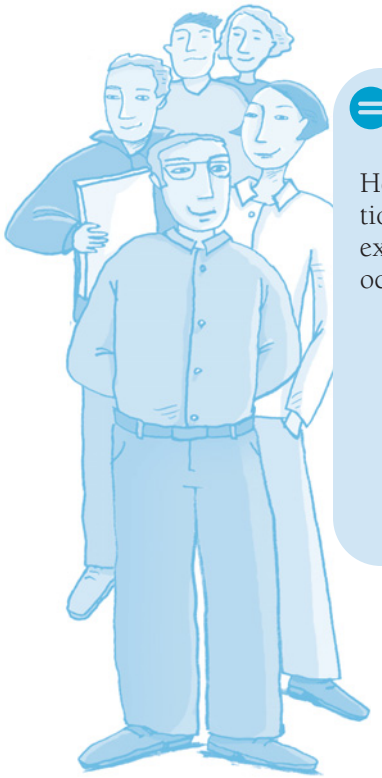


1 Become familiar with the work situation

It is useful to realize on your own what is happening at the workstation and ask yourself questions about the work before conducting interviews. The information sought concerns the operators' characteristics, this will help in locating them for the interviews, and the description of the workplace and of the task. The effort required to gather this information will vary, and depends on your knowledge of the company.

Find the operators for the interviews

It is necessary to obtain information on the number of operators who occupy the workstation on a regular or casual basis, and determine their characteristics. The objective is to improve your knowledge of the operators and find those who, during the interviews, are likely to provide various points of view on the work. For example, an operator who coaches new recruits at the workstation has a very specific representation of the work. He sees the difficulties encountered by novices, and he teaches them how to avoid these difficulties. An operator who has a high level of seniority has a good knowledge of how the work has evolved, the changes that have occurred at the workstation and their repercussions on the work activity. These are all perspectives on the work that will enrich the information collected in the interviews.



Know-how

Choosing operators

Here are a few criteria that will give you a better understanding of the operator population at the workstation analyzed. Criteria such as sex, age, status, seniority, shift and experience provide a preliminary profile of the characteristics of the operator population occupying the workstation.

Workstation operator characteristics

Operator	Sex	Age	Status	Workstation seniority	Shift	Experience	Comments
1	M	26	Apprentice	6 months	Evening		Wants to cooperate - sometimes has pains at end of shift
2	M	43	Regular	7 years	Day	- Has been trained in safe use of hoists - Trains novices on this workstation	
3	M	28	Regular	3 years	Night		Refuses to be interviewed
4	M	52	Former operator and replacement	11 years	Day	Very familiar with this workstation and the plant	

Free participation

It is important to allow the operators total freedom to participate or not participate in the interviews. The supervisor or the company's management must not use their authority to try to convince the operators or influence their decision.

The operators can be selected at an ERGO group meeting attended by workstation collaborators who are familiar with the work group. In the case of the workstation committee, the ergonomist may consult various people, such as the supervisor, an experienced operator, or a representative of the personnel office.

There is no infallible rule regarding the number of operators to be interviewed. Based on our experience, we have kept the guideline used in the short-cycle task analysis: a minimum of 3 and a maximum of 8 operators.

When there are 3 operators or less, the selection process is simple; it involves meeting all the operators and even looking for former operators at the workstation to obtain the greatest possible diversity of points of view.

When there are more than 3 operators, you must refer to the table of operator characteristics to find the operators to be interviewed. For it is not always easy to interview all the operators, given that the interviews last between 1 hour and 1 hour and 30 minutes. Thus, in the example presented in the table of workstation operator characteristics, operator 1 would be chosen because he is a novice, and operator 2 because he is experienced and trains new operators on the workstation. Since operator 3 does not wish to participate, you choose operator 4, who is familiar with the workstation.

Learn about the job

This involves producing a preliminary outline of the job that can be used throughout the analysis. You must describe the workplaces briefly and produce a list of the principal operations performed.

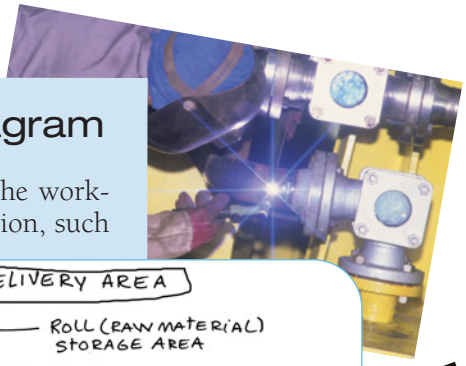
This job overview, among other benefits, can facilitate and accelerate discussions during the interviews. For example, when an operator refers to a machine or a sector of the plant, you can then locate it on the relevant diagram or photo. A list of operations can serve as a reference so that nothing is forgotten when an operator is asked to review all the work operations during the interview. Here are two types of know-how to help you produce the workstation diagram and the list of operations.

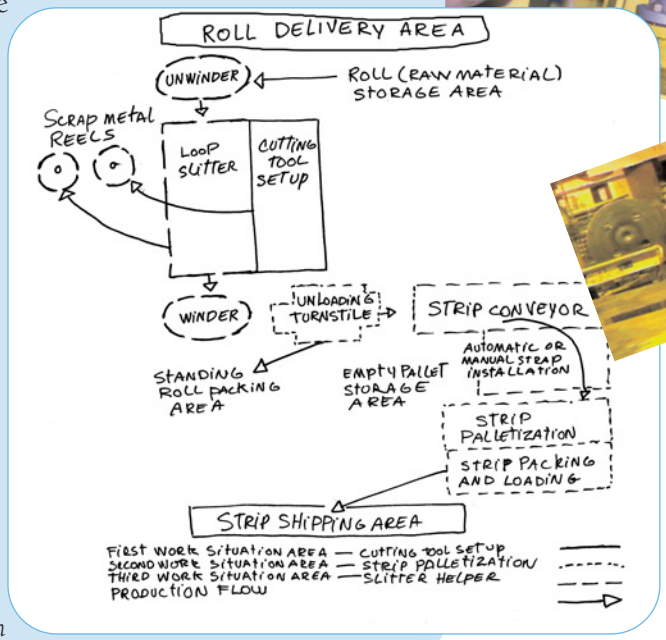
Know-how

Workstation diagram

Since this is the very beginning of the analytical process, the description of the workplaces will be general. It will schematize the main components of the workstation, such as the layout of work areas, the main equipment, the traffic areas, etc.

To represent the workstation, it is possible to use photos or a diagram produced by hand or with drawing software. What is important is to choose the means best suited to your resources and needs. The reality is reproduced better with photos, but it is more difficult to have a precise view of the entire workstation, especially if the operators use remote workstations. However, photos may be sufficient for an ERGO group familiar with the plant. We have chosen to produce a simple diagram of the product palletization workstation. Each piece of equipment is represented by a rectangle bearing its name and the product flow is indicated by arrows. The advantage of the diagram is that it can also be reused later, in Stage 2, in the summary of workstation observations.





Strip production workstation diagram

Know-how

List of operations

The list of operations divides the job into operations and briefly describes the means (tools, equipment, places) made available to the operators to perform each operation. The list presents the main operations in the sequence in which they are usually performed. Exceptional procedures or those that refer to rare models will often come up later in the interviews and during identification of problems.

This list should be regarded as a basic outline that can be helpful is selecting useful information during the interviews. It is also a starting point for organizing the information. The idea is to find a reasonable balance between too fine a breakdown (such as "take a tool" or "assemble two parts") that reveals nothing of the overall purpose of the subtask, or too broad a breakdown that does not provide enough information on the job content. For example, in the list presented, it was not enough to choose "unwind roll" as an operation, because this includes several operations, such as take out roll, install expansion boots, place roll on rewinder, cut strap.

List of slitter-assisted operations

- ✓*Take out rolls*
- ✓*Install strap or tap at the end*
- ✓*Install expansion boots*
- ✓*Wind roll*
- ✓*Install roll on unwinder*
- ✓*Remove strips on turnstile*
- ✓*Cut strap*
- ✓*Empty scrap*
- ✓*Advance material to the shear*
- ✓*Empty big box (scrap)*
- ✓*Cut beginning of roll*
- ✓*Empty shear boot*
- ✓*Climb on table to bend material*
- ✓*Cut with pneumatic shear*
- ✓*Insert and attach scrap*
- ✓*Install strap*
- ✓*Do setup*
- ✓*Change strap roll*
- ✓*Insert strips in rewinder*

2 Gather information on the work situation

The questionnaires proposed for the interviews are similar to those already developed for the repetitive or short-cycle task analysis process. In fact, a concern for musculoskeletal problems is common to the questionnaires for both processes. This is why all the problems more specific to the WMSD problem have been updated and retained. However, the questions regarding the work have been adapted to the long-cycle task analysis. Thus, to obtain a more complete picture of the work performed, a multi-part question has been added. It allows deeper investigation of the information regarding operations performed on the job.

Conduct interviews

The interviews are supported by two questionnaires, one addressed to the supervisor and the other to the operators. These questionnaires are administered individually. An interview lasting about 1 hour and 30 minutes should be scheduled with each operator and the supervisor.

The following description applies to both questionnaires (operator and supervisor). You will find a complete version of each questionnaire appended to this guide. However, because of the similarity that exists between these two questionnaires, only the operator questionnaire will be explained.

The questionnaires are divided into major sections, each of which includes one or more questions on the same theme. You will find questions related to:

General information
Questions to situate the workstation in the company, note certain characteristics of the operators interviewed (sex, experience, etc.) and the pre-requisites for learning at this workstation.

Accidents occurring at the workstation
Question designed to familiarize yourself with all the types of accidents that have occurred at the workstation and the circumstances of the event, mainly the sequence of causes.

Description of work operations and their difficulties
This is the central question of the questionnaire. The operators and the supervisor are asked to describe each operation, the tools and equipment used, the materials, the workplaces, and the variation factors. The most important part: they are asked to identify the difficulties they experienced in each operation. Experience shows that a list of operations helps the interviewer follow the respondent's description and ensure that no operations or special conditions have been omitted. The list also facilitates note taking and will be very useful in summarizing the answers.

Work-related musculoskeletal pains (only in the operator questionnaire)
This question serves to describe, for each operator: the joint region or regions affected by the pains or discomfort, signs of their severity and of their causes.

Work performance conditions of a more general nature
Some questions take a more general look at the work situation. One question asks the respondent to rate the most difficult or painful operation. Other questions also concern rotation and changes made at the workstation.

ERGO group members who have never conducted an interview or who want to refresh their memory on how to proceed should consult the guide *ERGO groups – a tool for WMSDs prevention,* p. 17 to 20.

Confidentiality and respect

Is it really possible to assure the confidentiality of information collected in interviews in a plant? The operators known each other well. Especially if only a few of them occupy a workstation, it is very likely that they will identify the sources of certain comments, despite the efforts to depersonalize the questionnaires. Instead of proliferating controls, we decided to adopt simple measures, such as choosing to summarize the interviews as a "depersonalized" working document, not associating an operator's name with information extracted from the questionnaires, and not allowing group discussions to focus on individuals.

3 Organize the gathered information

Complete the Interview Summary

The Interview Summary is the working document that accounts for all the information gathered from the operators and the supervisor. In the coming weeks, the workstation committee or the ERGO group will refer to this summary in carrying out the other stages of the process, such as planning the observation process and seeking solutions.

Its content should focus primarily on what the majority of the respondents consider problematic. Generally, these are key values, that is, aspects of the work that must be examined in detail. It is also essential to pay special attention to comments by operators experiencing difficulties that appear to be more specific. For example, if insertion of a part requires very great dexterity because the equipment is in poor condition, then this information should be considered, even if it is mentioned by only one operator. Safety problems regarding equipment or procedures will sometimes be of concern to some operators more than others. It is also necessary to deal with these problems.

In fact, not all respondents will take a uniform position on the same aspects of the work situation. Even if they describe each operation, they will emphasize the ones they consider most worrying. They are right, because in an hour and a half, it is impossible to cover everything.

This is why the summary should contain both the broad consensus points and the more specific points to be validated in the analysis.

Tools

Know-how

Interview Summary

The Interview Summary has three parts, as illustrated in the following example (slitter helper workstation).

- The first part reports specific data: general characteristics of each operator interviewed, their discomforts, accidents, most difficult or painful stages.
- The second part includes the summary of the description of operations and the difficulties reported by all respondents. Allow for several pages, because the number of operations always exceeds the space provided.
- The third part concerns difficulties generated by certain general conditions of performance of the work and recent changes in the workstation.

Interview Summary 8

Production sector: *Roll cutter*
Workstation: *Slitter helper*

	Worker:#1	Worker: #2	Worker: #3
Sex	*M*	*M*	*M*
Height	*6'*	*5' 10"*	*6'*
Dominant hand	*Right*	*Right*	*Left*
Status	*Apprentice*	*Regular*	*Regular*
Seniority with the company	*6 months*	*8 years*	*3 months*
Experience at this workstation	*6 months*	*7 years*	*3 months*
Accidents	*Cut:* *- In cutting the strap on the unwinder*	*Cut on the left wrist:* *- In throwing a piece of metal into the box* *- In attaching the scrap metal strip* *- Tendonitis, bursitis in the righ shoulder* *- Cut on the left hand*	*Cut while unpacking roll*
Regions affected that present work-related problems (discomfort, pain)	*- Discomfort on the right side* *- Tired legs*	*- Lower back pains* *- Pains in both hands* *- Neck pains*	*- Lower back pains* *- Right shoulder pains*
The most difficult or painful stages of the work	*- Inserting strips in the rewinder* *- Inserting expansion boots (rubber)*	*- Attaching scrap to thick material* *- Sliding scrap on thick material* *- Inserting thick material strip in the rewinder*	*- Sliding scrap* *- Throwing scrap in box (first turn trim)*
Other workstations occupied in the company	*- Doing the setup*	*- None*	*- None*

Interview Summary pages 8-9-10 of the Tools section

Interview Summary 9

Can you explain what operations are performed and the difficulties associated with them? If possible, indicate whether these operations vary and their importance, their intensity and the time invested.

