SUEDE

10th March 1975

ergolab

Ird/ub

Professor Alain Wisner
Conservatoire National des Arts et Métiers
41 Rue Gay-Lussac
PARIS 5 FRANKRIKE

Dear Alain,

Many thanks for your kind letter. My wife, Gun Ivergård, will arrive at your laboratory in the morning the 5th of June. Is it OK if she arrives at about 10 o'clock in the morning?

Pity enough it will not be possible for me to travel together with her this time. However, there may be a small chance that we will take a week's holiday in Paris the week after her visit to Paris. If you will be in Paris that week it might be possible for us to continue our discussions then. I will write to you as soon as I know anything more about our holiday.

With the best wishes,
Yours sincerely,

Toni Ivergård

8

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För forskning och konsultation
Mosebacke Torg 18

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I-Tryck Lito AB, Luleå 1974

Roger Blome
Suède

1975-12-31

NATIONAL BOARD OF OCCUPATIONAL SAFETY AND HEALTH
Occupational Health Department

Address: Arbetarskyddsstyrelsen
Arbetsmedicinska avdelningen
S-100 26 Stockholm, Sweden

RESEARCH PROJECTS 1975

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83. Solvents project: *In vitro* investigations (I. Åstrand)

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Datum 1976-08-17
Beteckning 076-51

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C Hultin/TS

Professor Alain Wisner
Laboratoire de Physiologi du
Travail et d´Ergonomie
Conservatoire Nationale des
Arts et Métiers
41, rue Gay-Lussac
750 05 - PARIS
FRANCE

Dear Professor Wisner,

Referring to my last letter I am sending you a final program concerning the meeting in Stockholm, September 7 - 10, a presentation of the Swedish participants together with some information concerning Swedish legislation, occupational health services and research etc. Three of the presentations are still missing but will be sent over under separate cover as well as the Swedish abstracts.

Yours sincerely

Bo Oscarsson

ARBETARSKYDDSFONDEN
Swedish Work Environment Fund

BO/SEd

Stockholm, August 13th, 1976

Professor A. Wisner
Laboratoire de Physiologi du Travail
et d'Ergonomie
Conservatoire Nationale des Arts et
Métiers
41, rue Gay Lussac
750 05 PARIS, France

Dear Professor Wisner,

By representatives of the French Embassy in Stockholm I have learned that you will participate in the French delegation, coming here in Stockholm as our guests 6th - 10th of September. I was very glad to hear this and look forward to seeing you. In a few days I think you will get a programme for your visit here by Dominique Jerome at the DGRST.

Perhaps you know that your study on shift work has attained great attention here in Sweden. I believe that many experts and representatives of the organisation on the Swedish labor market will be interested in meeting you to get more information about the study when you come here in September. You will also meet some of them, who are members of our board at a dinner-party, September 7th.

To get a little more information about the study I would appreciate if you could send me a copy of the report before your coming here.

Looking forward to seeing you.

Yours sincerely

Bo Oscarsson

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Wenner-Gren Center

Telefon
08 - 30 65 00

Telegramadress
Workhealthfund

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- [ ] English
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- [x] Proposals for a new work environment legislation. Summary of the final report by the commission on the work environment. In English.
- [ ] Directions No ....
- [ ] Notice No ....
- [ ] Arbete och hälsa No ....
- [ ] Methods Report No ....
- [ ] Investigation Report No ....
- [ ] Training Report No ....
- [x] List of publications and duplicated reports from the Board's Occupational Health Department. In English.
- [x] List of research projects in progress at the Board's Occupational Health Department. In English.

Signature, name Pr WISNER ALAIN

Name of Institution LABORATOIRE DE PHYSIOLOGIE DU TRAVAIL ET ERGONOMIE du CONSERVATOIRE NATIONAL DES ARTS ET METIERS

Address 41 RUE GAY-LUSSAC
75.005 PARIS FRANCE

EMPLOYEES AT OJ

HOW MANY

Operating staff		2.843
Other staff		908
Total, about		3.751
of which		
women	17 %	
non-Swedish subject	12 % (about 450)	

WORKING HOURS

Office hours, 8-17	20 %
Day hours, 7-16	25 %
Shift work, 06-14-22	50 %

(5-shift: 7 days free, 4 afternoons, 1 day free, 4 mornings, 4 nights)

PAYMENT

Office employees have individual month salary

Operating staff have periodic wage 4.835 - 5.135 Sw Crs + shift compensation

(Shiftworker about 64.415 Sw Crs/year)

DO MANY EMPLOYEES LEAVE THEIR JOBS?

Five out of one hundred leave per year, 4 %.
Corresponding figure for similar industries is 10 %.

ABSENTEEISM

The absenteeism for illness and on-the-job injuries is half the average rate for the total industry (that is 9 %).

INDUSTRIAL DEMOCRACY

We have a well built out and organized activity with joint industrial council, department councils, primary groups and meetings on the job places, where questions regarding the job environment, regulations and personnel policy are discussed and decided about.

DOES PEOPLE LIKE IT AT OJ?

Shift \ Team No	1				2				3				4				5			
Morning	4	4	3	3	3	3	5	5	5	5	1	1	1	1	2	2	2	2	4	4
Afternoon	3	5	5	5	5	1	1	1	1	2	2	2	2	4	4	4	4	3	3	3
Night	2	2	4	4	4	4	3	3	3	3	5	5	5	5	1	1	1	1	2	2
Free	5	3	2	2	1	5	4	4	2	1	3	3	4	2	5	5	3	4	1	1
Free or supplementary shift	1	1	1	1	2	2	2	2	4	4	4	4	3	3	3	3	5	5	5	5

The rules

1. All jobs
2. Overtime
3. Shiftwork
4. Holidays
5. Holiday pay
6. Layoff benefit
7. Visit to doctor
8. Wage deduction
   a) illness, industrial injuries
   b) other absenteeism
9. Employment, beginning and ending
10. Starting rate
    a) beginners
    b) underaged
11. Training, meetings and negotiations
12. Travelling time
13. Temporary transfer
14. Definite transfer

