Safety
of work equipment

Guide for Risk Analysis
and choice of Protective Measures

October 2002

l'Assurance Maladie
sécurité sociale

PREAMBLE

This document is intended for company managers (users), designers and manufacturers of work equipment, in order to ensure a proper level of safety.

For this purpose, **risk analysis**(1) must be performed. The present document aims at formalising this analysis and the choice of corresponding protection measures :

- This guide should help **company managers** acquire equipment ensuring the operators of a level of safety in line with the various foreseeable or planned uses. It should also facilitate risk analysis on existing equipment and facilities.

- It should allow **designers and manufacturers** to perform risk analysis on the basis of planned or foreseeable operations by the operators and thus identify and implement protection measures adapted to the hazardous situations.

- This guide can also be **applied in a great variety of areas** such as those mentioned in Chapter 4.

(1) European Directive 98/37 of 22 June 1998, known as " machinery directive " states in Annex 1 that " The manufacturer is under an obligation to assess the hazards in order to identify all of those which apply to his machine ; he must then design and construct it taking account of his assessment." (This arrangement is transposed into French labour regulation : see section 1.1.2 of Annex 1 to Article R.233.84)

Safety of work equipment

GUIDE FOR RISK ANALYSIS AND CHOICE OF PROTECTIVE MEASURES

SUMMARY

ANNEX

1. INTRODUCTION

As a result of technological progress, modern machinery is increasingly efficient, faster, smarter, more flexible and, furthermore, able to perform self-diagnosis.

Negotiations between customer and supplier therefore seldom take into account the people in the workplace. The future user, whether he be a production operator or a maintenance worker, is then forgotten, together with the risks to which he is exposed.

Increasing machinery complexity affects machine reliability, so that human intervention is still required to prevent detected malfunctions from causing lengthy production shutdowns or the manufacture of faulty products. Workers are therefore expected to be efficient, capable of performing their tasks immediately and responding quickly to malfunctions, whether the risks are visible or not, analysed or not, and estimated or not.

European directives on design of work equipment have two fundamental goals :

- design and manufacture of safe products;
- removal of technical barriers which could restrict the circulation of products.

While these directives offer designers and manufacturers access to a larger market, this means that they, in return, must offer safe products, meeting the essential requirements of these directives.

Regulations do not dictate how to proceed. The designer is free to conceive the means needed to meet occupational health and safety requirements. In practice, this freedom of action offered to the manufacturers is seldom used. Machinery for which a certificate of conformity has been provided and the CE marking affixed often entails risks that could have been detected and remedied by further analysis.

- How can future risks be controlled as of the design stage ?
- How can collaboration between users and designers be facilitated ?
- What means and tools can be employed so that a user wishing to invest in new machinery may be sure that his employees will not be exposed to risks of harm to their physical integrity or health?
- What information should be supplied to the manufacturer so that the new equipment, apart from purely legal aspects, may be truly adapted to man ?

The proposed approach is based on analysis of operators' tasks/activities and work situations.

While this approach is, of course, appropriate for special machinery and facilities, it can be used for less complex - or even standard - equipment or everyday work situations.

For simple, standard machinery, this approach should be adopted when the company's specific use of the machinery and environment could generate hazardous situations that were not originally foreseen by the manufacturer for conventional applications.

Depending on the sector of activity and the complexity of equipment and facilities, the use of this method does not exclude compliance with codes, regulations and standards and the use of other

analysis methods.

Finally, it is not advisable to outsource this analysis work, since this could result in :

- possible loss of know-how,
- making the method inefficient and superficial,
- depriving oneself of progress which would be possible through increased knowledge and the proposal of new solutions.

The aim of the present document is to make users and designers aware that, with common sense and using simple means, workers' health and safety can be taken into account. Using the proposed analysis approach, focusing on workers, effective protective measures can be identified and then applied..

Various training sessions held at the CRAMIF have shown the practical nature of the approach discussed in this document, which is designed to be simple and understandable without aiming at being exhaustive or universal.

2. ANALYSIS METHOD

2.1. PRINCIPLE OF THE METHOD

The method proposes **examining each operator task, step by step**, in as detailed and concrete a manner as necessary. This will supplement the risk analysis performed by the designer on the equipment functions.

Such functional analysis often does not describe the operators' actions, whether they are in a normal operating situation or in incident recovery mode (maintenance, repair, etc.)..

To make better allowance for workers, therefore, this method proposes supplementing functional analysis as of the design stage, with :

- the list of tasks;
- risk analysis;
- the operator's manual, ensuing from the previous two documents.

The first part of the method involves drawing up a list of tasks that the operator will have to perform, irrespective of the subsequent analysis (see example in Chapter 3)..

Inevitably, the tasks actually performed are always somewhat different from the tasks stipulated. This difference can be considered as an operator response to the problems encountered in adapting capacities (staff + facilities, even well designed) to the work to be accomplished.

For greater efficiency and pragmatism, analysis of tasks and work situations should involve operator participation whenever possible. Otherwise, the designer will have to imagine and list them.

In all cases, thinking should allow for foreseeable abnormal tasks and situations(2) .

(2) Section 1.1.2 of Annex 1 to Article R 233.84 of Machinery Directive 98/37/EC

This analysis of tasks and work situations must be performed not only for the production stage but also for all other stages: adjustment, servicing, maintenance, cleaning, etc.

This description stage can be tedious. However, as a result :

- hazardous situations will not be overlooked;
- it will be possible to imagine prevention solutions other than the "first idea that springs to mind"..

The second part involves **performing risk analysis**, looking for the various situations which could lead to harm by imagining the various scenarios resulting, in particular, from malfunctions, and by choosing protection measures.

The risk analysis will be formalised on the basis of a table proposed in Chapter 2.2.

In the hand left part of this table will be listed for each task, operation by operation, and for each hazard or danger, the risk elements which are essential to the analysis :

- the hazard or danger;
- the hazardous situation;
- the hazardous event and possible harm;
- and the probability and severity of the initial risk will be quantified.