Operations / actions (Name, description, place, equipment, tool, material)	Difficulties (With what factors do you associate them?)
1. *Remove rolls*	• *Aisles aren't wide enough*
2. *Install rubber (expansion boots)*	• *Heavy* • *Difficult to insert (rolls deformed or crushed)*
3. *Put roll on unwinder*	• *Difficult to insert (rolls deformed or crushed)* • *Sometimes (fairly rarely), have to use torches, shears, hydraulic jack, sledgehammer or iron bar (crushed rolls)*
4. *Advance material to the shear*	• *Material jammed in the magic eye cavity*
5. *Cut beginning of roll*	• *Heavy (thick material)* • *Box far away to throw and dispose of pieces*
6. *Climb on the table to bend material*	• *Slippery (Oil on the table and material)* • *Climbing up and down (risk of falling, no support)* • *Some operators not climb on the table. They prefer to bend the material with the sledgehammer on each side of the part.*

Interview Summary 10

TRAINING

Do the operators receive training before occupying this workstation? Does the training allow the operator to learn the job well?

Coaching period on the workstation. Then he completes his training by teaming up with the slitter operator, who has experience in all workstations related to the slitter. Theoretical auxiliary training on slitter operation and metal cutting.

GENERAL CONDITIONS

What general conditions have been recognized that make the work more difficult? Include comments on rotations, if applicable.

- *Hot in summer*
- *Turnstile zone and setup table not very well laid out?*
- *Noise in the reel area because of a pump*

OTHER INFORMATION

Note the changes that have been made to the workstation and their positive or negative impacts on working conditions.

The location of the steps leading to the slitter has been changed, which has the advantage of facilitating access to the slitter. However, the steps are in poor condition. They have to be changed.

The pneumatic shear was changed to a model that works better. It would be necessary to continue in this direction and upgrade the tooling completely.

Interview Summary pages 8-9-10 of the Tools section

Goals pursued	Action plan	= Know-how
1 **Plan observations**	Determine the operations to be observed	
	Select the operators to be observed	
	Set the video observation schedule	
	Complete the video observation planning grid	**Tool** Video observation planning grid
2 **Perform observations**	Film the work activity	Perform the observations
	Complete the Observation Summary	**Tool** Observation Summary: Video observations Observation Summary: Workstation diagram

Data gathering — Stage 2 — Workstation observations

Workstation observations complete the data gathering process. They concretize the job description obtained in the interviews and allow you to ask new questions and formulate hypotheses concerning the presence of problems and risk factors at the workstation. In addition, the video images recorded during the observations will serve as the basis of discussion for the committees in identifying problems (stage 3). However, before setting out with your camera, we suggest you take the time to plan the observation sessions, especially in the context of work involving varied tasks.

1 Plan observations

The purpose of planning is to select the operators and operations most representative of the work activity and the work performance conditions the operators consider most difficult, so that they can be analyzed later within the group.

Planning of the observations is based on the interviews. During the interviews, the operators described the operations they perform. They explained the difficulties they encounter and the pains they feel.

In the case of the ERGO group, the participants already have the Interview Summary they have just completed. In planning the observations, they also benefit from the presence of the supervisor and at least one workstation operator. The ergonomist must produce the plan on his own, because the workstation committee is not active yet. However, he can consult the workstation supervisor or operators to produce or revise the plan.

Determine the operations to be observed

Here is how we proceeded to select the operations to be observed. The decisions taken were noted in the observation planning grid:

Fig. 2.1 Operator installing a strap roll on the reel.

Operations characteristic of the job as a whole

In the case of varied tasks, it is difficult to film all of the work activity. However, it is a good idea to film at least one complete cycle, showing all of the operations. Even if the operations do not all present major problems, new information, not raised in the interviews, may emerge from the discussion. In practice, you will try to choose, as a model that requiring additional effort, a production condition that the operators consider difficult.

Related operations

Certain difficulties are associated with less frequent tasks, such as maintenance, setup or scrap disposal operations. These operations are performed regularly, once a day or once a week. Their observation is then essential to the analysis, especially if they present difficulties reported by the operators. According to the Interview Summary, for the operator helper workstation, all scrap disposal modes raised problems.

For example, for disposal of large scrap containers, the operator had to manoeuvre in awkward postures, as in the case of the shear located under the slitter. The operation consisting of changing and installing a strap roll on the reel (Fig. 2.1) requires the exertion of force to manipulate the heavy rolls.

Select the operators to be observed

In general, the criteria used to find operators at the interview stage also apply in the case of operators to be observed (See Know-how: selection of operators).

However, in the case of long-cycle tasks, it is particularly important to select experienced operators and novices because learning work activities is a long and difficult process. Thus, there can be significant differences in the work methods of these two types of operators, (Video observation planning grid, p.11 of the Tools section).

Meeting the operators to be observed

The purpose of the meeting with the operators and the supervisor is to explain the purpose of the observations and how the committee intends to use the videotapes. It is important to take the necessary measures with corporate management and the union so that the video images of the operators remain for the exclusive use of the ERGO group or the workstation committee and that they can never serve for other purposes. Ideally, a signed written agreement assures the operators that the video material will be reserved strictly for analysis of their workstation. The operators must also have the choice of whether or not to be filmed without being pressured by the employer or union party or the persons involved in the application of this process.

Set the video observation schedule

Filming a long-cycle task demands a lot of availability and flexibility on the part of the observer. Contrary to short-cycle tasks, for which the task is repeated several times an hour, certain long-cycle tasks may take several hours to be performed completely. Moreover, certain maintenance operations, special product utlization or production of rarer models only occur once a day or once a week. This is why it is essential to organize the video recordings in collaboration with the supervisor. This person knows the work plan for the next few weeks and can indicate the appropriate times to film a specific task or a specific product (see observation planning grid). Despite these planning efforts, it is not unusual for the observer to be informed only 1 or 2 hours in advance of production of a specific model. This allows the observer little time to prepare for the observations, especially if he is coming from outside the plant.

Complete the video observation planning grid

The video observation planning grid serves as a quick reference to remind yourself which operators and working conditions you have agreed to film and when this will be possible.

Know-how

Video observation planning grid

Video Observation Planning Grid 11

Production sector: _____

Workstation: *Loop slitter helper*

Operations to film	Why	Operators	When
Entire cycle with thick, rigid metal roll	*Operations considered more difficult*	*Operator 4, the most experienced*	*- Rarer production* *- Supervisor will give warning as soon as he knows — 4 to 12 hours in advance*
Entire cycle with more flexible metal roll	*Most common operations* *Operations considered less difficult but more dangerous, because the operator has to climb on the metal sheet to align it properly (Fig. 2.2)*	*Operators 1 and 2, for a better perspective on the difficulties experienced by the apprentice compared to the strategies and tricks developed by an experienced operator*	*- Day and evening shift* *- Possible every day* *- Operator 2 day shift and operator 1 evening shift*
Scrap disposal: *(1) Reels* *(2) Under the shear* *(3) Large container*	*(1) The scraps are often trapped* *(2) The container is difficult to access and very heavy* *(3) The operator's arms are outstretched to empty the container*	*Operator 1 and, if possible, operator 2*	*(1) Reels are emptied after each roll (several times a day)* *(2) Shear is emptied as infrequently as possible (Operator 1 does it in the evening)* *(3) Supervisor will give warning before emptying it – this mainly happens on the day shift (every 3 or 4 days)*

Video observation planning grid - page 11 of the Tools section

Fig. 2.2 Operator climbing on the metal sheet to insert it properly in the slitter.

2 Perform observations

In this process, it was decided to use video observation, because a visual medium is required to stimulate discussion by the participants. Although it has many advantages, video does not account for the entire work reality. Consequently, it is sometimes necessary to return to the workstation to verify certain details, take measurements or ask the opinion of several operators.

Film the work activity

Video recording of this type of task is more complicated and takes time, because the operator performs many operations and the task involves many variable factors. The operator does not remain in one place at his workstation, but may have to move from one machine to another. Consequently, it is difficult to predict the shots in advance, and installing a fixed camera is a waste of time. The observer must follow the operator and look for appropriate shots so that nothing is missed concerning the operator and his work activity (operations performed, risk factors, safety problems). It is also essential not to hinder the operator when filming his work.

It is not always possible, within a reasonable time, to film everything anticipated when the observations were planned. If a given production condition cannot be filmed, you will have to ask the participants to remember the difficulties encountered under this condition and the strategies adopted to avoid them. You can also refer to the interviews for the missing conditions.

In all cases, it is to the observer's advantage to record all the operations he considers relevant to the analysis, such as unexpected situations, incidents or special conditions, even if they were not recorded in the observation plan.

Know-how

Perform the observations

Shorten the shooting time
To reduce the time allotted to video recording, it may be advantageous to film the entire task when conditions are difficult or dangerous. For example, for the slitter helper workstation, the operators mentioned that cutting flexible and oily metal was dangerous. Therefore, to reduce shooting time, the experienced operator was filmed when a roll of this type of metal was cut.

Record the operator's comments with the camera microphone
To facilitate your recollection of the type of production, the operator observed and the problems during filming (events, incidents, production problems), we suggest using the video camera microphone to make comments. When the video recording is completed, it will be easier to complete the Observation Summary by watching the video and listening to our comments.

Time-date the video while recording
Time-dating the video images marks the sequences as they are recorded. This makes them easier to find when preparing the committee meeting, provided for in stage 3. The observer will be able to view the recordings before the meeting; for each task, working condition or operator the observer will be able to note the date and time recorded on the videotape. When the committee meets, it will then be possible to trace the most relevant video sequences and reduce the committee's viewing time.

Complete the Observation Summary

The Observation Summary allows you to note the production conditions, variations and incidents recorded during filming of the workstation and to complete the workstation diagram produced during the interviews. The record has two parts: the video observations and the workstation diagram.

Video observations

The interest of noting in detail the production conditions during filming and everything that deviates from normal working conditions, is to have a more accurate image of the reality illustrated on the video. In our example, there were several work shutdowns during the observations. It is important to note why and what this changed in the operator's work activities – a defective tool, a broken wire, a deformed roll or very oily and slippery metal have different impacts on the job.

In the first column of the summary, enter the basic information characterizing this observation: the task or operations observed, the operator, and the date and time that the recording started and ended. In the second column, you must note the production conditions during recording: production intensity; model or characteristics of the product manufactured; tools and equipment used. In the comments section, you must note everything that influences the work activity, including rush orders, the operator's absence and broken tools. You must also note incidents, production shutdowns or any other unusual event.

Tool

Know-how

Observation Summary: Video Observations

Observation Summary: Video Observations 12

Production sector: _____

Workstation: *Slitter helper*

Observations	Production conditions	Comments
Operations: *Cutting a complete roll* *Operator: Worker 1 (apprentice)* *Date: May 12* *Time: Start: 7:00 a.m.* *End: 9:30 a.m.*	*Very oily flexible metal,* *3 rolls one after another*	*Difficulty installing the expansion boots because 2nd roll deformed*
Operations: *Cutting a complete roll* *Operator: Worker 2* *Date: May 13* *Time: Start: 2:30 p.m.* *End: 4:00 p.m.*	*Thick metal* *3:20 p.m., 3:35 p.m.* *Slitter shutdown because the wire broke on the reels*	*The operator has difficulty pulling the wire and recovering it under the slitter*
Operations: *Cutting a complete roll* *Operator: Worker 4 (Experienced)* *Date: May 13* *Time: Start: 12:30 p.m.* *End: 2:00 p.m.*	*Thick metal* *The customer wants a shorter roll.* *The pneumatic hand shear must be used.*	*The operator had problems with the hand shear*
Operations: *Reel scrap disposal* *Operator: Worker 1* *Date: May 14* *Time: Start: 3:30 p.m.* *End: 3:50 p.m.*	*Thick metal*	*Cramped work space*

Observation Summary video, see page 12 of the Tools section

Workstation diagram

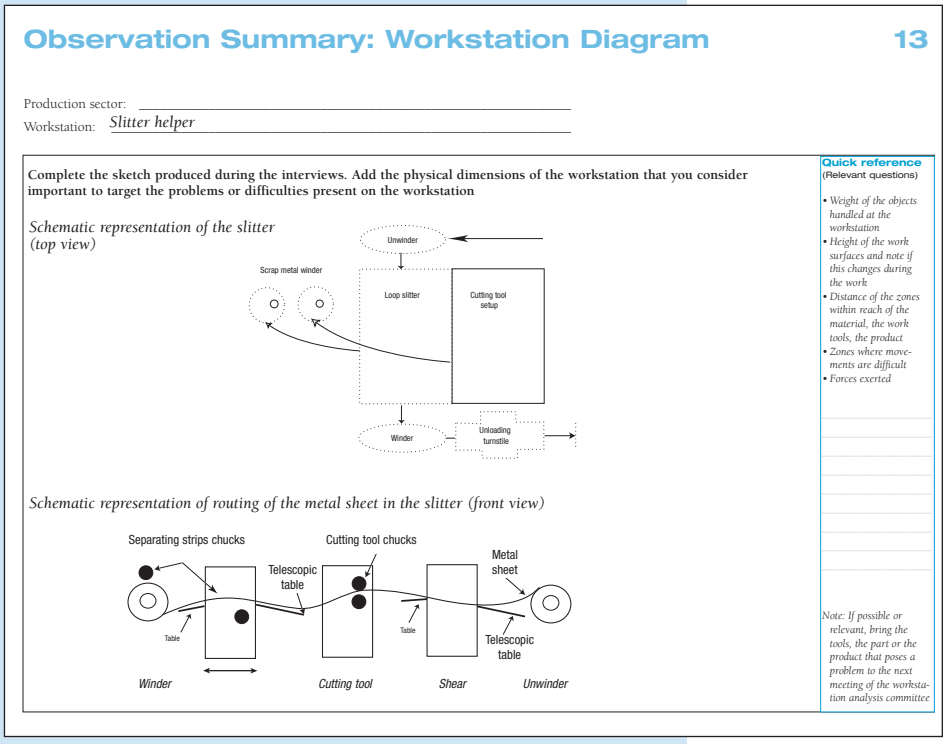
To provide extra information, such as work zones, traffic zones, circulation of material and storage areas, it is sometimes useful to redo the workstation sketch produced during the interviews. You must also note the workstation's physical dimensions, which seem to be important in targeting the problems at hand. To guide your efforts, you can use the quick reference from this record (See Know-how: Observation Summary: Workstation diagram) and add the features specific to your work environment.