GRÄNGES
OXELÖSUNDS JÄRNVERK

Tjänsteställe, handläggare

Dokumentnamn

Blad nr

Datum

Beteckning. Reg nr e d

Mottagare Ärende

Kopia till

WAGES SYSTEM at Gränges Oxelösunds Järnverk

Wages, work duration, holiday

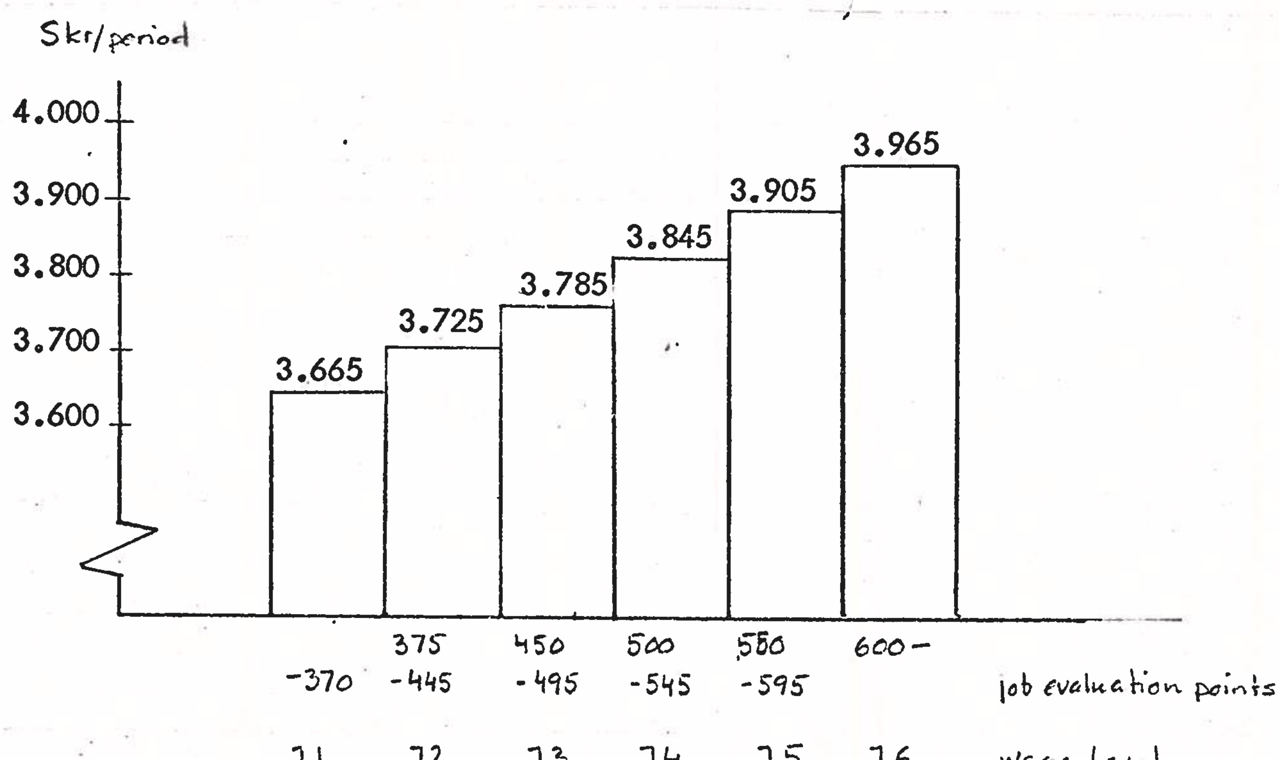
☐ Four week period wages

Why? - The kind of production
Working hours - variation (104-192)

Includes all manual workers

☐ The system

Each job is placed on a wage level. There are six levels (J1 - J6). This is based on a job evaluation, which expresses the difficulties of the job (skills, experience, working conditions etc). The present wage range is from 3.145 skr to 3.445 skr per four weeks (February 1975).



	1971	1972	1973	1974	1975	Raw iron	Steelw.	Plate mill
TURNOVER								
OJ workers	6,6	6,1	6,2	4,7	3,8	7,6	3,0	4,0
others	3,5	4,3	4,0	5,7	3,0			
Workers in Sw. steelind.	15,9	14,1	14,3	16,4	14,2			
ABSENTEEISM (illness and industrial injuries)								
OJ workers	8,4	7,9	6,0	7,4	7,1	6,6	6,2	7,4
others	2,6	2,7	2,9	3,4	3,9			
OVERTIME								
OJ workers	2,4	3,0	2,5	1,7	1,1	1,9	1,6	1,7
others	1,2	1,1	0,7	0,6	0,5			
INDUSTRIAL INJURIES (per 1.000.000 hours)								
OJ workers	41	39,6	38,4	38,5		60	32	40
Workers in Sw. steelind.	46	48	51					

The main points of our

PERSONNEL POLICY

1 The importance of the organizational structure for the individuals' working possibilities and working satisfaction must be considered.