In the right hand part of the table, the following decisions will be taken :

- Choose to act upon the risk element(s) enabling some of the most efficient protective measures to be taken,
- Choose the appropriate means of protection;
- Quantify the residual risk.

The higher the item in question in the list of risk components, the more effective must be the prevention measures chosen to reduce the risk (see Chapter 2.4).

At every stage of the project, the method allows the various players involved to express a viewpoint and to propose appropriate protective measures. It also enables optimisation of tasks and greatly facilitates production of operators' manuals and instructions.

The operator's manual shall detail all elementary operations, ensuring that they are in agreement with the analysis table. The drafting of this manual, in parallel to risk analysis, will be more efficient if it is performed from the very start of the design stage, at least in its principles and guidelines.

Once filled in, the analysis table is a summary of the various hazards and protective measures resulting from the risk analysis performed for each task.

It is presented hereafter with recommendations for use and the principal definitions. Examples of use are given in Chapter 3.

2.2. ANALYSIS TABLE : definitions ; User informations

FACILITY :
SUPPLIER :
PREMISES :
SYSTEM :

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reviewed on
by

TASK N° : name the task							MLP : Machinery Life Phase :	Frequency :		
- describe if possible the equipment and its function - describe the task, and the means used - add, a diagram or photograph if necessary							- State the Machinery Life Phase	- State the frequency and duration of the task		
OPERATION		ELEMENTS of RISK Risk : combination of the probability of occurrence of harm and the severity of that harm					PROTECTIVE MEASURES			
N°	Identification	Hazard or danger	Hazardous situation	Hazardous event *possible harm*	P initial	S initial	Which element should be acted on ?	Means	P residual	S residual
		Hazard : potential source of harm*	circumstance in which a person is exposed to at least one hazard. The exposure can immediately or over a period of time result in harm*	Occurrence in which a hazardous situation results in harm *Lésion physique ou atteinte à la santé**			Choose the risk elementt(s) which correspond to the most effective measures.			
	- List the successive stages of task performance with the various operator actions (or list the cycle phases for automatic operation) Also bear in mind waste	describe : - the energies involved, with quanti-fication (speed, weight, tension, pressure, etc.), or - the danger (sharp or perforating fixed part, presence of hazardous substances without projection, etc.)	- Describe exposure during planned servicing in normal operation - Imagine servicing operations in case of machine malfunctions - Imagine operating modes chosen by the operator and differing from those planned	- Think about unexpected starting - Think about the action of third parties who could operate on the equipment - Think about "abnormal" operator action - *State the possible harm*			The prevention approach favours **by order of priority :** 1) **elimination** (or reduction) of the **hazard** (inherent design measure) 2) **elimination of the hazardous situation** (i.g. automatisation of the task) 3) **the elimination of hazardous events** (i.g. by making the machinery more reliable) 4) **elimination or limitation of harm** (e.g. use of residual current sensing device, personal protective equipment; training and information; or else assistance to any victims)	- Describe the appropriate means for acting on the risk component(s) chosen alongside .		

MLP = Machinery Life Phase
Installation
Commissioning
Adjustment
Maintenance
Cleaning

Frequency of the task
Permanent
Dayly
Weekly
Monthly
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Annually

P = Probability of occurrence of harm
A : unlikely
B : seldom
C : occasionnal
D : high

S = Maximum Severity of the possible harm
1 : negligible
2 : low
3 : serious
4 : fatal

Means
Bold : inherent design measures or safeguarding
Italics : complementary protective measures and information for use

DEFINITIONS : the terms and definitions used are extracted from international standards - see ISO guide 51, EN/ISO 12100 (EN 292) and EN/ISO 14121 (EN 1050)

2.3. RISK ANALYSIS

2.3.1. Principle of risk analysis

Risk analysis is performed in three stages :

1. Determination of the field of application (production, maintenance…) and the limits of the machinery.

2. Identification of hazards or dangers.

3. Risk estimation for each hazard or danger.

It forms part of the risk assessment approach described in Standard EN 1050. Figure 1 is a representation of the iterative process enabling safety to be achieved, in line with the concept of safe machinery.