In our example, the first diagram used in the interviews presented a general view of the production; this was retained in the top part of the summary. However, following our observations, we added a front view drawing of the slitter for a better view of the cutting process and the set of tables used in routing the metal sheet.

Know-how

Tool

Observation Summary: Workstation diagram



Observation Summary: Workstation Diagram 13

Production sector:

Workstation: *Slitter helper*

Complete the sketch produced during the interviews. Add the physical dimensions of the workstation that you consider important to target the problems or difficulties present on the workstation

Schematic representation of the slitter (top view)

Schematic representation of routing of the metal sheet in the slitter (front view)

Quick reference
(Relevant questions)

- *Weight of the objects handled at the workstation*
- *Height of the work surfaces and note if this changes during the work*
- *Distance of the zones within reach of the material, the work tools, the product*
- *Zones where movements are difficult*
- *Forces exerted*

Note: If possible or relevant, bring the tools, the part or the product that poses a problem to the next meeting of the workstation analysis committee

Workstation diagram summary, see page 13 of the Tools section

The process chapter 2

Data gathering	Stage 1	Interviews
	Stage 2	Workstation observations
Diagnosis	**Stage 3**	**Identifying problems and their causes**
	Stage 4	Prioritizing problems
Work modification	Stage 5	Seeking solutions
	Stage 6	Implementing Solutions and follow-up

Goals pursued	Action plan	= Know-how
1 Prepare analysis of video observations	Present the results of the first stages	
	Recall useful notions for analysis of the videos	**Web site** IRSST and ASPMÉ
2 Identify the main problems	Hold a structured discussion based on the video observations *(Example)*	Type of problems Principal WMSD risk factors
	Complete the Analysis Summary	**Tool** Analysis Summary *"Problem identification"* section

Diagnosis — Étape 3 — Identifying problems and their causes

The purpose of the problem identification stage is to diagnose the main problems associated with performance of work operations, and their causes. This cannot be accomplished by one person alone, as is the case with the interviews or the video observations. With this stage, the real collective work begins, and continues to the end of the process regardless of the intervention mode selected - ERGO group or workstation committee.

For long-cycle tasks, the purpose of the analysis technique is to get the operators to verbalize based on the video recordings. On the basis of a structured discussion by the ergonomist, the operators are encouraged to engage in a free and open discussion of the problems encountered in the different operations viewed. The statement of the problem as expressed by the operators encompasses the difficulties encountered in the work, the health and safety risk factors and their determinants. The gateway to the analysis is no longer the risk factor, as is the case for repetitive tasks, but rather identification of the problems. The different points of view of the workstation participants invigorate the discussion and provide a wealth of information.

The role of the expert responsible for the intervention is to facilitate and structure the discussion. The expert coordinates the discussion, ensures that different points of view can be expressed and facilitates consensus on the principal problems targeted.

The problem identification section of the Analysis Summary serves as a work and memory tool for the participants. It is completed during the discussion. This summary will also serve to record the results of the problem prioritization (stage 4) and the problem solving (stage 5).

Why WMSD risk factors are no longer the gateway to analysis

Division of the work
Analysis of the risk factors necessitates a very fine division of the cycle; this will facilitate observation and analysis of the work actions. This division is appropriate for a short cycle, because the number of actions is smaller and they repeat at very short intervals, even several times a minute. This is not the case for long-cycle tasks, which can extend over several hours.

Very difficult to estimate the risk factor due to variability of the work
The impact of the risk factors depends on three dimensions: duration, amplitude (intensity), frequency. These dimensions are more difficult to estimate in the case of long-cycle or varied tasks. One example would be an awkward shoulder posture associated with the exertion of force, such as in the handling of certain tools. If this action is repeated every 30 seconds during an 8-hour shift, it is reasonable to believe that there is a risk factor of a frequency that deserves attention. In the case of a long-cycle task, when a risk factor is observed, it is very difficult to estimate its significance. What is its frequency? Its duration? Its intensity? It can take kilometres of video images and hours of analysis to obtain an estimate that is not always very reliable.

1 Prepare analysis of video observations

You cannot improvise in identifying problems – you have to prepare. This is why from the outset the action plans provide for the ergonomist to report to the participants on the results of the first stages of the analysis. He must also ensure that each participant understands the main types of possible problems and the risk factors that may arise from them.

Present the results of the first stages

Before beginning this stage, you must have completed

- **Interview Summary**
- **Observation Summary**

The ergonomist presents the data gathered since the process was first adopted. Special attention must be paid to operations associated with pains felt by workers or work performance difficulties.

It is important to note whatever it was possible to film according to the plan (stage 2). If there are still any operations or special conditions to be filmed or working conditions that are impossible to observe, the participants must be aware of this before finding other ways to obtain the relevant information.

Recall useful notions for analysis of the videos

The ergonomist assumes responsibility for organizing the information capsules. These capsules will differ considerably depending on the intervention mode. For the ERGO group that monitored and participated in data gathering, the reminder of the Interview Summary will be brief. In addition, the creation of an ERGO group in a work environment usually involves initial training. This training generally has three components: basic notions of ergonomics, WMSD prevention and a presentation of the analysis process.

For participants in the workstation committee, whose participation is more ad hoc, the information capsules will have to be more substantial. It is important to explain briefly what ergonomics is, the objectives of the process and a few basic notions of the origin and prevention of WMSDs (see IRSST and ASPME Web sites). However, the ultimate objective of this training is to prepare the participants for analysis of the videos and discussion on identifying the problems.

This preparation does not seek to have the operators adopt a specialized jargon. The important thing is that they recognize the problems most commonly encountered on the job and the resulting risk factors. They do not need to learn to name the work postures. The problems are identified in the company's language, common to all operators.

Web sites

For more information, see the Web document:

"Work-Related Musculoskeletal Disorders (WMSDs) – a better understanding for more effective prevention"

www.irsst.qc.ca/fr/_publicationirsst_664.html

www.irsst.qc.ca/en/publicationirsst_885.html

2 Identify the main problems

The purpose of this stage is to understand the work and identify its main problems. For this purpose, you first hold a structured discussion based on the video recordings and record the information gathered in a summary.

Hold a structured discussion based on the video observations

The discussion among the participants is based on the video observations. Its primary objective is to identify the problems related to the work activity. The ergonomist ensures that systematic questions are asked for each operation viewed. The participants introduce nuances on the significance of the different problems, because they are in a position to explain how this happens in reality and the conditions under which an operation is either more demanding or easier to perform. The video images stimulate discussion, but the participants' knowledge gives them broader significance.

The ergonomist's role

For the discussion to be effective, it requires the support of an ergonomist who has the dual role of offering expertise and structuring the discussion.

- He ensures the orderly presentation of video sequences and the progress of the work.
- He facilitates the discussion and asks questions to identify the problems encountered, the resulting risk factors and their determinants. He encourages the emergence of different points of view and discussion of variations in working conditions.
- He summarizes the relevant information that emerges from the discussion, and ensures that all the participants agree on the fact that a specific situation is or is not a problem before recording it in the Analysis Summary.
- He ensures that the discussion focuses on the work and its difficulties. The discussion must never attack or denigrate individuals. Moreover, the committee meetings are not forums to resolve labour relations conflicts that might exist within the company.

Example

To explain the sequence of a structured discussion further, take the example of the operation that consists of attaching strips of scrap metal or trimmings (1 cm on each side), resulting from cutting of a large metal sheet by a loop slitter. These trimmings must be routed onto two reels for subsequent disposal in scrap containers.

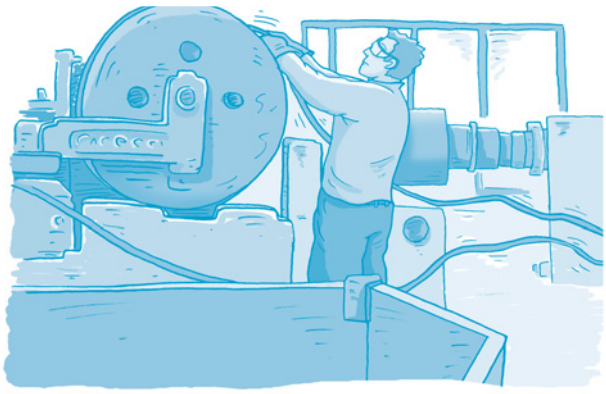
- **The statement of a problem puts the emphasis on a work operation and its performance context.** Each problem mentioned by the participants has a work operation as its starting point. The participants first explain how this operation is performed and why it is performed in this way. Some add explanatory elements, which will vary according to their experience and where they work in the company.

Fig. 2.3 Operator trying to bend a very rigid metal strip to insert it in the reel.

  - Generally, the problem is put on the table because it hinders the work activity, with consequences for the quantity or quality of production required, or makes the work more physically difficult or more dangerous.
  - For example, viewing the operation to "insert and attach the scrap metal strips (1 cm) in the reel" reveals that this operation is difficult. This is because the operator has to pull very hard to "uncoil" the two strips (from each side of the sheet being cut by the slitter), which are sometimes very rigid, and attach them to a scrap reel (fig 2.3). Those strips also tend to jam during winding. This situation reveals several types of problems, including incidents caused by strip that breaks and has to be reattached, material that is difficult to handle, the forces to be exerted, reels that do not work properly.

- **The statement of a work problem expresses the WMSD or accident risk factors more or less directly.** Often the risk factors are implied in the discussion. The facilitator must make sure that he raises them for the participants to confirm their presence and significance. In our example, the operation that involves inserting and attaching the metal strips was initially associated with an WMSD problem, because the operator must make an effort to force the scrap strip onto the reel. He also has to work in a bent position and stretch to fasten it in place (Fig. 2.4). However, during the discussion, questions were also raised about the risks of metal cuts, noise and heat, none of which are visible in the video images. It is also important to consider the risks to the workers' safety.

Fig. 2.4 Operator attaching a very rigid metal strip to the reel, which involves awkward postures and the exertion of force.



- **The causes of the problems are often discussed.** Whenever this occurs, group discussion has raised the causes of the problem. It was mentioned that because of the metal's spiral shape, the operator has to pull very hard to get it to the reel, especially when the metal is thick and rigid. Also, the scrap strip tends to detach from the reel because the holder is broken. There is very limited work space in this zone (fig. 2.5), thus obliging the operator to bend and stretch.

- **The consequences of problems are mentioned frequently.** In our example, the cuts and pains reported by the workers, either in the discussion or in reference to the Interview Summary, reveal consequences for worker health and safety. There are also production consequences because the strip breaks often or detaches from the reel (Fig. 2.6), which results in metal cutting delays.

- **A glance at the Interview Summary** confirms that several workers consider this stage to be the most difficult and that some of the pains they feel are associated with this operation.

Fig. 2.5 Operator who has to empty the reel in a confined work space.

Fig. 2.6 Operator who has to cut and reattach the metal strip that has detached from the reel.

Know-how

Types of problems

Tools and equipment

- Dimensions
- Noise
- Design
- Vibration
- Handling
- Weight
- Slippery grip
- Efficiency
- Quality
- Maintenance
- Availablity

Layouts

- Dimensions of work surfaces
- Space provided for the worker
- Space available to move around
- Arrangement of equipment
- Presence of obstacles
- Reach zones
- Support surfaces

Training/ Information

- Long enough coaching
- Sufficient learning time
- Demanding rotation
- Insufficient instructions
- Inapplicable instructions

Floor

- Hardness
- Slope
- Unevenness

Materials-products

- Dimensions
- Volume
- Slippery
- Dirty
- Heavy
- Grip
- Sharp
- Shape
- Hot/cold
- Quality
- Supply

Ambient conditions

- Temperature
- Humidity
- Lighting
- Noise

Other problems

- Teamwork involves difficulties
- Is there good synchronism
- Tense work climate with co-workers, supervisor?
- Upstream and downstream workstation
- High or low level of autonomy
- Availability of teammates

Know-how

Principal WMSD risk factors

Organizational factors

- Workload
- Pace
- Work schedule
- Distribution of breaks
- Mode of payment
- Technological changes

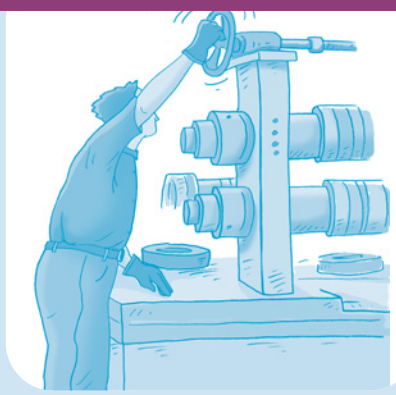
Awkward posture

- Extreme posture
- Effort to maintain

Strain and force

- Intensity of force
- Joint used
- Direction of strain
- Grip
- Posture
- Personal characteristics

Static muscular work



Physical aggressors

- Impact
- Vibration
- Cold
- Mechanical pressures

Risk factor modulators

To evaluate a risk factor's significance, three variables must be considered:

- **Duration** of maintenance of the risk factor
- **Amplitude** or intensity of the risk factor
- **Frequency** or number of times the risk factor repeats

Complete the Analysis Summary

The comments made during the structured discussion must be organized, sorted and summarized to be able to use them as work elements. The Analysis Summary, (See Know-how: Analysis Summary, problem identification section, p.33), is the preferred tool for organizing this information. Completed during the discussion, it allows each operation to be associated with the problems and their causes and the WMSD and accident risk factors. The summary then becomes a written summary of the main problems. Its primary quality is that it reflects the consensus of the participants around the table.

The present problem summary is intended to prepare participants for action – it is a decision-making tool. The grid will be used to compare and provide perspective on the different problems encountered, which will help the participants prioritize the main problems (stage 4). This grid will also help orient the main solutions (stage 5).

Breakdown into operations

The breakdown into operations was already carried out during the interviews. You must ensure that it corresponds to the filmed work sequence. Then, for each operation identified, you must complete the summary by identifying the problems and the resulting risk factors.