2 The demand for manpower shall be carefully planned for a considerable period.

3 The recuiting of personnel shall be carried out with great care.

4 Further education and development as far as the qualifications admit.

5 The employees' physical and mental health is very important for the company as well as for the employees themselves.

6 Rational, simple and efficiency-promoting wages/salary-systems shall be aimed at.

7 Information - consulting. Natural ways for application of the company's personnel- and organization policy.

8 The responsibility for the employees' reconciliation to society should principally rest upon the local government.

LOCAL PERSONNEL POLICY

Working method

1 The need for different policies is brought to the fore by the Personnel Council.

2 Project group (with representatives from the company and the personnel organizations)

3 Proposal to the Joint Industrial Council

4 Sent out to all employees for comments (+ the personnel organizations)

5 Revised proposal is sanctioned by the Joint Industrial Council

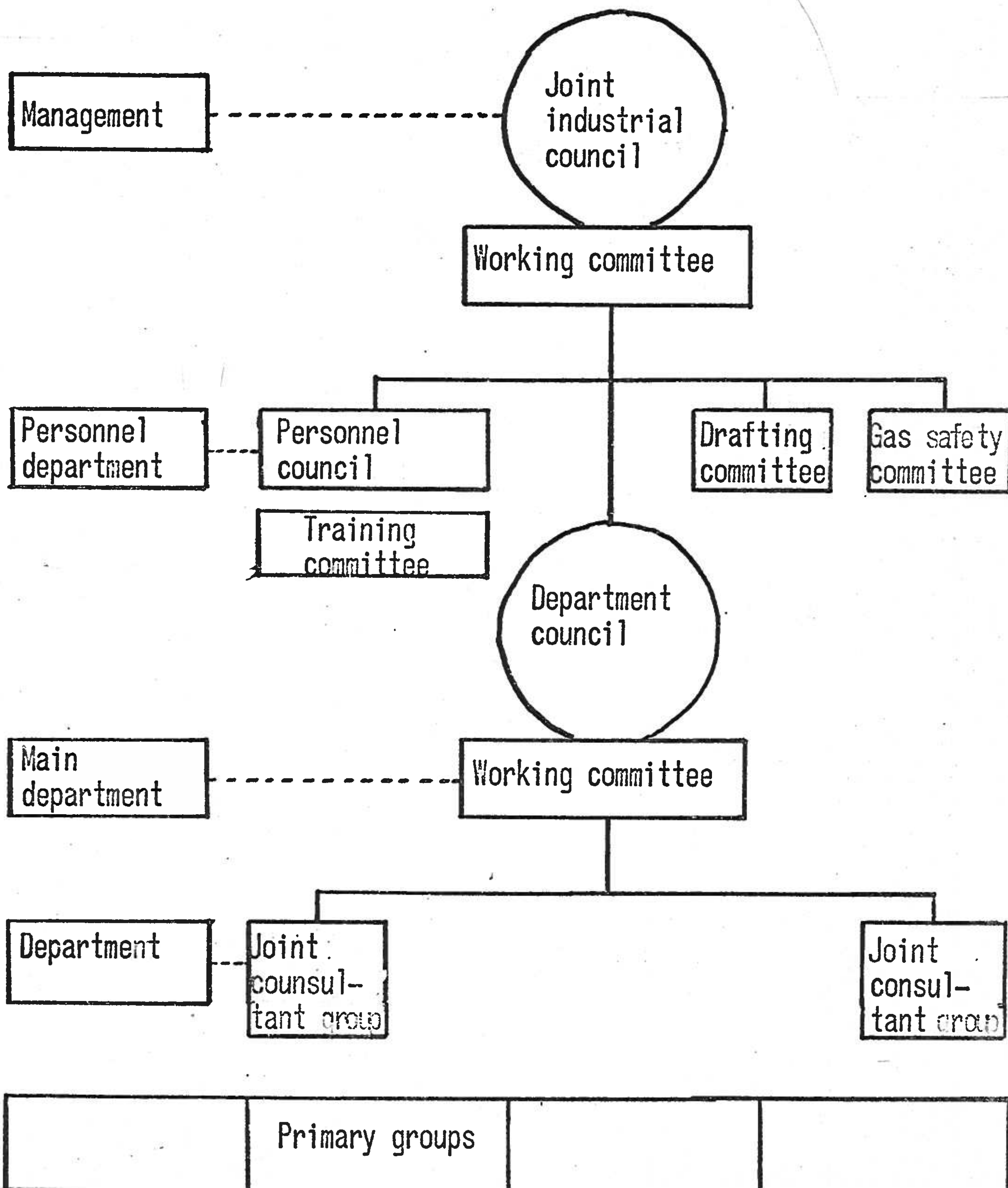
6 Distribution to all employees

Application

1 Is to be applicable to all employees

2 The department councils checks the application

3 Makes it possible to treat the whole staff in a similar way


Management
Joint industrial council
Working committee
Personnel department
Personnel council
Drafting committee
Gas safety committee
Training committee
Department council
Main department
Working committee
Department
Joint counsul-tant group
Joint consul-tant group
Primary groups

A GOOD WORKING PLACE?

Ever thought of leaving?	11 % Yes
Tell friends and acquaintances to apply for a job here?	55 % Yes
Tell your own children?	42 % Yes
How are the personnel questions managed?	47 % Better

YES, IT IS GOOD HERE

but 1 person out of 5 does not want his own children to work here.

Verkst. dir.
IAN WACHTMEISTER

FÖRETAGS-PLANERING K Gedin	TEKNIK G Wahlberg	PRODUKTION S Gunnarsson	SERVICE E Banell	PERSONAL-ADMINISTRATION G Jonzén	EKONOMI S-O Fröberg	MARKNAD I Gustafsson
Utvecklings-planering	Kvalitetsteknik	Järn	Underhåll	Organisations-planering	Kalkyler	Norden
Treårs-planering	Kemiskt laboratorium	Stål	Nyanläggning	Avtal och löner	Produktions-ekonomi Marknads-ekonomi Administra-tionsekonomi	Dotterbolags-marknader utanför Norden
Beredning och samordning av investeringar	Driftforskning	Plåt	Transport	Information	Behandling av ekonomiska data	Övriga världen
Administration av större projekt	Stålforskning	Planering	Koks o Media	Företags-hälsovård: — Medicinsk — Teknisk — Yrkesmedicin och långsikts-planering	Affärsbokföring	Tackjärn och järnsvamp
Yttre miljövård	Teknisk service	Analys		Personal-planering: — Rekrytering — Utbildning — Personalad-ministratörer	Kassakontor	Användnings-områden
Samordning av system	Svetsforskning OJ - ESAB - DJ	Projekt		Personal- och samhällsservice inkl kurativ verksamhet	Kontorstjänst och intendentur	Marknads-planering
Övergripande administrativt effektiviserings-arbete	Materialteknik OJ - DJ					Marknads-kommunikation
Nyanläggningar	Tekniskt foto					Order och system
MEROX återvinning	Bibliotek					Personal

OJ 66/9.74 14000x50 512.258 FACIT-TRYCK

GRÄNGES

Tjänsteställe, handläggare: INGE SELINDER

Mottagare/Ärende: PERSONNEL DEP.