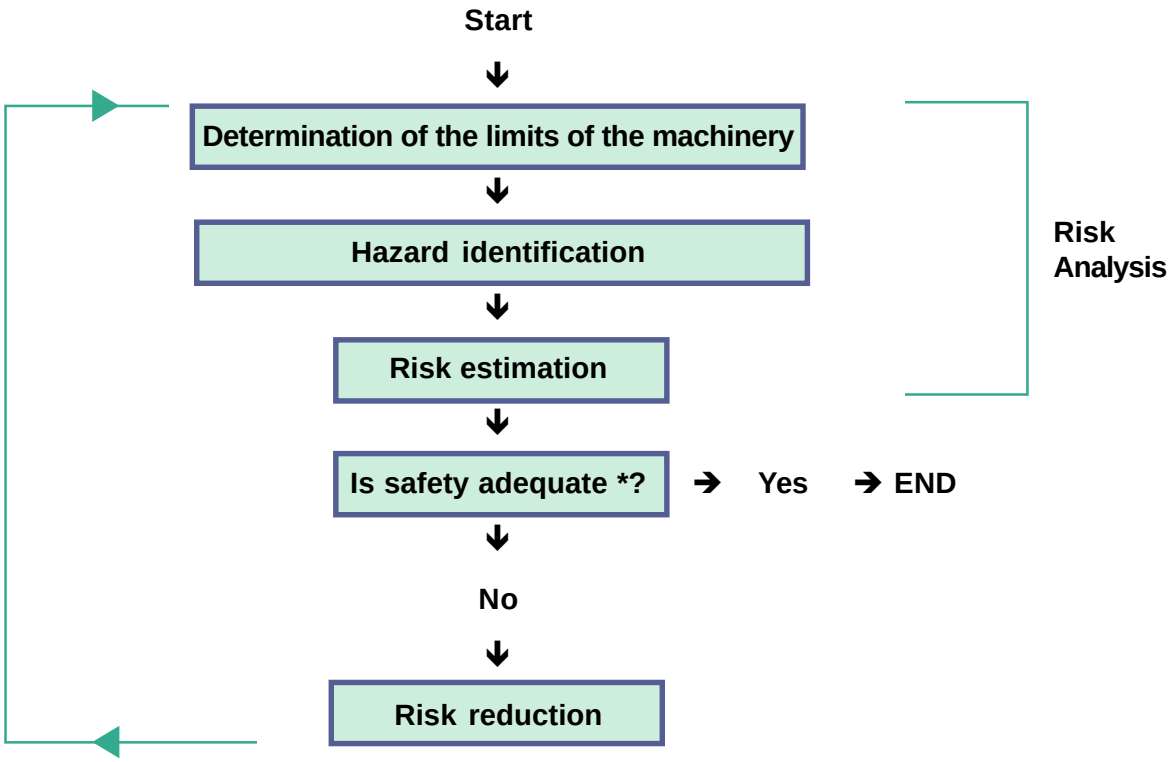


Figure 1 : The iterative process to achieve safety

***** «**Is safety adequate** ?» means, according to standard EN 292-1:1991 :

- Has the required level of safety been reached ?
- Is it certain that an equivalent level of safety cannot be obtained more easily ?
- Is it certain that the measures taken :
  - . do not excessively reduce the ability of the machine to perform its function ?
  - . do not generate new, unexpected hazards or problems ?
- Are there solutions for all operating conditions, for all intervention procedures ?
- Are the solutions compatible with each other ?
- Are the operator's working conditions not jeopardized by those solutions ?

2.3.2 Conditions of occurrence of harm

Harm occurs only if the following three conditions are all met :

- A person is exposed to a hazard or danger (and is then in a hazardous situation);
- A hazardous event occurs, triggering the accident mechanism;
- There is no possibility of avoiding the harm.

A schematic representation is given in Figure 2.

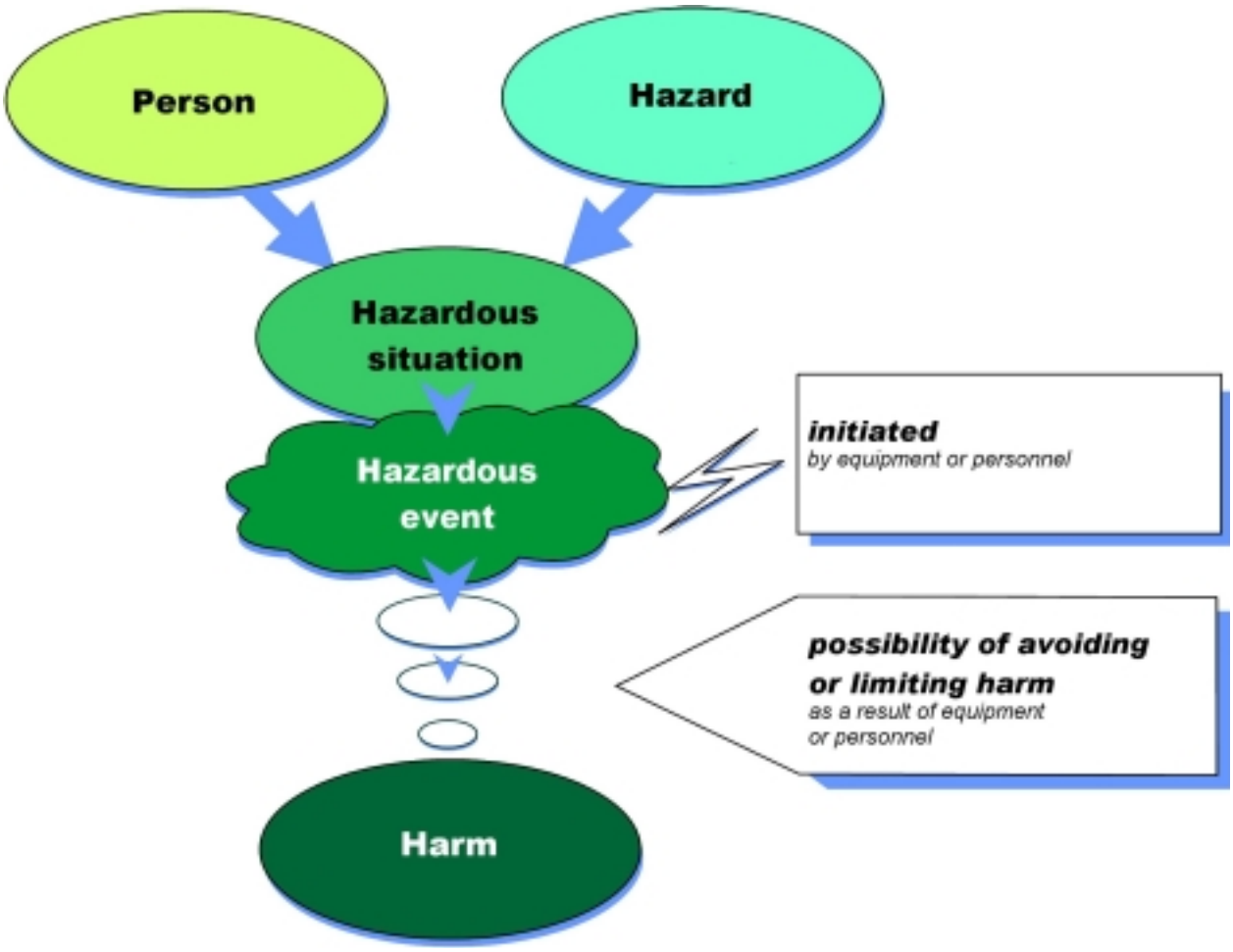


Figure 2 : Conditions of occurence of harm

An example of conditions leading to harm is attached in Annex B.