Problems and their causes

As previously explained, the description of the problem may refer to different dimensions of the work situation, ranging from its design/planning and its organization to its consequences for the workers (injuries, pains) or the production system (equipment failure, production shutdown, quality impairment). This heading covers all the comments that describe the problems, their causes and the special working conditions associated with them. Thus, it is important to know that a specific piece of equipment is difficult to move because it is in poor condition, or that the floor has unevennesses that make it more difficult to handle equipment. In another case, a worker may attribute the problem to teamwork, because he has difficulty finding a teammate available to help him perform an operation. (See Know-how: Types or problems, p 31).

Risk factors

Certain WMSD or accident risk factors are perceived as problems, such as exerting a force or the risk of falling whenever the operator goes to feed the machine. These factors should be noted in the summary. The risk factor is verbalized first in the descriptions of the problem; however, to highlight it, it will be set apart in the "Risk factors" column. Even if the gateway to the analysis is identification of the problems encountered while performing the work, it is important to find the risk factors present (See Know-how: Principal WMSD risk factors, p 32)

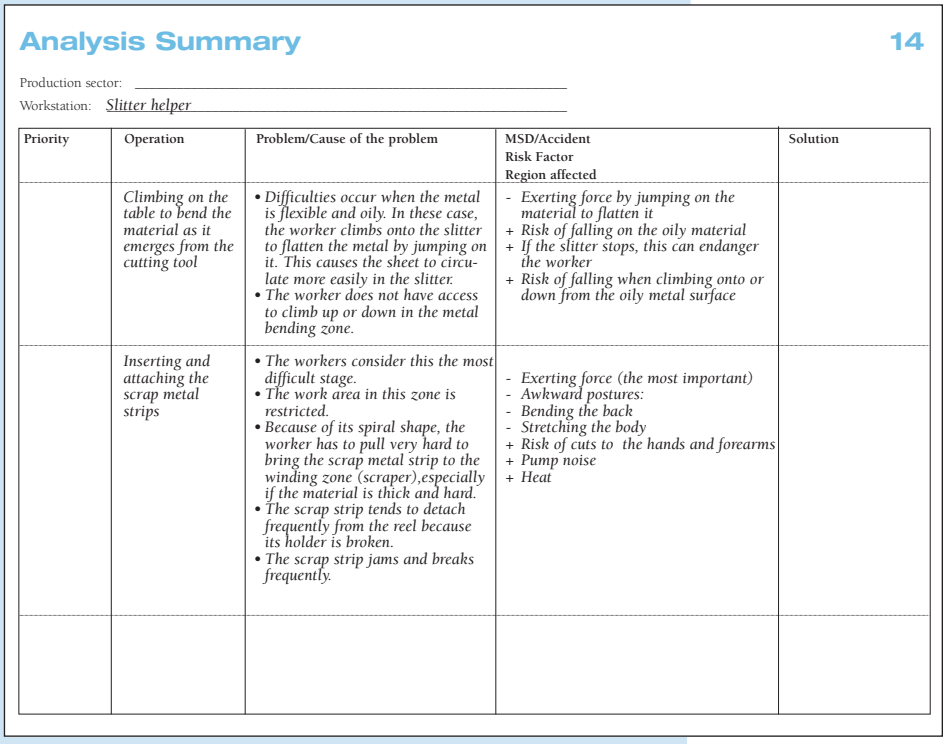
Before a risk factor can be noted, it must be recognized as such by the participants and the ergonomist and reported by the workers in the interviews.

Accident risks are also very important to consider. By watching the video and questioning the workers, it is possible to detect, for example, that there is a risk of falling or a risk of bumping into an object for a given operation.

Know-how

Tool

Analysis Summary



Analysis Summary 14

Production sector: _____

Workstation: *Slitter helper*

Priority	Operation	Problem/Cause of the problem	MSD/Accident Risk Factor Region affected	Solution
	Climbing on the table to bend the material as it emerges from the cutting tool	• *Difficulties occur when the metal is flexible and oily. In these case, the worker climbs onto the slitter to flatten the metal by jumping on it. This causes the sheet to circulate more easily in the slitter.* • *The worker does not have access to climb up or down in the metal bending zone.*	- *Exerting force by jumping on the material to flatten it* + *Risk of falling on the oily material* + *If the slitter stops, this can endanger the worker* + *Risk of falling when climbing onto or down from the oily metal surface*	
	Inserting and attaching the scrap metal strips	• *The workers consider this the most difficult stage.* • *The work area in this zone is restricted.* • *Because of its spiral shape, the worker has to pull very hard to bring the scrap metal strip to the winding zone (scraper),especially if the material is thick and hard.* • *The scrap strip tends to detach frequently from the reel because its holder is broken.* • *The scrap strip jams and breaks frequently.*	- *Exerting force (the most important)* - *Awkward postures:* - *Bending the back* - *Stretching the body* + *Risk of cuts to the hands and forearms* + *Pump noise* + *Heat*	

Analysis Summary page 14 of the Tools section

Data gathering	Stage 1	Interviews
	Stage 2	Workstation observations
Diagnosis	Stage 3	Identifying problems and their causes
Diagnosis	**Stage 4**	**Prioritizing problems**
Work modification	Stage 5	Seeking solutions
	Stage 6	Implementing Solutions and follow-up

Goals pursued	Action plan	= Know-how
1 **Prioritize problems encountered**	Assign a priority rating to the operations	Meaning of the priority ratings How to assign a priority ating *(Example 1, example 2)* **Tool** Analysis Summary *"Prioritization"* section

Diagnosis Stage 4 Prioritizing problems

This stage must be performed by the workstation committee or the ERGO group. The priority rating certainly draws on all the data gathered, but it also depends on the participants' experience with the workstation and the company. The prioritization stage will directly influence the organization of the search for solutions, so it is important that all the participants agree with the orientation chosen.

1 Prioritize problems encountered

The purpose of this stage is to estimate the significance of the problems targeted in the previous stage; this is carried out in the light of all information gathered on each operation. A priority rating is then assigned to each operation. This rating has a double significance – it indicates both the severity of the problems associated with this operation and the intervention priority to be assigned to these operations when seeking solutions.

Assign a priority rating to the operations

A priority rating is assigned after a discussion among the participants. The Analysis Summary serves as the basis of discussion, because it contains the description of each operation, their problems and the risk factors associated with them. However, these problem-related data must be reviewed in the light of the interviews, especially with regard to the accidents that have occurred at the workstation, and the operations that resulted in pain. Finally, when seeking solutions, the participants take a position on the urgency of intervening in the targeted problems by assigning a priority rating to each operation.

Before beginning this stage, you must have completed:

- **Interview Summary**
- **Analysis Summary, problem identification section**

We have retained a three-rating prioritization scale for this process, identical to the one already used for the repetitive task analysis process. See Guide 2, *"ERGO groups – a tool for WMSD prevention"*. The rating is entered in the priority column of the Analysis Summary (See Know-how: Meaning of priority ratings).

Be careful. Sometimes confusion sets in at this stage when the participants prioritize on the basis of the likelihood of finding solutions to the problems. For example, in some groups, the participants assigned rating 1 to problems for which they already had applicable solutions in mind and rating 3 to problems that indicated a costly solution or on which it was more difficult to act. Also beware of problems that operators have learned to avoid through improvisation, while waiting for better solutions to present themselves. They tend, over time, to consider these difficulties as partially under control and rate them as minor problems, especially when there are more serious problems to solve.

In these situations, it is necessary for the ergonomist to bring the discussion back to its real purpose, i.e., determining the significance or severity of the problems present or the risk factors, without considering the costs or efforts required to solve them. There will always be time during problem solving to find ways to implement realistic solutions. At this stage of the analysis, it is important to have a clear picture of the problems and their severity. The following two Know-how items illustrate how to assign a priority rating.

Know-how

Meaning of priority ratings

Rating 1 MUST

This rating is assigned to operations presenting severe problems or risk factors. These are problems that you absolutely want to solve when seeking solutions.

Rating 2 SHOULD

Rating 2 is assigned to problems that are considered less important and that it would be desirable to correct. Acting on these operations could improve the situation significantly, although this is not the heart of the problem.

Rating 3 COULD

Rating 3 corresponds to problems that are considered minor and for which it would be useful to find solutions.

Example 1 Prioritizing the operation **Insert and attach the scrap metal strips**

What does the problem identification section of the Analysis Summary show us?

This operation involves several WMSD risk factors, such as exertion with force when it is necessary to pull on a very rigid metal strip, and awkward postures associated with confined space to get to the machine and attach the metal strips to the reels. The participants also noted the presence of risk factors involving cuts to the hands and forearms on very sharp stretched metal. Also, regularly occurring incidents that oblige the operator to restart the operation, when the scrap strip breaks, jams or slips off the reel.

First finding: Presence of several WMSD and accident risk factors that repeat whenever a roll is cut and with each break or incident. High-amplitude forces are exerted when the metal is thick or rigid.

What do the interviews tell us?

Two out of three workers identified this operation as the most difficult and painful. One of the workers interviewed suffered a cut while attaching the scrap strip.

Second finding: Operation recognized as difficult and causing pains (lower back, hands). One accident (cut) was reported by a worker.

What rating was assigned to this operation?

The participants quickly reached a consensus and rating 1 was assigned to this operation. This may be attributed to the significance of the WMSD and accident risk factors, the occurrence of a cut to the worker on the workstation and the fact that the majority of the workers interviewed consider this to be the most difficult operation.

Analysis Summary 14

Production sector: _____

Workstation: *Slitter helper*

Priority	Operation	Problem/Cause of the problem	MSD/Accident Risk Factor Region affected	Solution
	Climbing on the table to bend the material as it emerges from the cutting tool	• *Difficulties occur when the metal is flexible and oily. In these case, the worker climbs onto the slitter to flatten the metal by jumping on it. This causes the sheet to circulate more easily in the slitter.* • *The worker does not have access to climb up or down in the metal bending zone.*	- *Exerting force by jumping on the material to flatten it* + *Risk of falling on the oily material* + *If the slitter stops, this can endanger the worker* + *Risk of falling when climbing onto or down from the oily metal surface*	
	Inserting and attaching the scrap metal strips	• *The workers consider this the most difficult stage.* • *The work area in this zone is restricted.* • *Because of its spiral shape, the worker has to pull very hard to bring the scrap metal strip to the winding zone (scraper),especially if the material is thick and hard.* • *The scrap strip tends to detach frequently from the reel because its holder is broken.* • *The scrap strip jams and breaks frequently.*	- *Exerting force (the most important)* - *Awkward postures:* - *Bending the back* - *Stretching the body* + *Risk of cuts to the hands and forearms* + *Pump noise* + *Heat*	

Analysis Summary, page 14 of the Tools section

Example 2 Prioritization of the **install the strips on the turnstile** operation

What does the problem-identification section of the Analysis Summary reveal?

Once the roll has been cut, a series of strips of different widths are obtained on the winder. These strips must be then transferred to the unloading turnstile to be prepared for shipping. The interviews show that manipulation of the strip-restraining bar requires the operator to exert substantial force and bend his back (Fig. 2.7). In addition, the workers use a cart to remove the strips; also to gain access to this cart they have to move within the turnstile area. This area is dangerous, because the turnstile can be activated from several control panels and the workers can be injured while passing under it. These operations are performed whenever a roll is cut.

However, following analysis of the palletization workstation, there are plans to improve safety in the turnstile area very soon.

First finding: According to the participants, manipulating the bar involves an WMSD risk factor to be considered and safety in the turnstile area frequently poses a problem for workers.

What do the interviews tell us?

The workers interviewed mainly emphasized the difficulty of access to the cart and that the floor is sometime slippery. They did not associate this operation with specific pains or incidents.

Second finding: interviews do not reveal major problems related to this operation.

What rating was assigned to this operation?

Rating 2 was assigned to this operation because it involves accident risk factors in the turnstile area and WMSD risk factors for the back. However, these are not problems that had major consequences on workers' occupational health and safety.

Analysis Summary 14 continued

Production sector: _____

Workstation: *Roll palletization*

Priority	Operation	Problem/Cause of the problem	MSD/Accident Risk Factor Region affected	Solution
2	*Placing the strips on the turnstile*	• *The worker must pass under the turnstile or walk around the machine to have access to the control panel* • *The workers use a heavy retraining bar to prevent them from intermingling.*	- *Exerting force (handling the restraining bar)* - *Bending the back* + *Risk of bumping against the turnstile while passing under it*	

Analysis Summary, page 14 of the Tools section

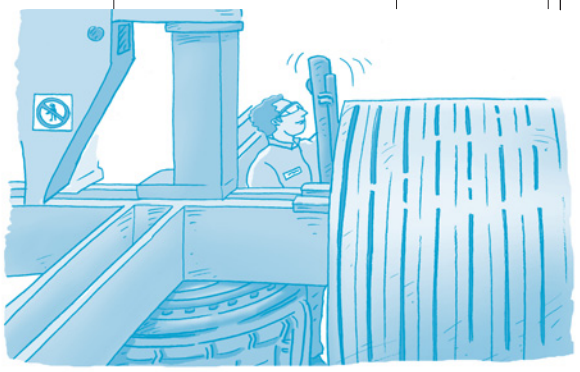


Fig. 2.7 Operator manipulates a restraining bar

General problems

Even though priorities are assigned one operation at a time, it is important to have a more general understanding of the situation. If similar problems recur in several operations, they must be treated as a single problem when seeking solutions. For example, on the slitter helper workstation, the operations that involve climbing onto the slitter all involve the risk of falling on the oily metal (Fig. 2.8).

Fig. 2.8 Operator has to climb on the slitter table to flatten the metal.

Thus, the problems of access to the slitter and circulation of the metal sheet should be viewed comprehensively, because they concern several operations of this workstation. Moreover, this overview of the problems led us to consider the slitter's design and the inadequate operation of the turntables that support and guide the sheet through the slitter, (see figure opposite).