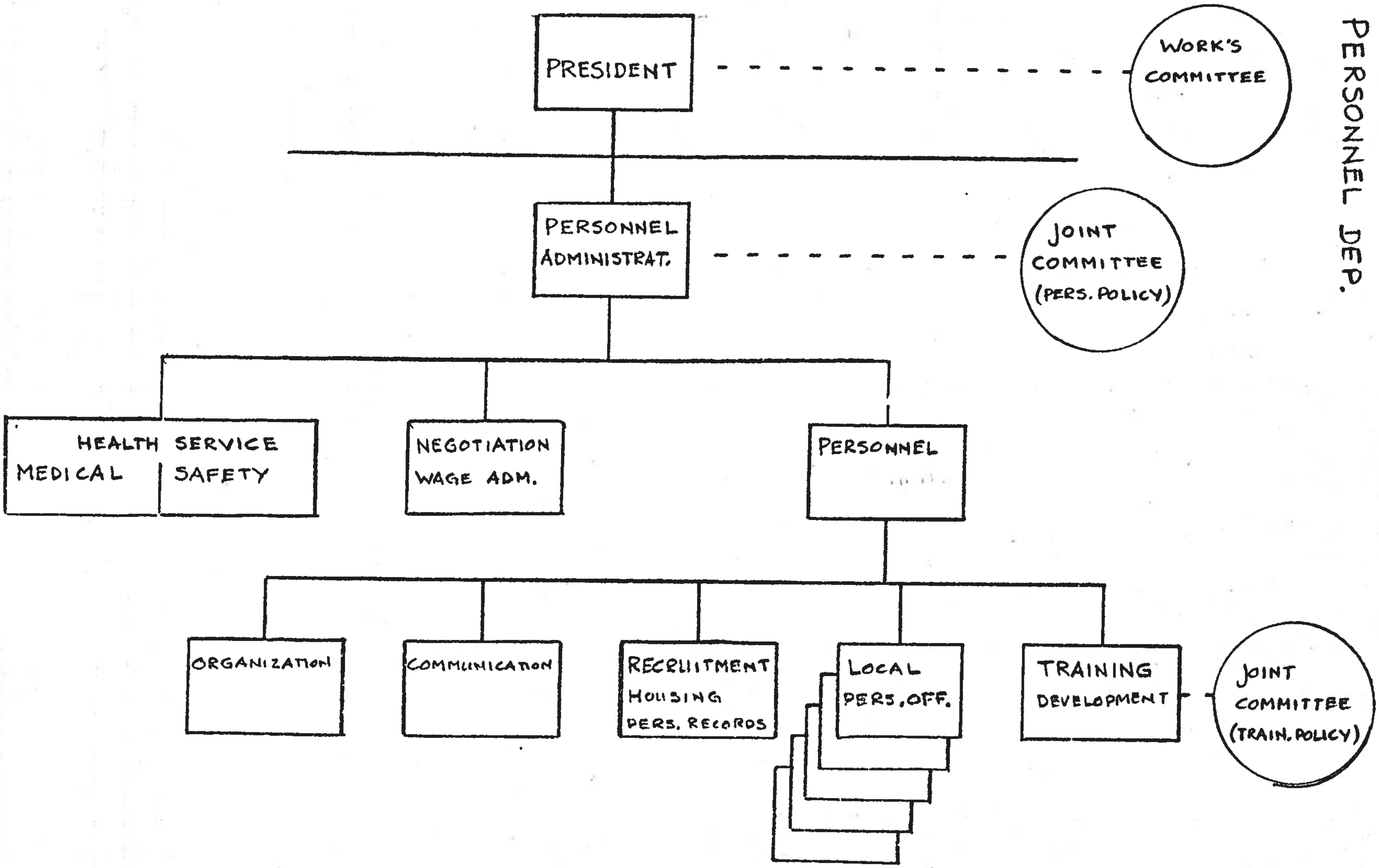
Kopia till

Dokumentnamn

Datum

Beteckning/Reg nr

Blad nr



MAN AS WE SEE HIM

1 We want everyone to make a good work and to be responsible for it

2 Ability to develop imagination, skill and creative force exists in people

3 In all our work we shall strive after a community that is distinguished by
sincerity
confidence and
respect for each others' opinions

4 In all relations personal integrity shall be respected and protected

5 The worth of each person shall be respected by giving him opportunity to as much as possible influence decisions and measures that can affect himself

PERSONNEL POLICY

- Very great efforts shall be done to provide for employment security

- The employment security must be based upon a long-range personnel-planning

- It shall be possible for the employees to contribute to the changes

- The proceedings shall be adapted to the single individual's situation

- Economic security

A 12-POINT PROGRAMME FOR INCREASED JOB-SATISFACTION AND PRODUCTIVITY

Eliminate obstacles

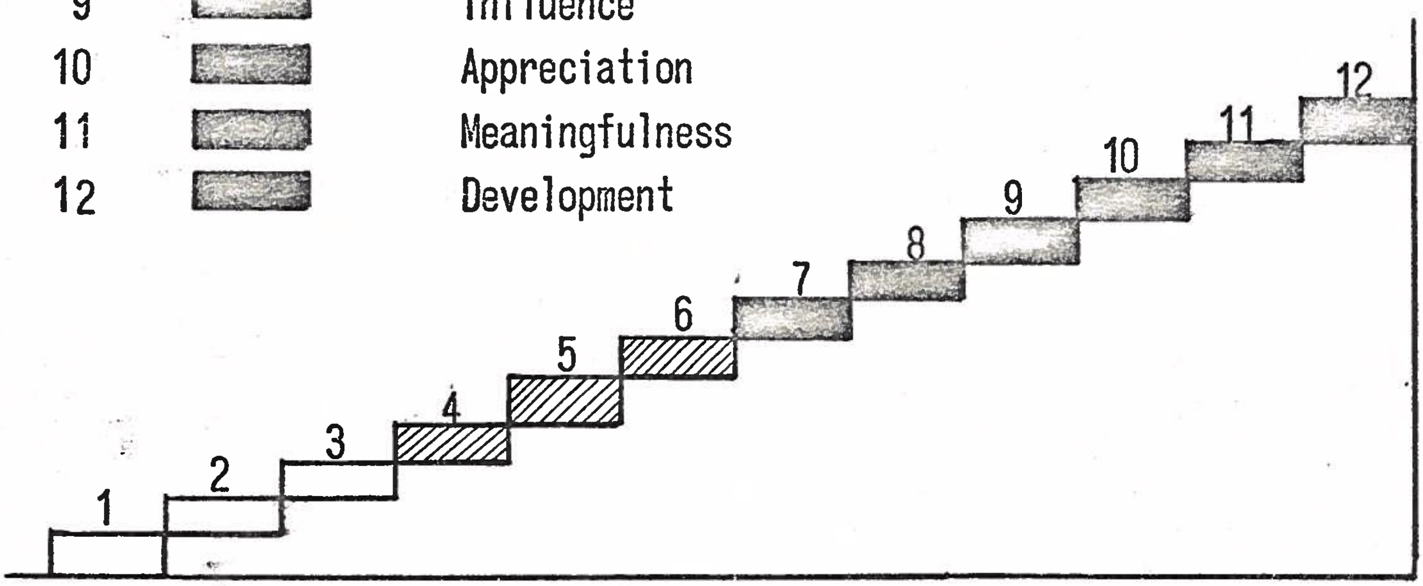
1 Wage/salary-systems
2 Working environment
3 Rules and routines

Create co-influence

4 The shape of the jobs
5 Planning and organization
6 Changes

Alter the jobs

7 Contents
8 Difficulty
9 Influence
10 Appreciation
11 Meaningfulness
12 Development



INDUSTRIAL DEMOCRACY

at Gränges Oxelösunds Järnverk

Agreements about Work's Council and safety regulations since 1948 resp 1937.

In 1973 we agreed about a new organization adjusted to the local situation (an exception from the central agreements).

Fewer groups and councils, more frequent meetings and specified authorities and responsibilities.

- At the executive level a Joint Industrial Council, 14 members (4 from the company, 1 SIF, 1 SALF and 4 Metall + 1 safety officer and 1 safety representative from Metall), which meet every 4 Mondays.

  Decision questions:
  - Safety and working conditions
  - Layout and design of working places
  - Administrative principles and management techniques

  Consultation questions:
  - Changes of importance in production
  - Work methods and production processes
  - Plans, budgets and investments

  Information questions:
  - Reports from the company
  - Investigations and planned projects
  - Information company - community

- Close to the personnel department is a Personnel Council (3 from the company, 1 SIF, 1 SALF and 3 Metall). Meets every 4 weeks together with the personnel department and has 6 separate meetings.

  Decision questions:
  - Personnel policy
  - Discipline rules
  - Plans for development of personnel administration

  Consultation questions:
  - Employment of personnel officers
  - Short time plans for personnel department

INDUSTRIAL DEMOCRACY
at Gränges Oxelösunds Järnverk (cont'd)

Information questions: Present personnel situation
Labour market prognoses
Attitudes and opinions

- At main department level (e g steelplant, rolling mill) we have Department Councils. They have the same authority and responsibility as the Joint Industrial Council and the Personnel Council for the separate main department. The working part of these councils are their working committees, which for instance decide about investments in better working conditions and breaks against discipline rules.

- All these councils are representative and so are the joint consultant groups. They work on department level, where we have continuous shift work, and coordinate questions from the five different shifts. Most frequent questions in these groups concern safety and working environment.

- This change of organization resulted in fewer representatives in total. To compensate for that we use to have two open house meetings a year. They are arranged by the Joint Industrial Council, and their purpose is to give all employees a possibility to have their questions answered directly and to be informed about questions of current interest.

- And probably the most important thing in the long run for the industrial democracy: the primary groups. These are the working groups - the foreman and his group, a group of clerical workers and their boss. This is the place where most of the day-to-day problems can and shall be solved by consultation and participation. A new management style and more activity from all is requested.

- What about the results up till now?