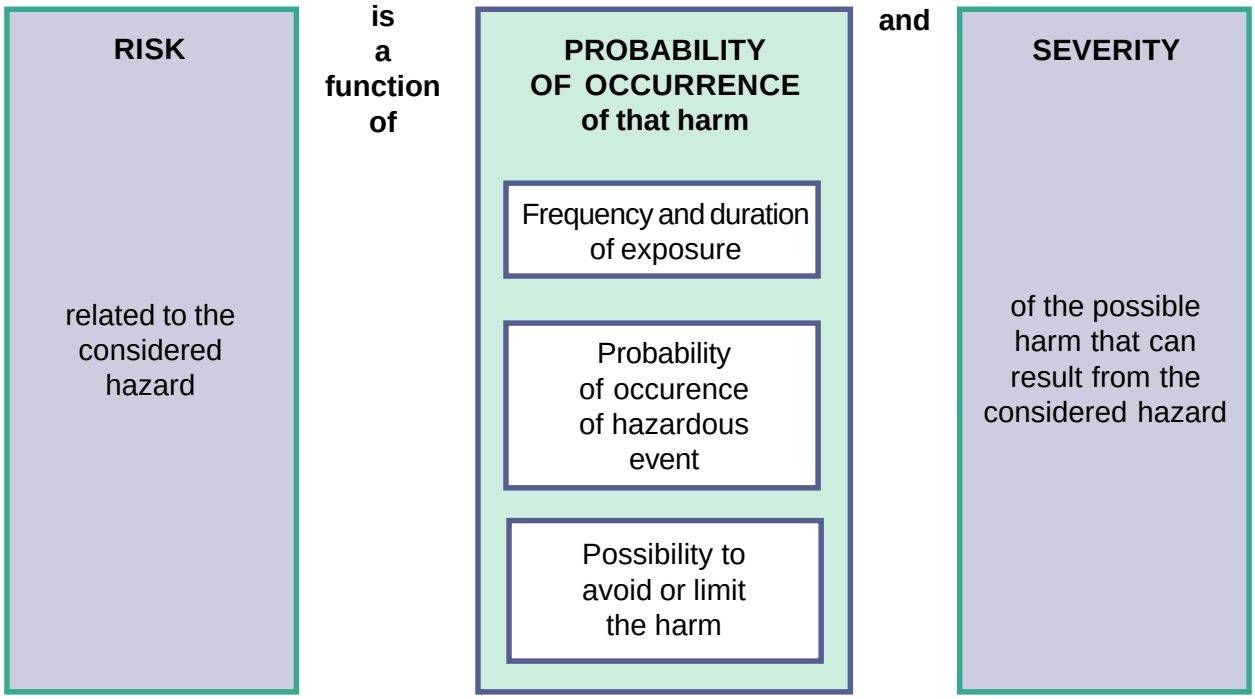
2.3.3. Risk estimation

Risk results from the combination of the probability of occurrence of harm and the severity of that harm.

The probability of harm is a function of :

- the frequency and duration of exposure to the hazard;
- the probability of occurrence of a hazardous event;
- the possibility of avoiding or limiting harm.

(see figure 3)



This definition is a quantitative approach to risk

Figure 3 : Risk estimation as per Standard EN 1050:1996

The hazard may result from the equipment (machine, environment, etc.) or personnel. These factors must therefore be taken into account in estimating the probability of occurrence.

Simple scales can be used to quantify the severity and probability of harm (see example proposed with the analysis table).

2.4. ELIMINATION OF HAZARD OR REDUCTION OF RISK

To eliminate (or reduce) risk, the condition(s) leading to harm should be treated as per Figure 2.

The higher in the following table is the aspect dealt with by the protective measure, the more effective said measure must be. Measures to eliminate rather than reduce the risk should be preferred.