Data gathering		Stage 1	Interviews
		Stage 2	Workstation observations
Diagnosis		Stage 3	Identifying problems and their causes
		Stage 4	Prioritizing problems
Work modification		**Stage 5**	**Seeking solutions**
		Stage 6	Implementing solutions and follow-up

Goals pursued	Action plan	= Know-how
1 Seek solutions to the problems identified	Identify possible solutions	
	Evaluate and categorize the solutions	Solution evaluation criteria **Tool** Action Follow-up Summary
	Concretize, simulate and describe the chosen solutions	**Tool** Analysis Summary *"solution"* section Description of the chosen solutions
2 Present the chosen solutions to the steering committee	Prepare an analysis report	Analysis report
	Organize the meeting with the steering committee	

Work modification — Stage 5 — Seeking solutions

The first stages of this process mainly emphasized a better understanding of the work, and more specifically of the problems present in the work situation and their causes. We now have to find ways to transform the work situation.

Seeking solutions is not a linear process. Depending on the number and complexity of the problems encountered, some solutions are put in place quickly, while others have to be designed. The purpose is not to solve everything at the same time, but to present a comprehensive proposal to the steering committee for workstation improvement that will include short, medium and long-term solutions. In fact, this involves planning concrete implementation of certain solutions and, in some cases, obtaining authorization to pursue the development of others that take longer to conceive and refine. Since this is one of the most complex stages of the process, the ergonomist plays a particularly important role.

1 Seek solutions to the problems identified

The purpose of this stage is to identify and design the changes that will help solve the problems identified in the previous stages.

Concretely, the process of seeking solutions begins with the formulation of ideas for improvement. Their feasibility and effectiveness must be considered. The solutions chosen are then tested or simulate so that you are better able to decide whether they really improve the work.

Some solutions can be developed at the same time, if they are related, while others can be discussed separately because they concern a more specific or isolated problem. For example, the scrap disposal problem under the shear was considered in isolation, contrary to the problem of routing the metal sheet into the slitter, which involves several interrelated problems, operations and solutions. Considering them together facilitates analysis of the impact of the improvements on each other.

The sequence and duration of the process of seeking solutions depend on several factors, such as the company's characteristics and production and the problems encountered. For example, major corporations are equipped with good technical support; however, there are more formal procedures to be observed when changes are made to production, such as changes intended to meet inspection standards. Sometimes these requirements demand a little more time. Moreover, in some environments, it will be very difficult to perform simulations or tests, because it is not always possible to bring a large machine or a manufacturing process to a halt. It is necessary to wait for production shutdown periods.

The mandate of ergonomist in seeking solutions:

He organizes and coordinates the process :

- He facilitates meetings of the ERGO group or the workstation committee.
- He seeks support (investment, leave for personnel) from the steering committee and information concerning the company's future projects that could have an impact on seeking solutions. For example, if it is anticipated that all tools on the floor will become pneumatic, it is useful to know this before selecting new ones. If there is a question of adding a night shift, it is important to account for this in the measures to be established.
- He identifies external collaborators in different departments, such as Personnel, Engineering and Maintenance, capable for providing additional information. In smaller companies, he contacts those who are responsible for these functions.
- He ensures liaison with external collaborators whose participation is more ad hoc, such as suppliers, the personnel manager, the engineering department, other operators.
- He categorizes the problems and detect those that are not the responsibility of the workstation committee or the ERGO group, due to their complexity and the additional analyses that their resolution would require.
- He collaborates on the tests to be performed at the workstation, alone or with other participants.
- He presents the results of the process involving external collaborators to the committee or the ERGO group.

Identify possible solutions

Before beginning this stage you must have completed:

- **Analysis Summary, problem identification section and prioritization**

Generally, there is no shortage of ideas. The operators and the supervisor have been thinking about them for a long time. Following the analysis, the technical personnel, the ergonomist and the other participants in the analysis also have a point of view. At this stage, it is interesting to consider several possible solutions, without favouring one or the other, and to encourage all participants to express their views.

This is why brainstorming is an excellent starting point in problem solving. All participants are equal. They voice their opinions as participants, rather than as operators, supervisors, engineers or ergonomists. They are invited to suggest ideas, from the most farfetched to the most believable, without censorship or criticism by any other participant. Later in the process, these ideas will be the focus of comment and discussion.

It is possible to conduct several brainstorming sessions, depending on the links that exist among the operations or the problems. For example, at the strip palletization workstation (these strips are rolls cut to the width specified by the customer), the various operations were performed sequentially. First the strips were unloaded from the turnstile, then the straps were installed and finally the strips were palletized. These three operations were discussed separately. The first brainstorming session assigned priority 1 to installation of the straps, but also integrated all the related operations, such as filling the ring loader (priority 3) and feeding the strapping machine with strap rolls (priority 2). These operations are interconnected and any change to the strapping machine is at risk of having repercussions on the other operations.

The second part of this exercise is to organize the main solutions proposed, which will be evaluated by the participants in the next stage.

Evaluate and categorize the solutions

The "solution, evaluation and categorization" stage uses the same critical questioning and evaluation criteria already developed in our previous guide: "ERGO groups – a tool for WMSD prevention". At this stage, the possible solutions identified during brainstorming are discussed and described in more detail. The objective is to evaluate the benefits of each possible solution and whether it is relevant to develop it further. The solutions that do not satisfy the evaluation criteria will be eliminated. The presence of operators and the supervisor, as well as collaborators from the Personnel or Technical department is required, because there are several questions that only they can answer.

The evaluation of the solutions is based on a series of relatively simple questions, with the aim of ensuring that:

- The proposed solution solves the targeted problem;
- The solution is feasible;
- The solution does not generate new problems.

We set out criteria for evaluating the effectiveness and feasibility of the solutions and their potential impacts on the work situation (See Know-how: Solution evaluation criteria). This list helps you review different characteristics of the solution more systematically and give direction to the discussion during the meeting of the workstation committee or the ERGO group.

Frequently, there are no immediate answers to these questions. You have to phone suppliers, ask other people in the company and sometimes even visit other plants. This may necessitate additional processes and tasks to be performed between meetings of the committee or the ERGO group. The "Action Follow-up Summary" lets you note all the processes and all the tasks you have to perform. You can also indicate the responsible persons and the schedule in this record. (See Know-how: Action Follow-up Summary, page 43).

Know-how

Solution evaluation criteria

Effectiveness

- Will this solution have a direct effect on the problem? How will it work?
- Will this solution eliminate or affect the causes of the problem?
- Will this solution mitigate the impact of the problem?
- Will it reduce the difficulty, the risk factors or the dangers?

Feasibility

- Is this solution technically achievable? Is it possible?
- How much will it cost (equipment, labour, training, etc.)?
- Is the solution compatible with the work methods and operator characteristics, etc.?

Impacts of the solution

- Impacts on health and safety
- Impacts on production, incidents, quality
- Impacts on the organization of work, work schedules
- Impacts on downstream and upstream workstations
- Impacts on the training required by the operators and technicians
- Impact on the environment, etc.

For example, several problems were raised regarding the strapping and providing the machine with straps and rings. Two solutions emerged from this stage. One consisted of correcting each problem identified, while the other gave preference to buying a new machine. In fact, the preferred solution was to improve the existing machine, because this solution had the advantage of being less costly. In addition, keeping the same machine made it easier to forecast the impacts of these changes on the work. However, one question persisted: was it possible to adjust the counterweight of the strapping machine head to prevent it from shifting backward (Fig. 2.9)? To ensure this outcome, it was necessary to know more about this type of machine or perform tests.

Action Follow-up Summary, page 15 of the Tools section

Action Follow-up Summary 15

Production sector: _____

Workstation: *Palletization workstation*

Date : *Meeting of May 30*

Solutions	Actions required	Responsible	Timeframe	Status
Ensure that it is possible to adjust the strapping machine head to zero gravity	*Consult the expert who maintains this machine*	*Jacques*	*May 28*	*Presence of the expert at the group's next meeting*

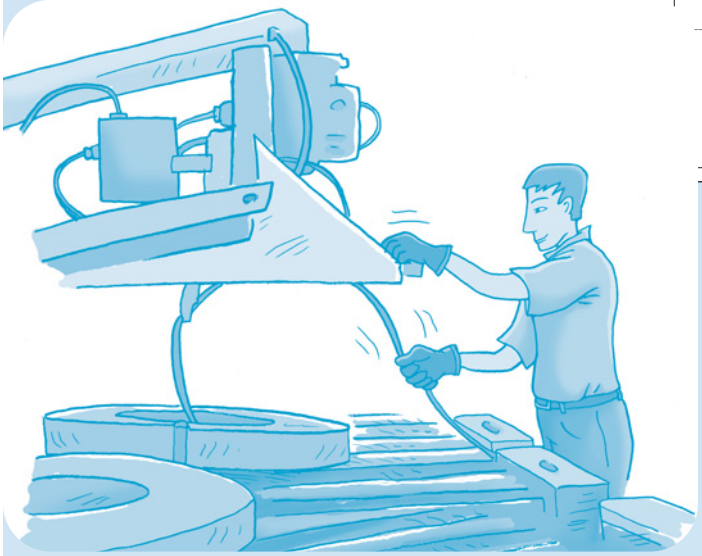


Fig. 2.9 Operator must approach and hold the strapping machine head.

Concretize, simulate and describe the chosen solutions

The purpose of this stage is to materialize the solution as much as possible in order to have a more accurate representation before permanently applying it in the work context. This is also a way to obtain a more precise idea of the characteristics the solution should have and define its specifications. Often, the tests help us become aware of the solution's real dimensions. Sometimes they reveal other work requirements, simply by moving a machine. This is also an opportunity for discussion with the workstation operators who have not contributed directly to the solution's design. They now have the opportunity to add their comments.

It is important to plan these tests by basing them on target results. What do you want to know? These tests often facilitate more tightly focused answers to questions already raised at the evaluation stage, but which were answered in theory alone. The tests allow a practical answer.

There are different ways to concretize a solution. For example, a scale drawing, a workstation diagram, a computerized 3D representation that gives a better view of the dimensions, the movement areas and the spatial arrangement of the equipment. Mockups, temporary workstations and prototypes are ways of getting closer to the work performance context. There is also the possibility of borrowing a piece of equipment or a tool to test it at the workstation. If tests are impossible, as in the purchase of equipment that cannot be borrowed temporarily, visits to companies that have purchased similar equipment may be informative.

The implemention methods for concretizing the solution depend, among other factors, on its characteristics, variation in working conditions, the number of operators, and the time it takes. For example, by staging different work scenarios, a detailed redevelopment plan of a section of the plant is very useful in verifying operator movements and the layout. However, the operators and supervisor of the workstation and the adjacent workstations should study these plans in the presence of the ergonomist and the designers. However, photos or specifications are insuffficient in giving an opinion on the comfort of a chair – the operators for whom it is intended must use various models of the chair over a fairly long period. To test a tool, the operators first must be allowed to get used to it; thus, the tests must extend beyond this adjustment period.

Depending on the methods that could be implemented, the conclusions to be drawn from the tests will not be the same. The farther the method to be simulated deviates from reality, the more prudent the conclusions must be. Furthermore, these simulations must not be taken for reality, because despite all our efforts, not all working conditions (and their variations) can be tested. It is really at the time of solution implementation that the final adjustments can be made. Also, some solutions have been tested in isolation. It is only when they are all implemented that it will be possible to see if there are negative interactions among the solutions that affect the work.

Fig. 2.10 Operator activating the turnstile control panel before the workstation is reconfigured.

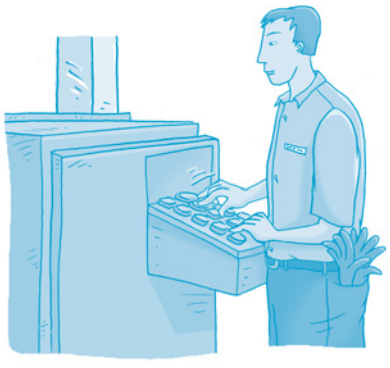


Fig. 2.11 New lower and reconfigured control panel.

Tool

Know-how

Analysis Summary

Fig. 2.12 Operator inserting the rings in the strapping machine head. This involves awkward shoulder postures.

Analysis Summary, page 14 of the Tools section

Analysis Summary **14 continued**

Palletizing rolls

Priority	Operation	Problem/Cause of the problem	MSD/Accident Risk Factor Region affected	Solution
1	*Approaching the strapping machine head and strapping the strips*	• *When the operator does not hold the knob of the strapping machine head when inserting a strap or activating the control buttons, the strapping machine head slips upward. It thus has to be repositioned for each strap he inserts around a strip.* • *Some operators adjust the machine's counterweight so that the head lifts when at rest to prevent the strips circulating on the conveyor from striking it as they pass.*	*Bending the right shoulder* *Bending elbow movement* *Repetition* *Strain*	• *Adjust the strapping machine head counterweight to prevent it from shifting backward.* • *Move the strapping machine head forward so that it is more within the operators' reach.* • *Install a guard to prevent the strips circulating on the conveyor from hitting the strapping machine.* *or* • *Replace the strapping machine.*
1	*Inserting the strap*	• *The operator must adjust the end of the strap whenever he inserts it in the strapping machine head. He must perform this action at least three times per strip.*	*Repetition* *Exerting force with the thumb*	• *Reduce the conduit through which the strap passes to prevent it from jamming as it slides into this conduit. Thus, the operators no longer will have to adjust the strap end with each insertion.*
2	*Inserting rings in the strapping machine*	• *The ring load is located on top of the strapping machine. To reach it the operator is at arm's length (Fig. 2.12).* • *Filling the loader is demanding on the wrists, because the operator both has to keep the stack of rings straight and remove the iron wire that binds them.* • *The rings must be slid into the loader without intermingling them. The operator performs these movements at arm's length and blindly, because the rings are only visible from the rear.*	*Bending the shoulders* *Bending the back* *Bending the wrists*	• *Move the strapping machine head forward so that it is more within the operators' reach.* *or* • *Replace the strapping machine.*

Example

- **Case of the palletization workstation.** This workstation is a good illustration of the contribution of testing to the development of solutions. For example, there was a suggestion to adopt new pneumatic tools for manual installation of the straps. After a two-week test period, the operators rejected this solution, because the tools increase the work area footprint due to wires that must be followed continuously. Also, an unsuccessful attempt was made to adjust the strapping machine counterweight. On the other hand, these tests resulted in contact with another plant faced with the same problem, and that was also conducting a series of similar tests. The company decided to see whether the tests in the other plant were conclusive. Otherwise, it plans to acquire another strapping machine. Major modifications were made to the strip unloading control panel. It was lowered, new buttons were installed and their layout was completely reviewed according to whether they are used frequently or simultaneously. These modifications have not been tested enough by the operators, who disapprove of installation of two buttons to raise or lower the conveyor; this replaced the former, single switch. They also find the panel too low (Fig. 2.10 and Fig. 2.11). At the end of this stage, the solutions adopted area ready to be recorded in the above Analysis Summary (see Know-how: Analysis Summary, Solution section).