  We are pleased with the development. After the first year we had an enquiry among the involved representatives, which gave us a strong support in our intentions - this was a better organization.
  Now we have co-determination on all decision levels, a closer contact between the operating "line"-organization and the groups and councils. The problems are handled and solved on the rigt level, and there is less confusion about which way to drive a question. We have got a way to work, which we think can make it possible to handle the new situation, which will come with the new labour legislation.

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RECONSTRUCTION AND GENESIS OF ACCIDENTS ADVANTAGES AND DIFFICULTIES

Jacques LEPLAT

Industrial accident symposium
STOCKHOLM - September 1976

RECONSTRUCTION AND GENESIS OF ACCIDENTS
ADVANTAGES AND DIFFICULTIES

Accident anlysis has always been considered a preferred way of approaching safety studies and devising preventive measures. But the starting point of all such anlyses is always an attempt, however summary, to reconstruct the genesis of such accidents. This is confirmed by the most commonplace reports, and both the advantages and deficiencies thereof are known. It is to enhance the advantages and remedy the deficiencies that more systematic methods have been worked up with a view to standardizing the gathering, presentation and analysis of data relative to accidents. In principle and use, such methods pose problems, some of which are discussed herein. This will be done primarily by reference to an analytic method with which we are more familiar (KRAWSKY, MONTEAU, CUNY, 1972), certain aspects of which will be developed by CUNY in his paper.

This method is an original attempt at arrival at the genesis and it gives a good insight into the difficulties underlying such attempt. The following critical reflections owe much to it.

I) JUSTIFICATION OF THE STUDY OF THE GENESIS OF ACCIDENTS

To study the genesis of an accident is to study the conditions in which the accident occurred. Such genesis is characterized by the factors brought into play and by the rules governing their relationships, which rules can record the sequence of events leading up to the accident. The concept of system will accordingly frequently be evoked in study of the genesis. The system is the aggregate of the factors taken into consideration by the analyst, with its operational rules: man/machine, shop, department, production line system, socio-technical system, all are examples of the various types of systems to which the genesis may relate. The accident, an unplanned event, results from a dysfunction of the system (LEPLAT and CUNY, 1974). It thus is a symptom of such dysfunction (as fever is a symptom of sickness). The model underlying any genesis study will therefore be the following:

Dysfunction (s) $\longrightarrow$ accident

To reconstruct the genesis will thus be to give structure and content to this model diagram. Such reconstruction raises certain problems.

- Choice of the reference system: The dysfunction of the elementary system giving rise to the accident can itself be conceived as a product of another system which becomes the source of the dysfunction. Such source itself can be considered as the product of another system and so on. The diagram then becomes:

Dysfunction 3 $\longrightarrow$ Dysf.2 $\longrightarrow$ dysf.1 $\longrightarrow$ accident

a dysfunction to the left of the arrow being considered as the source of the one to the right. The relations between the systems productive of such dysfunctions may be various, the interlocking relation not being the only one as shown by the following example.

The terminology may vary with the writers. Thus JOHNSON (1973) refers to the "error change" sequence, BENNER (1975) to "condition event".

We can "go back" to a more or less remote point in the genesis and it is helpful to have cut-off criteria: thus we can confine ourselves to dysfunctions having their sources in the company. It is to be recommended, in all cases, that the trace-back not be cut off too early.

- Accidents, breakdowns and risk factors:

If an accident is a symptom of dysfunction, such dysfunctions may have other symptoms - accidents or even breakdowns. It can then be seen how genesis study ties in with prevention study. To identify a dysfunction is to detect an accident source, a risk factor. A dysfunction in the chain leading to the genesis is an accident source or risk factor insofar as it generates events leading up to the accident; but it is also a consequence of sources of dysfunction when it is assigned to its antecedents in the chain or the system (LEPLAT, 1975).

Such a conception also suggests the existence of other dysfunction indicators than accidents and that along this line safety studies can have other starting points than accidents, although it will still remain to be demonstrated that accidents and breakdowns express the same dysfunction. Thus, study of traffic accidents has shown that they are correlated with injuries in a given situation (intersection) only from a certain level of gravity. (RUSSAM and SABEY 1972).

II) MODI OPERANDI AND DIFFICULTIES OF GENESIS STUDY

It is doubtless not by chance that, after the great amount of work devoted to safety, agreement is far from being reached on a method calculated to discover the genesis of accidents. Like any historical event, an accident is the result of manifold determinants: technical, economic, sociological, psychological, physiological. Study of the genesis of an accident, like any clinical study, is the hardest there is since it necessitates a grasp of the interaction of such determinants. There are only practical limits to the genesis study.

A first category of difficulties encountered in any genesis reconstruction is that of the validity of the available evidence. The second is that inherent in any study of error in identification of the causal factors and mechanisms. This second category is particularly tricky when human beings play a role in the genesis. Any ascription of the accident to dysfunctions calls for a system functioning model. The easiest model to adopt is the normative model of the operation which describes how it should proceed. But, as is well known, actual work rarely coincides with such a model and accident interpretations may thereby be distorted if care is not taken. It is necessary, but sometimes difficult, to define the functioning of the system in which the accident occurred - in particular the modi operandi of organization of the subject's conduct.

This indicates the importance of analysis of work in the dual sense of analysis of work exigencies and analysis of the operator's behaviour to meet those exigencies. The dysfunction can be identified only by due knowledge of the operation, just as the checks to be made to diagnose a breakdown require due knowledge of the machine (in the absence of standardized procedure, of course).

In light of these preliminary remarks, let us consider certain problems arising at the various stages of the reconstruction.

- Choice of facts: As discussed, an accident can be inserted into various systems, hence the factors liable to intervene in the genesis are numerous. Choice of such factors depends on manifold conditions, including:

- the analyst's qualifications: worker, engineer, safety official, psychologist, doctor will tend to assign priority to the read grids corresponding to their specialties.
- the analyst's relation to the accident-event. This will vary according to whether he is the victim, a witness, one directly responsible. The maximum distortions are those leading to distortion of certain facts to avoid certain interpretations.
- the analyst's position in the production process. It has been demonstrated that the types of variables invoked to report accidents vary according to the line of command level (as between workers and foreman for example)
- the analysts' attitude: thus VIBERT (1957) has shown in an investigation of conversion of companies that "workers satisfied with their work, integrated into and participants in the business are inclined to ascribe accidents to 'personal' causes. Contrariwise, dissatisfied, unintegrated, non-participant workers tend to cite 'non-personal' causes entailing liability of the company" (p. 427).
- the analyst's opportunities for intervention. He will tend to prefer variables liable to lead to interventions which he can effect. Thus, if he is not in a position to change work organization and methods and his activities relate to protective instructions and equipment, he will then be primarily alive to what involves the operator's conduct
- knowledge of the system and its functioning. Such knowledge is indispensable for assessment of the pertinence of the facts to be gathered, i.e. their connection with the accident. The importance of work analysis in the dual sense mentioned above cannot be overstressed in this connection.

Several types of measures have been developed to meet the difficulties arising from these conditions. The first consists of drawing up a list of possible factors the possible presence of which the analyst will have to check off as to the accident in question. This procedure is designed to broaden the analyst's field by calling his attention to a wide range of factors. The danger of such checklists is that they prompt the mention of facts the relation of which to the accident may be very tenuous. Such factors can then be broken down into "primary" and "secondary", "proximate" or "remote".