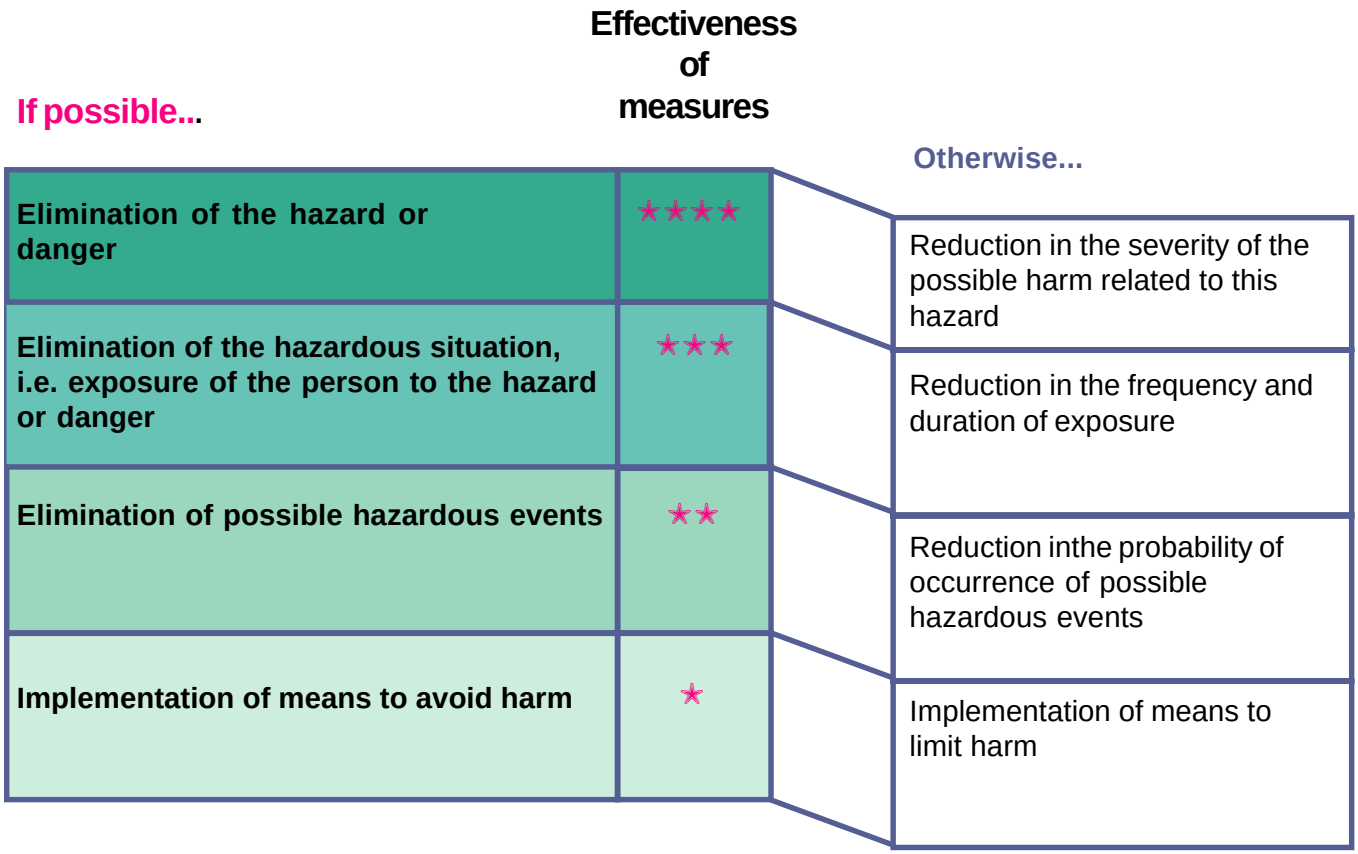


Figure 4 : Eliminating or reducing Risk

An example of conceivable measures to eliminate or reduce risks is attached in Annex C.

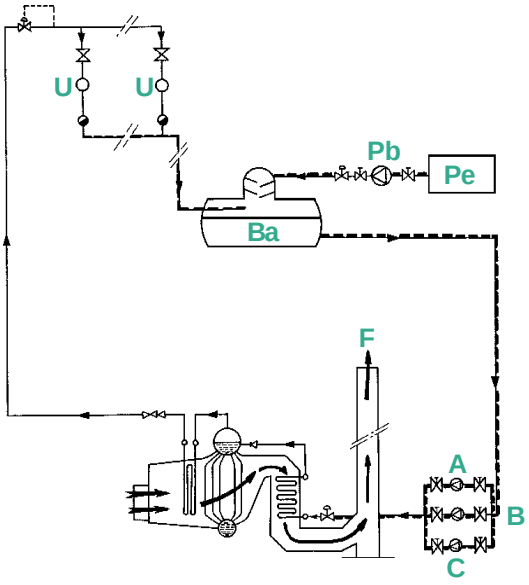
3. EXAMPLES OF APPLICATIONS

Example 1 : Water circuit of a steam boiler

Description :

The present example (non-exhaustive) is based on the list of tasks relating to the water circuit of a «boiler + steam consumer» assembly (see diagram below).

Boiler + steam consumer assembly



Pe : water station
Ba : feed water deaerator tank
A,B,C :boiler feed pumps
Pb : tank feed pumps
U : steam consumers
F : fumes

water circuit
steam circuit

LISTE OF TASKS :

Feed water deaerator tank feed pump (Pb)

1. Inspection visit
2. Stuffing box leakproofing check
3. Removal / refitting of pump
4. Removal / refitting of motor
5. Removal / refitting of motor-pump assembly

Feed water deaerator tank (Ba)

1. Inspection visit
2. Check on measuring instruments
3. Check on safety valves
4. Maintenance of safety valves
5. Maintenance of water circuit parts
6. Maintenance of steam circuit parts
7. Annual inspection of the interior
8. Annual cleaning of the interior

Boiler feed pumps (A, B, C)

1. Inspection visit
2. Test operation of standby pumps
3. Adjustment of stuffing box leakproofing
4. Removal / refitting of pump
5. Removal / refitting of motor
6. Removal / refitting of motor-pump assembly

OPERATIONS (details of a task) :

Each task should be broken down into operations during risk analysis. This breakdown is not necessary when drawing up the list of tasks, since it can appear directly on the analysis table.

In the following example we shall select Task No. 6: «Removal/refitting of the motor/ pump assembly (A, B, C)».

FACILITY : Boiler
SUPPLIER : XXX
PREMISES : Pump level -1
SYSTEM : Boiler feed pump

created on 10.09.1998
reviewed on 04.02.1999
by XXX

TASK N° 6 : Removal / Refitting of the motor-pump assembly | Machinery life phase : maintenance | Frequency : Annual

Three pumps A, B and C feed water to the boiler (one in service : e.g. B, and two on standby : A and C).

This operation is theoretically performed annually: removal of an entire pump system from its concrete block then fitting it back into place: e.g. A (motor-pump frame) for repair, without stopping the boiler (pump B stays in service). Removal to workshop on a self-propelled cart.

OPERATION		ELEMENTS of RISK					PROTECTIVE MEASURES			
N°	Identification	Hazard or danger	Hazardous Situation	Hazardous Event *possible harm*	P initial	S initial	Which element should be acted on ?	Means	P résidual	G résidual
6.1	The operator(s) disconnect(s)/ reconnect(s) the electricity of the pump A motor	Rotation of the shaft of the pump A motor	Work close to a rotating part of pump A	Contact with a rotating par of pump A *Injury*	D	4	Elimination of the hazard : Electrical isolation and energy dissipation of the motor	**Isolation switch with a padlock on main low voltage transformer or locally.**	A	1
		220 V live conductor for pump A	Work on an electrical part of pump A	Contact with live conductor of pump A *Electrocution*	D	4	Electrical isolation and energy dissipation of the motor	*Isolate the electrical circuit of pump A before servicing*	A	2
6.2	The operator(s) disconnect / reconnect pump A on the water circuit	Hot water at 105°C with a downstream pressure of 12 bar and an upstream pressure of 0.5 bar	Work close to pressurized hot water circuit	Hot water splashing *Burns*	C	3	Elimination of the hazard : water isolation	*Close the valves and make the water pressure fall* *Drain the water. Put a blind flange on the network side at the pump inlet and outlet* **Two blind flanges provided by the boiler supplier including a special acceptance of the flanges before assembling the pump**	A	1
		Hot parts of the pump		Contact with hot parts *Burns*	C	3	Elimination of the hazard : Wait until it cools down	*Wait 2 hours for it to cool down*	A	1
6.3	The operator(s) install the hoist on the monorail above the assembly	Work at heights : Gravity	The operator attaches the hoist at a height of 4 metres	Loss of balance Person falling : *Injury*	C	4	Elimination of the hazardous event : hoist attached with secure access	*Place a mobile scaffolding under the free end of the monorail to install the hoist*	A	1