  Finally, it is important to describe the solutions in detail. This description encompasses the characteristics of the chosen solution, its costs and the conditions necessary for its implementation.

  This description will be produced by the ergonomist, assisted by the participants in the analysis and collaborators from the company. A description may seem superfluous in some work environments where the individuals who performed the analysis are those who will supervise its implementation. However, in other companies, the individuals who carry out the analysis do not also monitor its implementation. This description can also serve for other uses, such as (1) presentating the analysis to the steering committee, (2) referring to it in the case of complex solutions, (3) as a reminder of the reasons that guided the choice of solutions, (4) to find the details of its specifications and (5) to inform new employees of its origins.

Know-how

Description of the chosen solutions

Contents

- Description of the operation
- Description of the problem to be solved (consequences, causes, photos, priority)
- Detailed description of the chosen solution
  - Representation of the solution (drawing, photo, supplier's pamphlet, etc.)
  - Summary of the tests and the results obtained
  - Advantages and disadvantages of the solution (based on the evaluation criteria)
  - Equipment to be purchased or converted, possible suppliers
- Description of the work to be performed to implement the solution
  - Work to be performed (internal and external)
  - Estimate of the number of hours required per trade
  - Equipment, material to be purchased
  - Costs
- Detailed work schedule
- Training or information to be provided to the operators
  - Where
  - Who
  - Duration
  - Costs
- Comprehensive evaluation if necessary

2 Present the chosen solutions to the steering committee

In this process, the steering committee plays a decision-making role regarding implementation of the solutions. The purpose of this stage is to communicate the highlights of the workstation analysis to facilitate this committee's decision-making. It is important to provide the committee members with information that will allow them to appreciate the importance of the process and the relevance of the chosen solutions.

Prepare an analysis report

A copy of this report is intended for the members of the steering committee. It must summarize the objectives and the results of the recent workstation analysis. Its content focuses on the reasons that justified the choice of workstation, the description of the problems by priority, the solutions and their short, medium and long-term implementation plan (see Know-how: Analysis report). We advise you to use the documents you have already developed during the analysis, i.e., the Analysis Summary or the description of the chosen solutions, completed by photos of the problems at the workstation.

Know-how

Analysis report

Contents

- Short summary intended for the Board of Directors (executive summary)
- Title of the workstation analyzed
- Workstation description
- Description of the solutions, if possible (See Know-how: Description of the chosen solutions) and the Analysis Summary and photos of the problems
- Short, medium and long-term implementation plan for the solutions

Organize the meeting with the steering committee

The analysis report be submitted to the members of the steering committee. However, they must also be presented with the highlights of this analysis and an explanation of what is expected of them. At this meeting the decision-makers will get an idea of the nature of the study and will be able to ask questions and clarify points that are less clear. This presentation will allow them to develop an enlightened idea of the solutions and to give their well-informed agreement, to their implementation.

The presentation to the steering committee can be delivered by either the ergonomist alone, by the entire working group or by the ergonomist accompanied by one or two resource persons. It is up to the steering committee, the ergonomist and the working group to decide who will present the study report.

Data gathering	Stage 1	Interviews
	Stage 2	Workstation observations
Diagnosis	Stage 3	Identifying problems and their causes
	Stage 4	Prioritizing problems
	Stage 5	Seeking solutions
Work modification	**Stage 6**	**Implementing solutions and follow-up**

Goals pursued	Action plan	= Know-how
1 Implement solutions	Inform and train the operators	
	Implement the solutions	
	Debug the solutions	
2 Do a follow-up at the workstation after solutions have been implemented	Analyze incidents, accidents and WMSD problems since the modifications	
	Meet the workstation operators	
	Complete the Solutions Follow-up Summary	**Tool** the Solutions Follow-up Summary Workstation Follow-up Questionnaire (complement)
	Make the necessary corrections	

Implementation of the solutions begins when the steering committee gives its agreement. It is also consistent with ongoing tests or development of certain solutions, as foreseen in the work schedule.

During the solution-seeking (problem-solving) stage, the circle of participants in the analysis was expanded to include many external collaborators, but the ERGO group or the workstation committee remained at the centre of the intervention. During the implementation stage, they no longer have the same role, because other persons generally implement the solutions. Although modification of the workstation is carried out by the company, it does not come under the direct responsibility of the workstation committee or the ERGO group. Moreover, the introduction of certain solutions can take several months, even beyond the existence of the workstation committee. Implementation transforms the role of ergonomist and the participants in the analysis. At this stage, they play more of a supporting role during implementation, and an oversight role during subsequent follow-up.

1 Implement solutions

The purpose of implementation is to introduce the solutions gradually into the real work situation, so that these changes do not create new constraints or problems in operator activities. To make sure of this, implementation of the solutions is completed by follow-up the workstation improvements. Any modification to a workstation upsets ways of doing things that have been acquired over a long period. It can be demanding to relearn the job with a different tool (Fig. 2.13 and Fig. 2.14), even if it works better, or meets the needs of customers with new software. Operators often must show patience and ingenuity when the solutions do not fulfill all their promises, especially if they have not been warned in advance. The major challenge during implementation is to involve the people affected by the changes and to be flexible enough to make the adaptations they feel are necessary, even if this complicates our plans.

The implementation phase is also a critical period for the people who design the solutions. Introducing changes in the actual process of production always involves unforeseeable events. The same principle applies when several solutions developed relatively independently are combined for the first time. It is impossible to predict everything. The expert and the participants in the analysis must be ready to intervene when difficulties arise. This is part of normal procedure in any change to a workstation. The solutions have to be debugged once they are implemented.

Fig. 2.13 Operator raising or lowering the chucks before workstation reconfiguration.

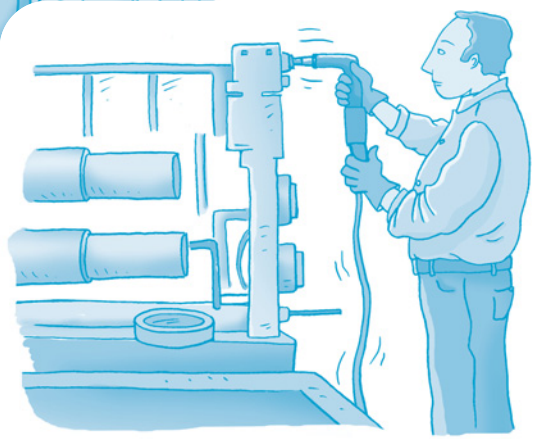


Fig. 2.14 New no-strain method of raising or lowering the chucks with the pneumatic ratchet already used to move the heads forward or back, which requires less adaptation by the worker.

Before beginning this stage, you must have completed:

- **Analysis Summary**
- **Detailed description of the solutions**

Inform and train the operators

Before proceeding with implementation, the ergonomist organizes a meeting of the participants in the ERGO group (or the workstation committee) and the workstation operators, to present a detailed plan of the solutions and the work schedule. Ideally, the members of the steering committee should be present at this meeting. The analysis report can serve as a reference document and be made available to the operators, for example, by posting it in the operators' lounge.

It is necessary to inform the operators that, immediately after the solutions are implemented, a debugging period will follow and that it will involve their participation to correct any annoying aspects or problems associated with the changes in the work situation.

Some changes imply that the operators will receive training, particularly when these changes concern their safety or the use of totally new equipment or software. The training may be conducted at the workstation, at the beginning of each shift, and be followed by a coaching period, if necessary.

This training is essential, because we cannot rely on the free flow of information to effectively do our job -- informing the operators. In one company, we found that one of the solutions implemented was not useful to the operators, because they were unaware of its existence. Elsewhere, the operators did not use new tools because they did not know how they worked. It is therefore essential to reach each operator on the workstation. The training needs must be defined at the same time the solutions are designed. They are part of the solutions. It then will be easier to explain their relevance and obtain the steering committee's approval for their implementation.

Implement the solutions

The solutions will be implemented either by an internal team composed of engineers or maintenance workers, or by external consultants. In the case of more organizational solutions, the Personnel Department generally takes charge.

Whenever possible, it is the ergonomist's role to ensure that the solutions are implemented in accordance with the analytical group's recommendations. Some solutions will not have been tested, as in the case of those that have to wait for a production shutdown before they can be implemented or that had to be acquired before they could be used. For these solutions, we recommend that you proceed gradually. For example, limit implementation to one workstation before generalizing the solution. Purchase only one tool and have each operator try it in turn.

Fig. 2.15 Operator inserting the new tool on the chuck.

Example

Implementation of composite tooling: We know that composite tooling for the cutting tool setup operation offers important advantages. These much lighter blades significantly reduce the strains on the operator's shoulders and back, which are the main cause of the operators' problems at this workstation. However, this new tooling is a recent innovation and is expensive. According to the information obtained, it performs well but, since it is more fragile, must be handled and stored with care. It must also be purchased before it can be tested, which implies obtaining the steering committee's agreement in advance. This means it must be implemented before it can be evaluated in greater depth. To some extent, this solution was tested at the same time it was implemented (Fig. 2.15). It therefore was agreed to buy only one set of composite tooling; this strategy was intended to verify in advance whether it complicated the setup stage for the operators, had the required strength and met quality standards.

Debug the solutions

Solutions should be debugged immediately after they are implemented. To some extent this involves noting the initial impacts of their implementation and correcting them, especially if they are an issue for the operators' health and safety or if they harm the quality of production. It is normal for adjustments to be made after the solutions are implemented.

This phase of the work must also take into account the development status of each solution. In the case of solutions that could not be evaluated before their implementation, the debugging phase is likely to be a little longer. You will have to return to the critical questioning that allowed you to evaluate the other solutions (See Stage 5: Evaluate and categorize the solutions) and request the participation of the operators and supervisor to review all the criteria for evaluating the solution. While some solutions may have been tested successfully, they ultimately must confront daily production and its many variations.

You must also expect that the work rhythm will slow down slightly. It is important to allow the operators some leeway to familiarize themselves with the changes in the work situation. Otherwise, they will tend to reject the solutions and return to their old tools. Also, during these periods of major change, there is an increased risk of incidents or injuries.

The ergonomist should make a first visit to the workstation to verify the final implementation of the solutions and obtain the comments of the workstation operators. He also works with the supervisor to ensure that any problems or irritants are corrected.

2 Performing a follow-up at the workstation after solutions have been implemented

Final follow-up is performed a few weeks after permanent implementation of the solutions; this period of time allows operators to become familiar with the changes. The purpose of this follow-up is to verify, through interviews and observation, the impact of the changes on the work, pain, safety and degree of satisfaction of the operators. It also provides information on the presence of new risks factors or problems that might have been introduced during modification of the workstation. Ultimately, follow-up reveals whether corrections will have to be made to ensure the workstation's adequacy.

The main stages of final follow-up are 1) gathering data on the situation at the workstation, 2) interviewing the operators regarding the changes made, 3) completing the Solutions Follow-up Summary, 4) making the necessary corrections.

Analyze incidents, accidents and WMSD problems that have occurred since the modifications

A good way to perform an initial evaluation, if the data are available, is to verify the frequency and type of accidents, incidents or WMSD problems that have occurred since the modifications were introduced. It is a good idea to compare the results with the data gathered in the initial interviews. This comparison allows you to verify whether (1) the same types of accidents or symptoms have been found, (2) new problems have developed, or (3) the situation seems to have improved.

Meet the workstation operators

To perform this final follow-up, it is essential for the workstation operators to meet. However, it is possible to conduct individual interviews with the operators or meet them as a group during a work meeting. Individual interviews allow each operator to express his opinion freely, while a group meeting creates interaction among the operators, bringing out the advantages and disadvantages of the modifications implemented. It may be advantageous to meet new operators who did not work on the workstation before the modifications, because they have a new perspective and their opinion on the workstation can be very useful.

The follow-up data can be collected by means of a questionnaire specifically constructed for the workstation you want to evaluate (See Know-how: Workstation Follow-up Questionnaire). Each solution implemented with the workstation operators is reviewed to obtain their opinion on the changes made. During these interviews, it is also important to verify whether the operators have made changes to the solutions implemented or how they have had to adapt their methods to adjust to the modifications. The interviews thus allow you to evaluate the operators' degree of satisfaction with the changes in their work situation.

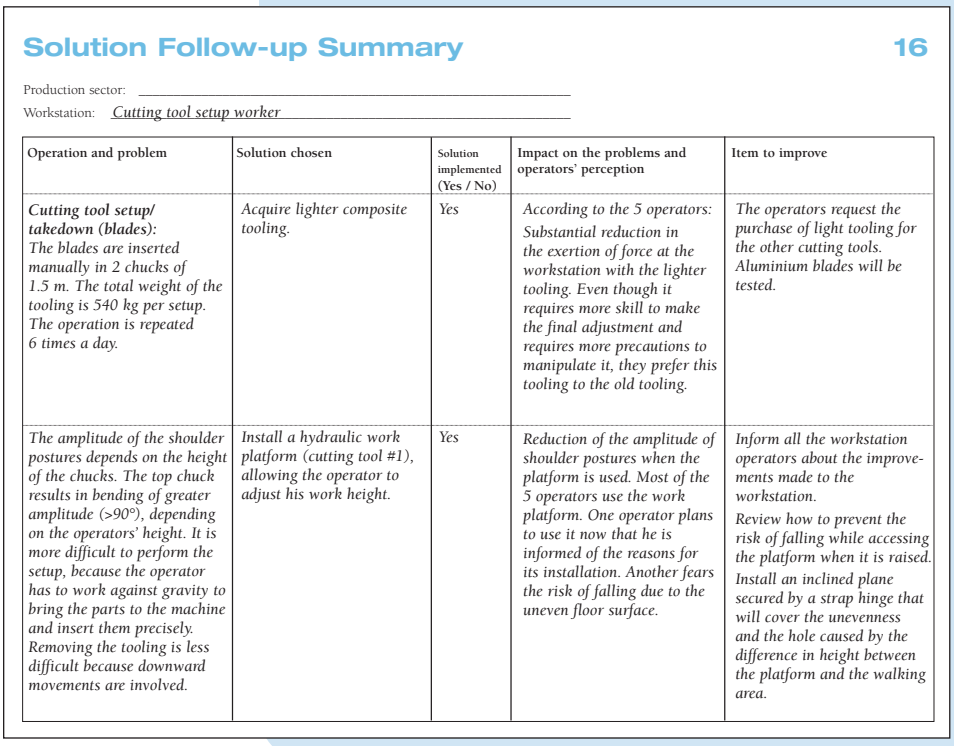
Complete the Solution follow-up summary

The next stage is to evaluate the results obtained in our follow-up. We propose the Solution Follow-up Summary for this purpose. For the different problems to be solved, it compiles the solutions chosen, the solutions actually implemented, the impacts observed on the risk factors (or the problems initially identified), and the operators' perceptions of the improvements obtained and the items to be improved.