A basic merit of the method worked up by the INRS will be to proffer a criterion of pertinence of the factors to be reported. Such factors must be facts, not interpretations. The facts antecedent to the accident and assumed to be related to it which are selected are those corresponding to variations in the work situation from its usual characteristics. "An inventory of variations is taken starting from the accident and proceeding therefrom progressively in order to broaden the field of investigation as much as possible." (KRAWSKY, MONTEAU, CUNY, 1972, p. 6). Identification of the variations calls for thorough familiarity of the analyst with the work and the usual conditions thereof.

- Reconstruction of the genesis and interpretation thereof

The gathering of the facts conveys at least implicitly a certain conception of the genesis. Organization of the facts will also bear the stamp of such conception and will clarify it to a degree. Such organization is designed to connect up the gathered facts, to bring out their interdependence. It will in most cases lead to a "tree", the origin of which is the accident and which will be ramified to a varying degree of complexity. Let us take for example the INRS method (KRAWSKY, CUNY, MONTEAU, 1972). Figure 1 is an example of an organizational diagram resulting therefrom. The diagram organizes all of the facts according to certain rules coded as follows, P and Q being variables (or events)

1°/ P ⟶ Q P is necessary and sufficient for the appearance of Q

2°/ P - - → Q P increases the probability of appearance of Q

3°/ P
Q P and Q are independent

4°/ P_1, P_2, P_3 } → Q P_1, P_2 and P_3 are necessary for the appearance of Q but not sufficient. Conjunction thereof is necessary and sufficient for such appearance of Q.

Carving up of the facts, like interpretation and organization thereof, depends in large part on the way in which the analyst conceives the genesis, on the working model of the system that he has adopted. But such models, even when they are clarified, generally remain quite summary and partial.

JOHNSON, who has developed a complex system of analysis, bases it on a quite vague energy concept. The accident is defined as an undesirable transfer of energy producing injuries and damage. (1975, p. 7), and energy as "the capacity to do work" (id.). Such energy may take various forms: kinetic, electrical, acoustical, etc. The interpretation will be oriented by this concept and in prevention an effort will thus be made to channel such energies so as to keep them from being harmful.

BENNER (1975) has proposed a theory of disturbance according to which accidents appear at the end of a series of events produced by actors causing actions. Such actors may be men or equipment items (machines, installations, etc.). If an action cannot adapt to surrounding conditions, the resultant disturbance triggers a series of events resulting in the accident. After identification of the actors, the conditions they operate in can be pinpointed and thereby their maladjustment to certain conditions.

The INRS method is based on a very general conception of activity as the execution of a task by an individual with a certain piece of equipment in a particular environment. It identifies these four components in the genesis of the accident and makes an analysis in terms of activity.

It is also based on the concept that the activity which led to the accident reflects a change from the usual activity: occurrence of an accident means that there was a prior variation.

These general models can be used for gathering and organization of facts. However, they provide only a quite formal frame for the analysis. They will have to be specified in more differentiated models to make prediction possible.

III) Use of the reconstruction of the genesis and limitations thereon

The aim of the reconstruction of the genesis is the prevention of which it is the instrument. Use of such reconstruction can assume various forms and also raise problems which will now be taken up.

. Clinical use: This means the use of each particular case. It consists of investigating into how the chain described might have been broken. It appears that a distinction must be drawn between two major methods. The first consists of devising measures calculated to eliminate the sources of dysfunction. Let us assume, for example, that the genesis of a road accident involved a "vehicle whose brakes failed". Measures will be devised calculated to eliminate the possibility of recurrence of the situation by taking action as to the source of the dysfunction which might be poor organization of the maintenance service. The second method involves investigation of the possible defences to the events generated by a dysfunction. In the postulated accident, ways will be sought to prevent the harmful consequence of the absence of brakes, for example by training the driver in remedial action to be taken. (How to stop a vehicle whose brakes have gone with as few harmful consequences as possible.) Training could thus be based not only on acquisition of skills to cope with normal situations, but also those required to meet disrupted situations, even if in principle they should not arise.

. Statistical use: This use involves data derived from a series of accidents. This should make it possible to determine the frequency of characteristics of the genesis and to check the relations thereof with features of the system and its functioning.

Statistical use entails definition of reliable indicators of the genesis, which properly summarize the information contained therein, while providing comparisons between geneses of different accidents.

The genesis can be characterized by the nature of the events making it up, events considered as components or factors of the accident. This is obviously a quite summary characterization, but not devoid of interest. Said events will then be categorized, frequently into the classes which served as a guide for gathering of the facts.

Let us take for example the event: "the driver overloaded his lorry". It will be noted that it already constitutes a generalizing coding since we refer to driver and lorry which designate categories which might have been specified. There could be a category "the worker overloaded a vehicle", "the operator is using a piece of equipment outside the norms" or a "task" category, etc. It is very difficult to fix the proper cut-off point on this "specificity - generality" axis. Headings which are too general provide little information and result in assimilation of very different facts which play varied parts in the genesis. Headings which are too specific, grouping only a small number of facts, provide meager support for hypotheses as to the role of the factors.

This way of characterizing the genesis remains quite static and it is desirable to try to apprehend sequences of factors, representing elementary mechanisms.

An attempt of this type has been made at the INRS (Darmon et al., 1975). 16 2-component sequences were identified (Individual (I), task (T), machine (Ma), environment (Mi). These pairs define "potential accident factors" or complex accident factors or risk factors.

For example, the pair (Ma, Ma) defines the incompatibility of technical members or products inter sese. This factor groups classes of diverse situations: the authors mention some of them: incompatability of equipment or technology, chemicals liable to damage a piece of equipment, etc.

Here again the problem is to seek the proper level on the "specificity - generality" ladder. It may be that, at least initially, it might be desirable to specify the class factors by making the analyses in situations which are homogeneous in certain respects (same production sector, same technology, for example). Interpretation of the sequences would be easier and might lead more directly to a diagnosis and corrective action.

It seems preferable to us not to thin out too prematurely the concrete data of the genesis by translating them into too general a language. Pondering of the entirety of a concrete diagram or the material portions thereof may lead to detection of configurations typical of events constituting complex dysfunctions reflected at several levels. It was in this way that ironworks investigations identified dysfunctions of the "poorly regulated coaction" or service intersection type. Such standard dysfunctions must themselves have their modi operandi and mechanisms specified in relation to the contexts.

- <u>A difficulty in use of the genesis data</u>

Study of the genesis shows us how the dysfunctions of a system can lead to accidents. An initial idea, mentioned above, is to base prevention on elimination of such dysfunction. Great prudence in this connection is however dictated. Sight must never be lost of the fact that the system is the site of numerous and complex interactions. Elimination of a dysfunction will not automatically result in enhanced safety.