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INSTALLATION : Boiler
SUPPLIER : XXX
PREMISES : Pump level -1
SYSTEM : Boiler feed pump

created on : 10.09.98
reviewed on : 04.02.99
by XXX

OPERATION		ELEMENTS of RISK					PROTECTIVE MEASURES			
N°	Identification	Hazard or danger	Hazardous situation	Hazardous event *possible harm*	P initial	S initial	Which element should be acted on ?	Means	P résidual	S résidual
6.4	The operator(s) lift(s) and handle the whole pump unit A	Suspended 150 kg unit	Presence under the load	Fall of load : *Person crushed*	C	4	Elimination of hazard Elimination of hazardous situation	**Appropriate lifting equipment : 250daN monorail fastened to a purpose-build ceiling and adequate slings,** *plus training in handling and lifting* *Make sure that no-one is positionned under the load*	A	1
6.5	All operations : the operator(s) work(s) on pump A or C near pump B in service	Rotation of the shaft of the pump B motor	Work near rotating part of pump B	Contact with rotating part of pump B *Injury*	B	4	Reduction of hazardous situation : pumps spaced apart to work without any contact with the pump in operation	**Distance between concrete blocks : 1 m minimum**		
							Reduction of hazardous event : Obstacle/rotating parts	**Guard supplied by the manufacturer** *- make sure the guard is present before intervening*	A	1
		220 V live conductor on pump B	Work near the electrical circuit of pump B	Contact with live conductor of pump B (direct contact) *Electrocution*	B	4	Reduction of hazardous event : Obstacle/electric parts	**Electrical circuit cover** *- check presence of electrical protection*	A	1

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Example 2 : Waste compactor (analysis of an operating procedure)

TASK N° : Loading the hopper of a waste compactor	Machinery life phase : in use	Fréquence : Permanent

The operator must load the waste to be compacted in the hopper. Once the objects (cardboard boxes, crates, one-way pallets) are dumped, he presses the starter knob on the control box. After three compacting cycles, the machine stops.

In some cases, after loading the hopper, the operator does not activate the starter knob. Objects are therefore waiting to be compacted in the hopper. As the objects are not compacted straight after being dumped in the hopper, the next user can find himself in a situation of hopper jamming (i.e. one-way pallet refusing to come down). The top ridge of the hopper is at 1.5 m from the ground. The hopper decking is 1.13 m of the ground. The bucket hanging bars are 0.7 m above the ground.

OPERATION		ELEMENTS of RISK					PROTECTIVE MEASURES			
N°	Identification	Hazard or danger	Hazardous situation	Hazardous event *possible harm*	P initial	S initial	Which element should be acted on ?	Means	P résidual	S résidual
0	After attaching the empty bucket, the compactor is switched on for future use : the compactor is energised									
1	The operator dumps waste in the hopper	220 V live compactor	The operator stands near a conducting metallic frame	Damaged connecting cable (rodents, humidity), energised by the frame *electrocution*	C	4	Reduce the hazardous event. Remove the hazard from reach Limit the possible harm : protective device adapted to the neutral condition	**- protect the cables with sleeves, shielding...** **- and use a leakproof equipment (IP55)** **- connect the frames to earth** **- and install a 30mA residual current sensitive device** **- and TN neutral condition or TT neutral condition**	A A	2 4

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TASK N° : Loading the hopper of a waste compactor							Machinery life phase :in use	Frequency : Permanent		
OPERATION		ELEMENTS of RISK					PROTECTIVE MEASURES			
N°	Identification	Hazard or danger	Hazardous situation	Hazardous event *possible harm*	P initial	S initial	Which element should be acted on?	Means	P résidual	S résidual
2	The operator starts the compactor	Cyclic mechanical movement of waste pressing (Force, Speed)								
3	The operator watches the compacting	Cyclic mechanical movement of waste pressing (force F, speed V) Projection of waste (mass M, speed V)	The operator watches the compacting near the hopper The operator is in the projection zone	Non-compactable waste is in the hopper : random trajectory of the projected waste *burning, puncturing, shock, etc.*			Avoid the hazard, avoid loading products that are hazardous, harmful or non compactable, etc. Avoid the hazardous situation Eliminate the risk of the operator being hit by a projectile (remoteness, obstacle)	*- train the operator to recognize whether products are compactable or not, and* *- organize the collection of non-compactable products* **- move the control box away from the hopper, and observe the hopper from a distance or indirectly (mirror)** **- set up obstacles to the projection of waste (hopper edges, hood)**	B B A	4 3 2
4	If compacting is not taking place correctly, the operator may wish to intervene physically. During compacting, objects may cling to the vault and refuse to come down. Their descent have to be assisted at the press level.									
4a	The operator rams the waste to obtain compacting	Cyclic mechanical movement of waste pressing	The operator pushes the upper part of the waste from the ground with a tool	Random movement of the tool when driven *Shock, pinching of upper part of the body with the tool*	C	2	Eliminate the operation Design a hopper capable of preventing or limiting vault clogging Avoid the hazard Eliminate the energy in motion Avoid the hazardous event Use a tool with a low bending resistance	**Design vertical or asymmetric hopper edges to avoid bearing surfaces** *Switch off the power before intervening on clogged waste, isolation prior to the operation* **Design a tool which is risk-free tool in case of pinching**	B A B	2 1 1
4b	Same as 4a above	Same as 4a above	The operator shoves the waste from the the bucket hanging bar (upper limbs and/or tool)	Loss of balance *Fall into the hopper and risk of crushing or fall to the ground*	C	4	Same as 4a above Avoid the hazardous situation Eliminate the possibility of climbing on the hanging bar	**Set up the hopper so that its edge cannot be used as a hanging point and the bar as a bearing point**	A	1
4c	Same as 4a above	Same as 4a above	From the compactor decking, the operator shoves the waste (lower limbs or upper limbs and/or tool)	Loss of balance *Fall into the hopper and risk of crushing or fall on decking or ground*	C	4	Same as 4a above Avoid the hazardous situation Eliminate the risk of falling into the hopper Eliminate the risk of falling to the ground from the decking	**- raise the edges of the hopper, and** **- adapt the access (staircase, hand-rail), and** **- install a hand-rail on the decking of the compactor**	B	1