Tool

Know-how

Solution Follow-up Summary



Solution Follow-up Summary 16

Production sector: _____

Workstation: *Cutting tool setup worker*

Operation and problem	Solution chosen	Solution implemented (Yes / No)	Impact on the problems and operators' perception	Item to improve
Cutting tool setup/ takedown (blades): *The blades are inserted manually in 2 chucks of 1.5 m. The total weight of the tooling is 540 kg per setup. The operation is repeated 6 times a day.*	*Acquire lighter composite tooling.*	*Yes*	*According to the 5 operators: Substantial reduction in the exertion of force at the workstation with the lighter tooling. Even though it requires more skill to make the final adjustment and requires more precautions to manipulate it, they prefer this tooling to the old tooling.*	*The operators request the purchase of light tooling for the other cutting tools. Aluminium blades will be tested.*
The amplitude of the shoulder postures depends on the height of the chucks. The top chuck results in bending of greater amplitude (>90°), depending on the operators' height. It is more difficult to perform the setup, because the operator has to work against gravity to bring the parts to the machine and insert them precisely. Removing the tooling is less difficult because downward movements are involved.	*Install a hydraulic work platform (cutting tool #1), allowing the operator to adjust his work height.*	*Yes*	*Reduction of the amplitude of shoulder postures when the platform is used. Most of the 5 operators use the work platform. One operator plans to use it now that he is informed of the reasons for its installation. Another fears the risk of falling due to the uneven floor surface.*	*Inform all the workstation operators about the improvements made to the workstation.* *Review how to prevent the risk of falling while accessing the platform when it is raised.* *Install an inclined plane secured by a strap hinge that will cover the unevenness and the hole caused by the difference in height between the platform and the walking area.*

Solution Follow-up Summary page 16 of the Tools section

Know-how

Workstation Follow-up Questionnaire

(complementary)

The following is an example of a questionnaire that can be designed to monitor operators. The first six questions inform us about the operators and the training they were given after the workstation modification. The seventh question is a summary table that, for each modification made, presents the opinions of the operators interviewed. The operator notes whether or not the modification has improved, maintained or deteriorated the work situation. For each problem identified, he also notes which points, in his opinion, still need to be improved or converted.

Once all the operators have been interviewed, the summary of the results will be useful in completing the Solution Follow-up Summary. The purpose is to find out, for each solution, the proportion of operators who consider it an improvement (or not).

Suggested questionnaire Not available in the Tools section

Workstation Follow-up Questionnaire: *Cutting tool setup worker*

1. How long have you done this type of work? *6 years*

2. How long have you been working on this workstation *5 years*

3. Did you work on this workstation before it was modified? Yes ☒ No ☐

4. How were you informed of the changes made to your workstation?

One of the members of the ERGO group came to see me and explained all the changes made to the workstation.

5. Did you receive training following the changes made to your workstation? (Experienced operator)

Yes, my supervisor came to explain how the new tooling works.

6. Did you receive training when you started on this workstation? (New operator on the workstation)

Problem	Solution chosen	Improve I= Improve S= Same W= Worse	Are there still any problems or things to improve? Explain An operator who worked on the workstation after the changes were made only answers this question
Cutting tool setup/takedown			
The blades are inserted manually in 2 chucks of 1.5 m. The total weight of the tooling is 540 kg per setup. The operation is repeated 6 times a day.	*Acquire lighter composite tooling.*	*I*	*I like the new lighter tooling a lot. It greatly reduces the effort required so I have a lot less pain. However, it's more difficult to do the final adjustment of the blades. It's taking me some time to get used to it.*

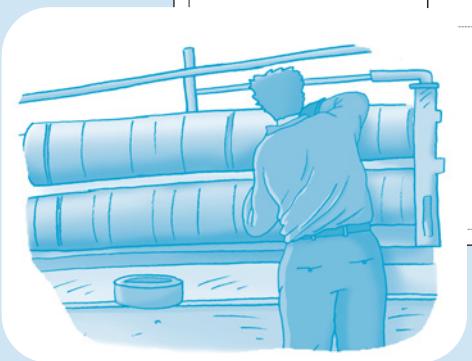


Fig. 2.16 Operator has to adopt awkward right shoulder and back postures because of the height of the chucks to inset the tooling before installation of the hydraulic work platform.

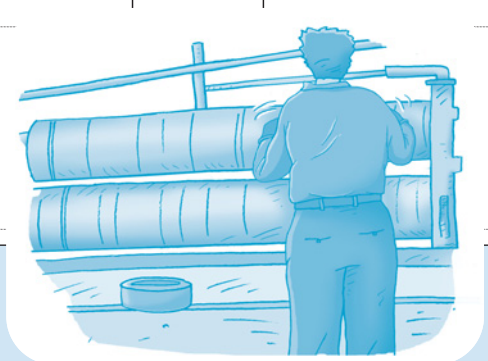


Fig. 2.17 Operator adjusts the height of the hydraulic platform to reduce the postural stresses on his right shoulder and back.

Make the necessary corrections

To complete the cycle, the necessary corrections must be made, based on the follow-up results. The data gathered in this stage will have informed you whether the modification is adequate, whether the problems and risks identified have diminished and whether certain items need to be modified.

Depending on the follow-up results, two main avenues may occur

When the interviews conducted with the operators reveal that only minor adjustments are required and that no new risks have emerged following the accident analysis, then the follow-up process shows that the modifications have solved the problems initially identified. The analysis has been productive even if the modifications implemented have resulted in some irritants for the operators. The necessary adjustment must now be made to optimize the situation.

However, despite the efforts accomplished, the follow-up stage sometimes indicates that the problems identified have not really been solved or that new problems were introduced by the modifications. If the analysis does not produce the expected results, the ergonomist must repeat the analyses required to adjust the focus and render the work situation acceptable.

chapter 3

Intervention assessment

In this chapter, we suggest a few ideas to help you assess the workstation analysis you have just completed. This assessment will give you a critical perspective for a better understanding of the intervention and its impact on WMSD prevention in the company. Such an assessment is also a compulsory stage before proceeding with a next workstation analysis.

An assessment validates whether the initial objectives have been achieved, based on the results obtained and the means implemented. In addition to the ad hoc results at the workstation, you must look at the more general effects on occupational health and safety practices. In this assessment, it is important to consider both the positive aspects and the negative aspects (which must not be repeated).

You will find guidelines in this chapter to produce your assessment. It is up to you to select the conditions and the level of detail required for this assessment. Also, depending on the situation in your company, it is not always necessary to formalize each stage and produce written documents. Sometimes a simple, well oriented discussion among all the people involved in the analysis can be just as effective as a more thorough assessment.

Who?

The ergonomist steers and organizes the assessment. This concerns him directly because he is responsible for the process and keeps track of every stage of the analysis and its implementation.

The participants in the analyses should collaborate in producing the assessment. Their point of view on implementation of the analysis and the functioning of the committees, as well as their suggestions for improving the process, will have to be considered in the final presentation of the assessment to the steering committee.

A meeting between the steering committee and the participants in the analyses should be organized to present the assessment to the steering committee and make the necessary decisions to improve the impact of the process.

When?

Depending on when it is produced, the assessment will not highlight the same aspects of the process. An assessment produced immediately after an analysis will focus more on the implementation of the process and the achievements already accomplished. An assessment performed in the longer term, six months later, for example, will focus on the effectiveness of all the solutions already implemented and debugged. However, it will be a little too late to remember in detail how the process was implemented, even if some evidence of this process has been preserved. Moreover, the people who collaborated in the analysis may no longer be available to discuss it. This is why we recommend producing the assessment about 2 months after completing follow-up of the analyzed workstation.

How to produce the assessment

The company's intentions: the objectives pursued

You must evaluate whether the company's initial objectives were achieved within a reasonable time and validate whether all the points provided for in the analytical process were applied. For example, did the working groups function as anticipated? Were the proposed solutions implemented? Were the funds reserved for this process invested?

Here are some suggested documents you can consult to research the objectives pursued in this analysis: the corporate objectives, the workstation analysis report, the plan for implementation of the solutions with the steering committee, and this guide.

Looking for indicators of the intervention's impact: the results obtained

The indicators are found in traces revealing what was really accomplished during the intervention and the results obtained. Some of the indices sought are quantitative or concrete, such as the cost of the solutions, the time invested or the technical modifications to the workstation. Other signs are more difficult to define, because they are conveyed by changes in the ways of planning, organizing or performing the work. They sometimes are manifested in minor changes in a procedure, a consultation among colleagues on the best way to perform work involving WMSD risk factors, an exchange of useful tips, or an increase in the reporting of pains when they occur. The purpose is to detect all the signs indicating that WMSD prevention has become common practice in the company, and that everyone has adopted it.

The same thoroughness should be applied in detecting the signs of approaches that have not worked well, such as the rejection of implemented preventive measures. For example, look for a solution not used by several workers at the workstation or workers who say they are poorly informed or uncomfortable with the solutions implemented.

Looking for good indicators is a three-part process

Part 1 Reading the quantitative indicators

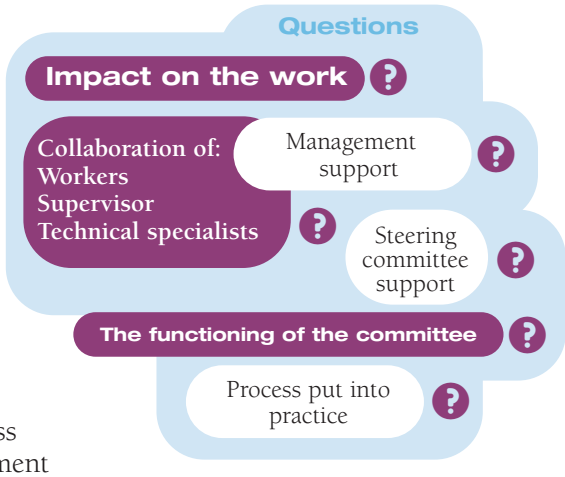
Using the documents resulting from the analysis, such as the workstation analysis report, the solution implementation tracking summary and the minutes of meetings, note the quantitative parameters that can be compared to the data produced before the intervention regarding:

- **investments**
  - Actual costs of workstation modifications (number, material costs, operator time, external resources);
  - Implementation of the intervention (duration, number of meetings, leave for personnel).
- **results**
  - Impact of the solutions on production (note indices regarding quality, work time and turnover at the workstation),
  - Impact of the solutions on the WMSD and accident risk factors (reduction of difficulty indices (weight, repetition, duration); reduction of risk factors (automation or replacement of operations, workstation modification); and reduction in the number of absences, accidents and WMSDs.

Part 2 Critical questioning

The second part consists of a meeting between the ergonomist and the participants in the analysis. The purpose here is to target the signs revealing the strong points and limitations of the process. During this discussion, which is based on critical questioning, the participants review the highlights of the workstation analysis to bring out the points of satisfaction and dissatisfaction.

Suggested themes



Corporate mobilization

- The support provided by the company by way of the steering committee
  - Support from management and the union throughout the work
  - Steering committee support
  - Informing the production workers of the company's intentions regarding WMSD prevention informing the workers at the workstation during implementation of the analysis
  - Leave for workstation workers and participants in the analysis
  - Implementation of different types of solutions (organizational and technical)
- Collaboration of workers / foremen / technical specialists
  - Collaboration of the company's stakeholders in the stages of the process
  - Satisfaction with the modifications made to the workstation (improvement of safety, production, organization of work, equipment and tools)

Implementation of the workstation analysis

- Functioning of the workstation committee or ERGO group:
  - Meeting the objectives set by the committee
  - Interruption of committee activities (meetings cancelled)
  - Satisfaction of the committee's participants (level of difficulty, facilitation, results, progress of the work)
  - Satisfaction of the participants regarding the analytical process
  - Satisfaction of the ergonomist (support from the company and the members, progress of the work, regularity of meetings, turnover of committee members)
- Putting the process into practice
  - Difficulties encountered in implementing the various stages of the process
  - Difficulties encountered when using the process tools
  - Relevance of the process to the workstation to be analyzed
- Impact on the work in general
  - Improvements to the work situation
  - Improvements to the workplace ambience

Part 3 Indirect impacts of the process

The ergonomist can interview individuals who are more peripheral to the analysis, such as the members of the OHS committee, the union and the Engineering Department. Because of their position in the company, they are often in a good position to observe the indirect impacts of the process. These indirect impacts can be manifested through changes to internal corporate policies. For example, operators can be encouraged to report their health and safety problems more promptly, so that the company can intervene before the situation worsens. WMSD follow-up measures can be implemented in the plant through the corporate health and safety committee. The Purchasing Department can be required to consult the OHS committee acquiring tools or equipment. These changes are indirect impacts of the intervention, because they occur during or after application of the process.

Producing the assessment of the analysis

Carrying out the assessment consists in more effectively documenting the path taken from the formulation of the intentions to the end of the completed analysis; the assessment is based on the information gathered. In concrete terms, the assessment can adopt the format that best suits you. What is important here is not so much to decide on the form this assessment should take, but to select the information that will be useful for a constructive review of the intervention that has just ended. Once it is completed, this first assessment will have to be discussed and ratified by the members of the steering committee in the presence of the analysis participants and the expert in charge of the process.