This phenomenon has been well described in the area of road safety (NAATANEN and SUMMALA, 1976). Elimination of certain accident-source defects in the infrastructure (sharp or blind turns, narrowing lanes) does not necessarily lead to an over-all improvement in safety. It results in higher speeds, an accident factor in turn. The benefit thereof is to a degree cancelled out because "all other things do not remain equal" and there is a restoration of the balance of the system. If the measure is to be really effective, it is thus necessary to be aware of these mechanisms in order to prevent them from happening. For example, in the case just mentioned, speed is so to speak a regulating variable in the system and the variations of that variable must be blocked if the improvement of the infrastructure is to conduce to greater safety.

Such interaction among the factors of a system and the requirement that a risk factor not be isolated from the context in which it occurs is illustrated by a study made by DOGNIAUX and reported by de KEYSER (1976), demonstrating that the harmfulness of certain risk factors depends on certain other variables, psychosocial variables in the particular case studied. "In the oldest division, the risk factors of noise, heat, congestion, stress, etc. converge ad lib, but the accident rate is low. The workers organize themselves more or less as they see fit, the supervisory staff are democratic and above all the company's cultural values are not interiorized. Division 3's situation is the converse: well ventilated premises, more space, authoritative supervision, acculturation to the company and more accidents" (p. 98).

Thus, if study of the genesis provides better information as to the functioning of the system as it is at the time of the accident, caution is needed in deducing effective preventive measures therefrom. Elimination of certain dysfunctions may, by virtue of the changes they entail, result in emergence of new risk factors elsewhere.

IV) CONCLUSION

In conclusion, we will stress certain conclusions from the foregoing discussion.

a) Importance of work analysis in genesis reconstruction.

Analysis of accident genesis is inseparable from work analysis and, more generally, analysis of the systems playing a part in the production of an accident. As sickness cannot be properly treated and prevented without knowledge of the functioning of the body, so accident interpretation and the devising of preventive measures cannot be dissociated from thorough knowledge of the work and systems in which the accident occurs.

b) Requirement of competence of the analyst.

Genesis reconstruction thus requires great competence on highly diverse levels, in the province of technology and the social sciences. Such competence cannot be acquired without systematic training, founded on solid basic knowledge and attainments. One does not become a safety specialist overnight, at any level.

c) Identification of genesis models and risk models.

Such identification, as has been emphasized, should be correlative to a classification of systems and dysfunctions thereof. This is the price of avoiding the drawbacks of over-formal models and over-generalized factors.

d) Devising of preventive measures.

It should not be overlooked that this does not in all cases derive directly from knowledge of the risk factors in a given situation alone.

BIBLIOGRAPHY

BENNER L. 1975, Accident investigations: Multilinear events sequencing methods, Journal of Safety Research, 7; 2; pp. 67/73

DARMON M., MONTEAU M., QUINOT E., ROHR D., SZEKELY J. 1975, Potential accident factors, Report N° 200/RE, Institut National de Recherche et de Sécurité, Nancy, 58 pp.

de KEYSER V. 1976, The limits of training and ergonomics, Education Permanente, 32, pp. 85-106

JOHNSON W.G. 1973, Sequences in accident causation, Journal of Safety Research 5, 2, pp. 54-57

JOHNSON W.G. 1975, MORT: The Management Oversight and Risk Tree, Journal of Safety Research, 7.I. pp. 4-15

KRAWSKY G., MONTEAU M., CUNY X., 1972, Practical method of investigation of accident factors, Report N° 024/RE/A, Institut National de Recherche et de Sécurité, Nancy, 27 pp.

LEPLAT J. 1975, Accident genesis and risk factors, Seminar on industrial safety investigation, Swedish Work Environment Fund, Report of the work psychology laboratory, Paris, 19 pp.

LEPLAT J., CUNY X. 1974, Industrial accidents, Paris PUB, 127 pp.

Näätänen R., SUMMALA H. 1976, Road-user behaviour and traffic accidents, North-Holland / American Elsevier, Amsterdam - New York, 270 pp.

RUSSAM K., SABEY B.E., 1972, Accidents and traffic conflicts at junctions

VIBERT P., 1957, Representation of the causes of industrial accidents, CERP Bulletin, 6, 4, pp. 423-428

SOME RESEARCH TENDENCIES IN THE FIELD OF WORK SAFETY IN FRANCE - A FACTUAL APPROACH

Alain WISNER

1.0 A biological view on the working class

Big differences in life expectancy, in ageing between manual workers and clerical workers.

These differences are not only related to working conditions but also to the general life conditions (food, housing, medical care).

The part of working conditions is anyway very important and specially the work accidents.

During the life of a manual worker, we may observe:

- 5 accidents followed by a rest period
- 0,5 severe accidents
- 5 % permanent incapacity degrees

These values are multiplied by 2 (at least) in building and public works industries and by 3 or more in lots of agricultural activities.

To these work accidents, we have to add the road accidents: 15.000 killed and 300.000 wounded every year in France. A high proportion of these road accidents are, in fact, work accidents.

The accidents and the general conditions at work and in life accelerate the ageing of workers. One can make a distrinction between "normal ageing" and "marks of life".

2.0 New trends in the main fields of research on work safety in France

2.1 The worker

- Reduction in the tendency to use personal selection
- Increasing interest for the characteristics of the different categories of the workers population
  - women 40 %
  - ageing people (>40 years old) 50 %. These people have aged

more quickly than the rest of the population in relation to their past working conditions (marks of life) C.N.A.M.

- Handicaped people. A handicap has no absolute value. It is strictly related to the task and has to induce changes in the task and/or environment.

- Increasing interest for the body and mind changes inducing higher risks and related to the working conditions: (AUDRAN, ROHR, SZEKELY, MONTEAU, JARRY)
    - toxics (INRS), drugs
    - monotonous work
    - overload (LAVILLE, CAZAMIAN)
    - shift work inducing lack of sleep and low vigilance (CAZAMIAN, FORET)

- Increasing interest for some types of limitation that have not yet been enough explored
    - effects of peak menial and physical load
    - short term memory
    - body image and space representation though visual and vestibular inputs - training and ageing of these abilities (C.N.A.M. - C.N.R.S.)

2.2 Task and technical layout

- Legislation, standardisation, reinforcement
- Psychophysiological studies of the technical layout
    - theoretical layout (as it is conceived in the engineering department)
    - real layout (how things are now working at the shop floor) TEIGER
    - operational image (how the worker understands the things working) PAILHOUS
    - training related to these analyses (real layout and operational image) and the knowledge of the permanent contribution of the workers' initiative to the smooth functioning of the technical layout.

- 3 criteria for the machine design and the evaluation of the individual protective devices:
  - protection efficiency (JAUNET) with many researches in the field of biomechanics (IRCOBI, ONSER, INRS), ventilation (INRS), noise (CNAM - CNRS).
  - comfort
  - easy performance at work
- An interesting approach of the real mode of utilization of the machines and individual protective devices is the careful examination of used machines and I.P.P. (FAVERGE, RNUP, ONSER, INRS)

2.3 Communications

- Formal or informal } JANKOVSKY
- Verbal or non-verbal }

3 main aspects:

- perception (acoustics)
- identification (phonetics)
- meaning (semantics)

Verbal communication (ROSTOLLAND - CNRS - CNAM)
How foreign workers understand verbal orders shouted in a noisy place: important safety problem in France, where many foreigners are working in building industry and steel works.