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TASK N° : Loading the hopper of a waste compactor							Machinery life phase :in use		Frequency : Permanent	
OPERATION		ELEMENTS of RISK					PROTECTIVE MEASURES			
N°	Identification	Hazard or danger	Hazardous situation	Hazardous event *possible harm*	P initial	S initial	Which element should be acted on?	Means	P résidual	S résidual
5	The operator dumps waste into the compactor	Compactor energised	The operator wants to retrieve an object; he gets into the hopper	Unexpected starting *crushing of all or part of the body*	C	4	Avoid the hazard Eliminate the energy Avoid the hazardous situation Eliminate the energy if an access in the hazard zone is detected	*Isolation before intervention* **Facilitate access to the hopper and detect access to avoid any starting (gate + opening and closing control)** **Due to possible failure to comply whith the operating procedure and the severity of the possible harm, the second solution will be chosen (avoid the hazardous situation)**	A B	2 4

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4. FIELDS OF APPLICATION

As we have seen, the proposed approach is well adapted to the design and use of work equipment.

However, being based on human activity, this approach can also be advantageously used in other fields such as :

- Design of working premises and buildings;
- Drawing up the dossier for subsequent intervention on the building;
- Building work;
- Drawing up the special plan for safety and health protection;
- Drawing up the asbestos removal plan;
- Provision of services (e.g. industrial cleaning);
- Drawing up the prevention plan in the case of work by an outside company;
- Drawing up the safety protocol for loading and unloading operations,

Annexe A : Empty table

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SYSTEM :

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by

TASK N° :							Machinery life phase :	Frequency :		
OPERATION		ELEMENTS of RISK					PROTECTIVE MEASURES			
N°	Identification	Hazard or danger	Hazardous situation	Hazardous event *possible harm*	P initial	S initial	Which element should be acted on?	Means	P résidual	S résidual

PML = Machinery Life Phase
Installation
Commissioning
Adjustment
Maintenance
Cleaning

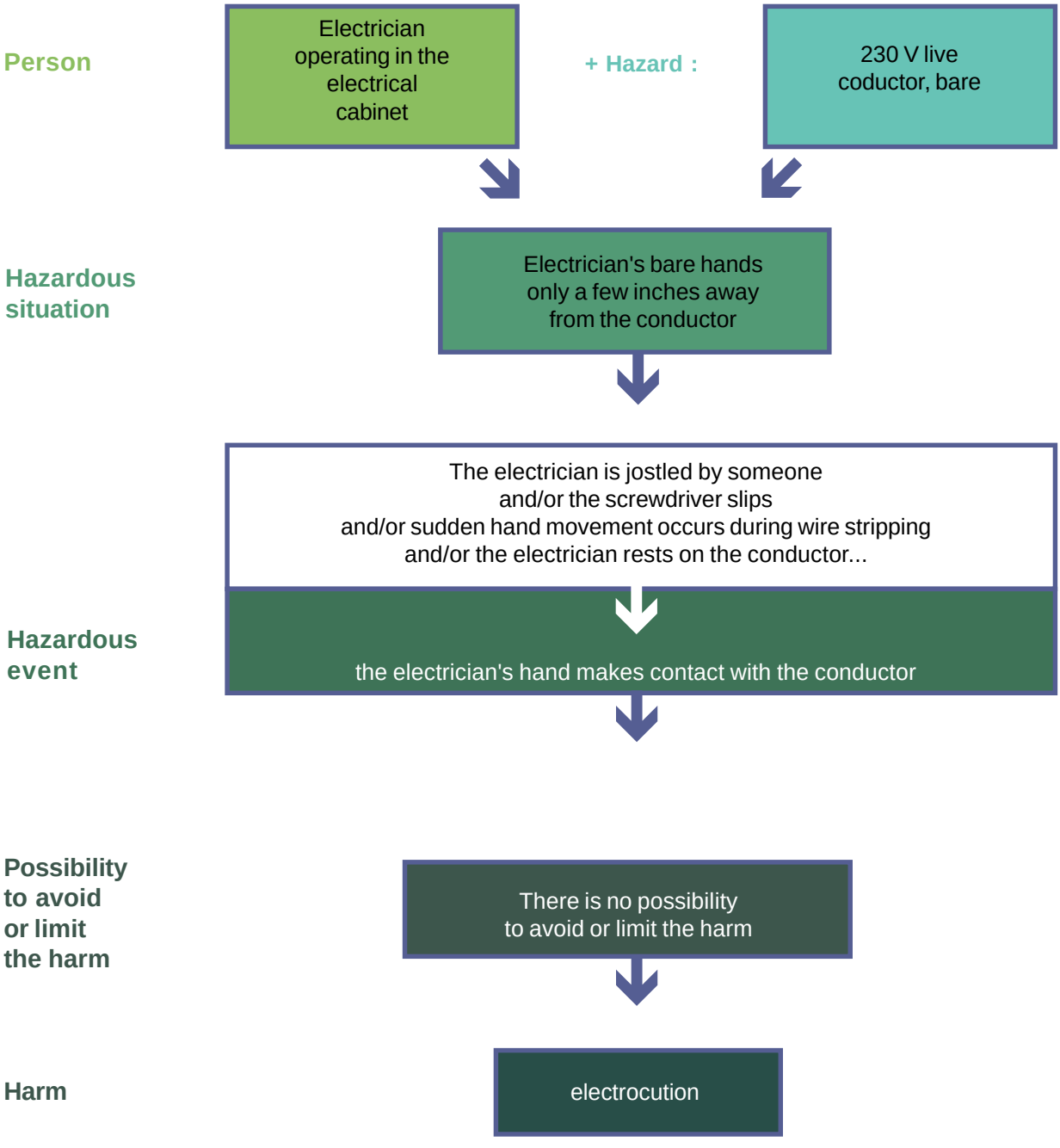
Frequency of the task
Permanent
Dayly
Weekly
Monthly
Biannually
Annually