The assessment should include four sections

Section 1 Comparative table of objectives and concrete achievements

This table focuses mainly on the quantitative data. It allows you to compare the initial forecasts with the actual data collected following the intervention, and to explain any variances. For example:

- Initially, a solution had been estimated at a lower cost, but in the interim the price of the basic material increased, which was unforeseeable.
- The solution was supposed to be implemented in April, but this was not feasible, because it was necessary to wait for the July shutdown.
- The list of the main problems compared to the list of improvements made to the workstation.

Section 2 Strong points — Achievements — Advantages of the process

This section presents a summary of the positive results in the application of the process and in the functioning of the committee. For example:

- Before buying workstation equipment, new forms of cooperation were developed between the Purchasing Department, which would henceforth consult the workstation workers, and the supervisor.
- The workers' satisfaction with the solutions implemented.
- The OHS committee draws on the ERGO group's expertise when there is a complaint of musculoskeletal pains at a workstation.

Section 3 Weak points — Dissatisfaction — Disadvantages of the process

This does not mean looking for scapegoats but identifying minor slipups and thinking about their causes so as to to correct our trajectory. For example:

- An implemented solution is not used at the workstation because the workers are unaware of how the new equipment works.
- Two members workstation committee dropped out during the analysis, because they felt uncomfortable on the committee.
- According to certain ERGO group participants, the process is too top-heavy.

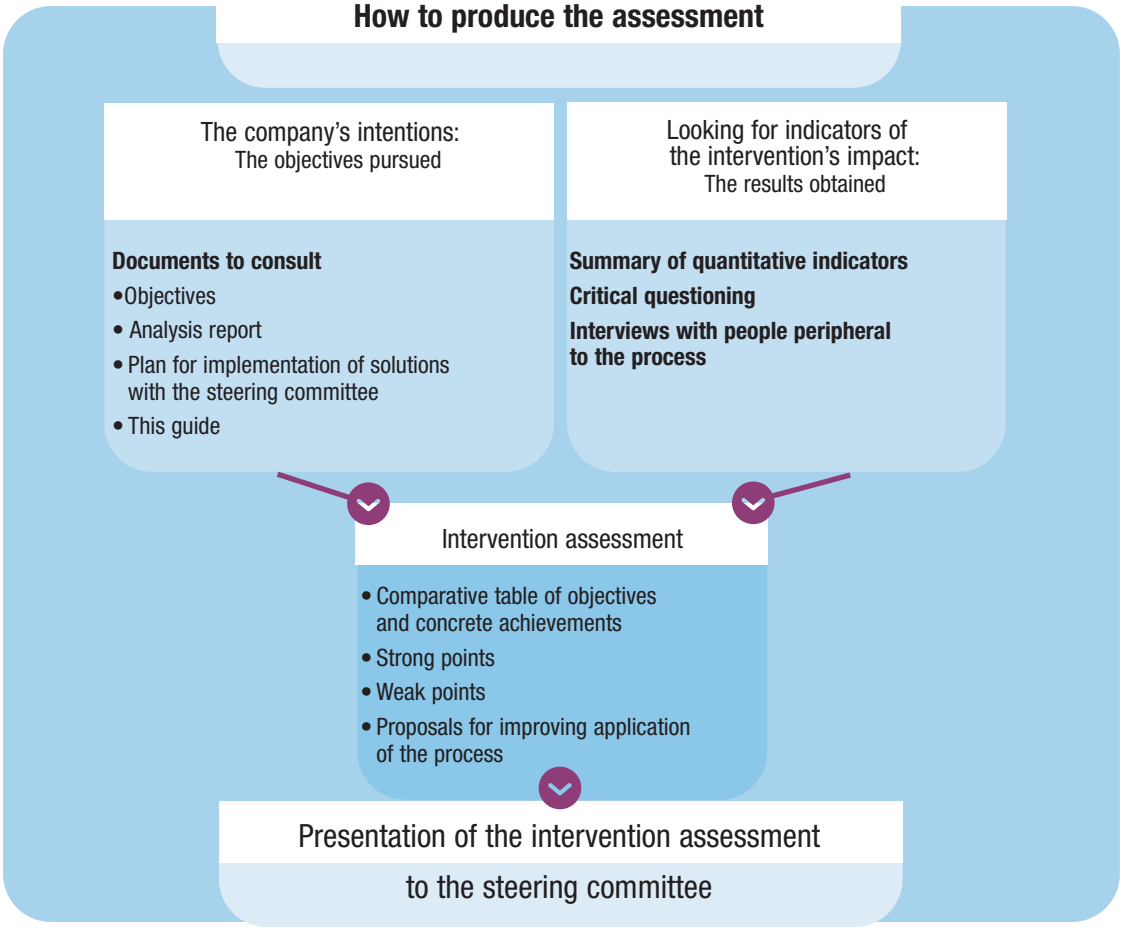
Section 4 Proposals for improving the application of the process

This is the most strategic section, because it will send clear messages to the participants in the process and the members of the steering committee. For example:

- The agreement on worker participation, and thus their leave, must be honoured throughout the process.
- To avoid too much variation in the prices, improve synchronization between estimating the costs of the solutions, their approval by the steering committee and the timing of orders.
- To prevent their premature departure, the ergonomist should keep abreast of the committee members' dissatisfaction.

Presentation of the assessment to the steering committee

Finally, the assessment is not complete without a meeting of all individuals involved in applying the process. This well-documented post mortem of the workstation analysis has the ultimate purpose of deciding on the future of the process within the company. As a decision-making body, the steering committee plays a crucial role here. By ratifying the process improvement proposals submitted to it, it will show its support for the efforts of the workstation committee or the ERGO group. However, the expert and the other participants at this meeting must also agree to follow the improvement proposals that concern them. The success of this process depends on the involvement of all stakeholders in the company. Furthermore, if the application of this process has not produced the expected results, it is necessary to understand the reasons and make the required corrections.



conclusion

Work involving varied tasks: an ergonomic analysis process for WMSD prevention

The application of this analytical process takes time and requires a sustained effort on the part of all personnel. An initial precondition for its adoption is support from an ergonomist to prepare the intervention by: defining the WMSD problem throughout the company with greater precision, ensuring the interest of the principal stakeholders and implemen-ting the intervention structure. This preparation is sometimes difficult to achieve because it seeks sound out the situation throughout the entire company and meet with the plant's various players, many of whom are skeptical about WMSD prevention. If the ergonomist succeeds in gaining the interest of and mobilizing a majority of players regarding the advantages of such a prevention process, he will have fulfilled a primary condition essential to its implementation in the company.

Analyzing the work also requires compliance with the key basic objectives of the process. The first objective is to gather useful information to understand the work (Stage 1: Interviews, and Stage 2: Workstation observation). The second objective is to analyze the work activity to reach a consensus among plant participants on what is happening at the workstation and the main problems encountered by the operators (Stage 3: Identifying problems and Stage 4: Prioritizing problems). The third objective of the process is to have the corporate stakeholders modify the workstation (Stage 5: Seeking solutions and Stage 6: Implementing solutions and follow-up).

Publishing this process is a starting point rather than an end in itself. In fact, we hope that this process, and tools it employs, will pass the ultimate test – an ability to probe the real situations that practitioners in the various work environments must face. It is they who must meet real demands and conditions, including deadlines that are often tight. We ask them to rework and correct this process and adapt its tools to their needs, so that collectively we can improve both our understanding of the ergonomic work analysis processes and their effectiveness.

tools

Varied task analysis: an ergonomic analysis process for WMSD prevention

Operator Questionnaire

1. General information

Production sector: _____

Workstation: _____

Worker's characteristics:

Worker: #1 ❑ #2 ❑ #3 ❑ #4 ❑ #5 ❑ #6 ❑ Sex: M ❑ F ❑

Height: _____ Dominant hand: Left ❑ Right ❑

Seniority with the company: _____

Experience at this workstation: _____

Other workstations occupied in the company: _____

2. How did you learn this job? Who was the trainer? How long did it take? Did this training allow you to learn the job properly?

3. Describe the accident(s) you had when you worked at this workstation.

Quick reference
(Relevant questions)

- *Where, when, how*
- *What workstation, what machine*
- *Type of injury*
- *Type of production*
- *Often or rarely*
- *Shift*
- *Overtime*

Operator Questionnaire

4. **Can you explain what operations are performed and the difficulties associated with them? If possible, indicate whether these operations vary, and describe their importance, their intensity and the time invested.**

Operations / actions (Name, description, location, equipment, tool, material)	**Difficulties** (With what factors do you associate them?)

5. **Have you experienced pain or discomfort related to your work in the past 3 months? If so, can you specify the areas(s) affected, the causes or the frequency? We would also like to know if you consulted a health professional and whether you were absent from work due to these pains.**

PAIN/DISCOMFORT IN THE PAST 3 MONTHS						
Regions affected Shoulder, neck, upper back, middle back, lower back, elbow, forearm, wrist, hand, hip, knee, ankle, etc.	**Side** ❑ Right ❑ Left	**Frequency** 1. Rarely 2. Sometimes 3. Regularly 4. Often	**Consulted health professional**	**Absence**	**With what do you associate it?** Operations, models, tools, equipment, speed, deadlines, taking information, etc.	**Do these pains oblige you to change the way you work?**

6. Which stages of the work do you find the most difficult or painful to perform?

Quick reference
(Relevant questions)

- *Awkward postures*
- *Static postures*
- *Major efforts*
- *Causes musculo-skeletal pains*

7. Do you work on rotation with other workstations? If so, can you explain its advantages and disadvantages?

Quick reference
(Relevant questions)

- *Workstations involved*
- *Frequency, duration*
- *Compulsory or voluntary*
- *Problems encountered*
- *Effects on other problems*

8. Are there general conditions that make the work more difficult?

Quick reference
(Relevant questions)

- *Work rhythm*
- *Schedule*
- *Layout of premises, workstation*
- *Instructions rules to follow*
- *Relations, coordination with other during work*

9. Have there been any changes to the workstation? If so, did this have positive or negative impacts on the working conditions.

Supervisor/Group Leader Questionnaire 5

1. General information

Production sector: _____

Workstation: _____

Enter the number of operators for each shift

	Shift 1		Shift 2		Shift 3		Shift 4	
Sex	**Female**	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**	**Male**
Regular								
Casual								
Other:								

2. Do the operators receive training before occupying this workstation? For how long? Did this training allow the operators to learn the job completely?

3. What accidents occurred at this workstation?

Quick reference
(Relevant questions)

- *Where, when, how*
- *What workstation, what machine*
- *Type of injury*
- *Type of production*
- *Often or rarely*

4. Do the operators rotate between workstations in your production sector? If so, can you explain the advantages and disadvantages?

Quick reference
(Relevant questions)

- *Workstations involved*
- *Frequency, duration*
- *Compulsory or voluntary*
- *Problems encountered*

5. **Can you explain what operations are performed and the difficulties associated with them? If possible, indicate whether these operations vary and their importance, their intensity and the time invested.**

Operations / actions (Name, description, location, equipment, tool, material)	**Difficulties** (With what factors do you associate them?)

6. Are there general conditions that make the work more difficult?

Quick reference
(Relevant questions)

- *Work rhythm*
- *Schedule*
- *Layout of workstation premises*
- *Instructions, rules to follow*
- *Relations, coordination with others during the work*

7. What operations of the workstation are reported to you as the most difficult to perform? Why?

Quick reference
(Relevant questions)

- *Awkward postures*
- *Static postures*
- *Major efforts*
- *Causes pain*

8. Have there been any changes to the workstation? Is so, has this had positive or negative impacts on the working conditions?

Interview Summary

Production sector: _____

Workstation: _____

	Worker:#1	Worker: #2	Worker: #3
Sex			
Height			
Dominant hand			
Status			
Seniority with the company			
Experience at this workstation			
Accidents			
Regions affected that present work-related problems (discomfort, pain)			
The most difficult or painful stages of the work			
Other workstations occupied in the company			

Interview Summary

Can you explain what operations are performed and the difficulties associated with them? If possible, indicate whether these operations vary and their importance, their intensity and the time invested.

Operations / actions (Name, description, place, equipment, tool, material)	**Difficulties** (With what factors do you associate them?)

Interview Summary

TRAINING

Do the operators receive training before occupying this workstation? Does the training allow the operator to learn the job well?

GENERAL CONDITIONS

What general conditions have been recognized that make the work more difficult? Include comments on rotations, if applicable.

OTHER INFORMATION

Note the changes that have been made to the workstation and their positive or negative impacts on working conditions.

Video Observation Planning Grid

Production sector: _____

Workstation: _____

Operations to film	Why	Operators	When

Observation Summary: Video Observations 12

Production sector: _____

Workstation: _____

Observations	Production conditions	Comments
Operations: *Operator:* *Date:* *Start time:* *End time:*		
Operations: *Operator:* *Date:* *Start time:* *End time:*		
Operations: *Operator:* *Date:* *Start time:* *End time:*		
Operations: *Operator:* *Date:* *Start time:* *End time:*		

Observation Summary: Workstation Diagram 13

Production sector: _____

Workstation: _____

Complete the sketch produced during the interviews. Add the physical dimensions of the workstation that you consider important to target the problems or difficulties present on the workstation

Quick reference
(Relevant questions)

- *Weight of the objects handled at the workstation*
- *Height of the work surfaces and note if this changes during the work*
- *Distance of the zones within reach of the material, the work tools, the product*
- *Zones where movements are difficult*
- *Forces exerted*

Note: If possible or relevant, bring the tools, the part or the product that poses a problem to the next meeting of the workstation analysis committee

Analysis Summary

Production sector: _____

Workstation: _____

Priority	Operation	Problem/Cause of the problem	MSD/Accident Risk Factor Region affected	Solution

Action Follow-up Summary

Production sector: _____

Workstation: _____

Date :_____

Solutions	Actions required	Responsible	Timeframe	Status

Solution Follow-up Summary

Production sector: _____

Workstation: _____

Operation and problem	Solution chosen	Solution implemented (Yes / No)	Impact on the problems and operators' perception	Item to improve