P = Probability of occurrence of harm
A : unlikely
B : seldom
C : occasionnal
D : high

S = Maximum Severity of the possible harm
1 : negligible
2 : low
3 : serious
4 : fatal

Means
Bold : inherent design measures or safeguarding
Italics : complementary protective measures and information for use

Annex B : Example of conditions leading to harm



Annex C :
Example of conceivable measures for eliminating hazards or reducing risks

(Application to the example of Annex B)

Person	● remote monitoring or remote diagnostic...	★★★★
Hazard	● de-energised and isolate electrically ● use a very low voltage for safety ● isolate the wire...	★★★★
Hazardous situation	● move conductor away from the work area... ● place a separating screen between the conductor and the work area	★★★
Hazardous event	● isolate the work area ● use a insulated screwdriver ● use a wire stripping tool, to avoid sudden hand movements...	★★
Possibility to avoid or limit the harm	● install a residual current sensitive device ● work with insulating gloves ● install an emergency stoppage device...	★

Annex D : Bibliography

Standards

EN 292 (1991) Safety of machinery – Basic concepts - general principles for design

EN 1050 (1996) Safety of machinery – Principles for risk assessment

INRS publications (Institut National de Recherche et de Sécurité)

ED 807 Sécurité des machines et des équipements de travail
Moyens de protection contre les risques mécaniques

ED 1368 Facteurs humains de la fiabilité et de la sécurité des systèmes complexes

ED 1503 Analyse du poste de travail et démarche ergonomique

ED 1520 Concevoir une machine sûre

ED 1521 Maintenance et maîtrise du risque

Miscellaneous

La sûreté des machines et installations automatisées. Published by : Apave – Télémécanique

Guide d'intervention sur les machines, sur les équipements de travail. Edition : CRAMIF : Note technique n° 11

La réglementation communautaire pour les machines – Commentaires sur les directives 89/392/CEE et 91/368/CEE. Edition : Office des publications officielles des communautés européennes.

Notes...

Notes...

THE OFFICE FOR PREVENTION OF OCCUPATIONAL RISKS OF CRAMIF

DEPENDING ON THE LOCATION OF YOUR COMPANY
GET IN TOUCH WITH THE MANAGER OF OUR LOCAL OFFICE
IN YOUR AREA

- **PARIS**
  17/19 place
  de l'Argonne
  75019 PARIS
  ✆ 01 40 05 38 16
  Fax : 01 40 05 38 13
  e-mail : antenne75.prevention@cramif.cnamts.fr

- **HAUTS-DE-SEINE**
  Immeuble Axe Etoile
  105 rue des Trois Fontanot
  92022 NANTERRE CEDEX
  ✆ 01 47 21 76 63
  Fax : 01 46 95 01 94
  e-mail : antenne92.prevention@cramif.cnamts.fr

- **SEINE ET MARNE**
  104 allée des Amaryllis - BP 82
  77196 DAMMARIE-LES-LYS CEDEX
  ✆ 01 64 87 02 60
  Fax : 01 64 37 12 34
  e-mail : antenne77.prevention@cramif.cnamts.fr

- **SEINE-ST-DENIS**
  29 rue Delizy
  93698 PANTIN CEDEX
  ✆ 01 49 15 98 20
  Fax : 01 49 15 00 07
  e-mail : antenne93.prevention@cramif.cnamts.fr

- **YVELINES**
  9 rue Porte de Buc
  78035 VERSAILLES CEDEX
  ✆ 01 39 53 41 41
  Fax : 01 39 51 06 24
  e-mail : antenne78.prevention@cramif.cnamts.fr

- **VAL-DE-MARNE**
  12 rue Georges Enesco
  94025 CRETEIL CEDEX
  ✆ 01 42 07 35 76
  Fax : 01 42 07 07 57
  e-mail : antenne94.prevention@cramif.cnamts.fr

- **ESSONNE**
  Immeuble EURO CAP EVRY
  507 place des Champs Elysées
  91026 EVRY CEDEX
  ✆ 01 60 77 60 00
  Fax : 01 60 77 10 05
  e-mail : antenne91.prevention@cramif.cnamts.fr

- **VAL-D'OISE**
  9 chaussée Jules César
  BP 249 OSNY
  95523 CERGY PONTOISE CEDEX
  ✆ 01 30 30 32 45
  Fax : 01 34 24 13 15

Headquarters
SERVICE PREVENTION DES RISQUES PROFESSIONNELS
17-19 place de l'Argonne - 75019 PARIS
Fax : 01 40 05 38 84
e-mail : prevention.atmp@cramif.cnamts.fr

You can also contact :

- **UNITE ETUDES TECHNIQUES ET ASSISTANCE EN PREVENTION**
  ✆ 01 40 05 38 32
  e-mail : etudes.prevention@cramif.cnamts.fr

- **UNITE HYGIENE INDUSTRIELLE ET PATHOLOGIE PROFESSIONNELLE**
  ✆ 01 40 05 38 30
  e-mail : hipp.prevention@cramif.cnamts.fr

- **UNITE INFORMATION - FORMATION**
  ✆ 01 40 05 38 59 ou 60
  e-mail : formation.prevention@cramif.cnamts.fr

- **ESPACE PREVENTION**
  Documentation ✆ 01 40 05 38 18
  Theater ✆ 01 40 05 38 47
  e-mail : espace.prevention@cramif.cnamts.fr
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Directeur de la Publication : Jacques TONNER - Conception : Prévention des risques professionnels
Réalisation : Division Courrier Général - Arts Graphiques - Reproduction
Dépôt légal : 4ème trimestre 2002 - Impression : CRAMIF
2ème édition 2000 - réimpression 2002 - 2500 ex.
Réf : DTE 127Eng