2.4 Psycho-sociological problems

- Type of supervision
- Attitude of management toward safety
- Study of safety problems with the workers
  - committees for hygiene and safety
  - ERACT (Research and action teams for working conditions (UIMM)
- Type of management action (?) on safety
  - rewards or punishment
  - teaching or advertisement
- Image of the plant among the workers, their interest for the jobs.
- Type of salary (piece rate ...)
- Pressure on quantity or quality of production

2.5 Systems research

- Accidents as a symptom of organization failure (FAVERGE, LEPLAT, CUNY)
- Description of potential factors of accident (MERIC, MONTEAU, QUINOT, SZEKELY)
- Decision and action trees (C.E.A., Atomic Energy Center)
- Use of these extensive approaches in special areas:

road (CHICH), agriculture (SÉE)

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COLLOQUE SUR LES ACCIDENTS DU TRAVAIL
organisé par

l'Association Franco-Suédoise pour la Recherche,
la Délégation Générale à la Recherche Scientifique et Technique,
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STOCKHOLM
7 au 10 septembre 1976

LA PREVENTION DES ACCIDENTS DU TRAVAIL

Recherche et description des facteurs potentiels d'accidents.

E. QUINOT - M. MERIC - M. MONTEAU - J. SZEKELY

Dans les deux exposés qui précèdent, Messieurs LEPLAT et CUNY ont montré comment pouvait être abordée par voie d'enquête, l'analyse structurale d'un accident, prenant en compte le maximum des antécédents qui l'ont provoqué, tout en indiquant les liaisons logiques et chronologiques qui unissent ces antécédents.

Pour mener à bien cette analyse, le praticien recueille sans les interpréter des faits de deux types :

- ceux qui présentent un caractère inhabituel par rapport au déroulement normal du travail,
- ceux qui présentent un caractère permanent et contribuent à la génèse de l'accident avec le concours des faits inhabituels.

Les résultats de l'analyse sont ensuite concrétisés par un arbre des causes illustrant l'enchaînement des antécédents (causes) qui ont concouru à l'apparition de l'accident. Cet arbre est construit en partant de la blessure, terme ultime de l' "histoire" et en remontant la chaîne causale, chaque fait recueilli comme antécédent entraînant systématiquement les questions simples suivantes :

- ce fait a-t-il un antécédent au moins ? Si oui, quel est-il ?

- a-t-il été suffisant ? Si non, quels autres antécédents sont intervenus ?

- a-t-il entraîné d'autres conséquences ?

Les réponses à ces questions font apparaître respectivement trois catégories de liaisons entre les faits :

- des enchaînements simples $X \longrightarrow Y$,

- des conjonctions (simples ou multiples) $\left.\begin{matrix} X_1 \\ -- \\ X_i \end{matrix}\right\} \longrightarrow Y$,

- des disjonctions (simples ou multiples) $X \longrightarrow \left\{\begin{matrix} Y_1 \\ -- \\ Y_i \end{matrix}\right.$.

Mis bout à bout dans l'ordre chronologique, les enchaînements composent l'arbre des causes relatif à l'accident étudié. On en trouvera un exemple en annexe. L'algorithme décrit ci-dessus est intéressant à plus d'un titre :

- Il permet d'élargir considérablement les connaissances que l'on peut avoir du sujet d'un accident.

- Il oblige à poursuivre les investigations sans se contenter d'une description schématique ne rendant compte que des derniers maillons de la chaîne événementielle. A vrai dire, cette investigation s'arrête quand certains faits trop antérieurs à la blessure, chronologiquement ou causalement, sont tombés dans l'oubli, ou, plus simplement, quand l'analyste estime qu'il possède un tableau suffisamment cohérent et complet de l'accident.

- De plus, l'arbre des causes est un outil de communication objective entre les membres du groupe de responsables qui discuteront du choix des mesures de prévention.

L'arbre des causes se construit, comme tout arbre, du tronc qu'est l'accident vers les branches que sont les antécédents ; mais, il est bien évident que les faits s'accomplissent en sens inverse. L'analogie avec l'arbre a ses limites : l'arbre des causes a ceci de particulier que, si on lui coupe une seule branche, l'enchaînement des évènements s'arrête et l'accident n'aura pas lieu. C'est un fait capital pour la prévention : supprimer une seule des multiples causes, c'est éviter l'accident.

Relatant une "histoire" particulière, l'arbre des causes éclaire objectivement la genèse d'un certain événement (accident) appartenant au passé. Ce point est déjà fort utile. Mais, sa véritable richesse n'en demeure pas moins ailleurs : seul ou associé à d'autres arbres, il devient en effet un outil de prévention à condition d'introduire un nouveau concept, celui de "facteur potentiel d'accidents", concept auquel la suite de cette note sera consacrée après une remarque préliminaire.

La démarche qui conduit à l'arbre des causes peut être appliquée à l'analyse de la genèse de tout événement, heureux ou malheureux, intéressant le monde du travail ou celui de la vie courante. A ce titre, elle mériterait d'être enseignée à l'école, permettant ainsi à l'enfant de se dégager d'une représentation naturelle trop simpliste des enchaînements qui lient les "choses de la vie". En prenant conscience de la complexité du réseau causal qui explique et prépare certains des événements importants de son existence, il apprendrait à y rechercher et à y reconnaître les séquences et les situations privilégiées et prémonitrices qu'il lui serait loisible de contrôler si besoin était.

X X

X

Pour introduire et pour éclairer la notion de facteur potentiel d'accidents (F.P.A.), il suffit d'imaginer la démarche du responsable de sécurité qui chercherait à exploiter les diagrammes d'accidents survenus dans un atelier ou même de tous ceux qui pourraient y survenir.

Il se donne comme mission de trouver les mesures préventives qui auraient permis de rompre les enchaînements constatés en un ou plusieurs points et de la façon la plus économique, c'est-à-dire en édictant le moins possible de règles. Il serait alors tout naturellement conduit à rechercher dans ses documents les situations ou les relations communes au plus grand nombre de diagrammes.

S'il s'agit, par exemple, d'un atelier de menuiserie, il ne manquera pas de constater d'abord que de nombreux accidents proviennent d'une absence de protection sur les outils tranchants. En décidant d'équiper les machines de protecteurs, il éliminera le maillon terminal des diagrammes, détournant ainsi de leurs conséquences douloureuses, l'ensemble des événements qui les avaient préparées et pourraient, sinon, y conduire de nouveau. Dans le cas de situations visiblement et évidemment dangereuses, il existe un nombre important de risques - F.P.A. connus avant la lettre - déjà couverts par la prévention grâce à l'application d'une réglementation adaptée et à la mise en place d'un contrôle technique. Ces mesures interviennent la plupart du temps sur les antécédents proches de l'accident.

Mais, dans le même atelier, nombre d'accidents ne se solderont pas par une blessure par outil tranchant, en particulier : tous les accidents considérés généralement comme le résultat du hasard, d'un "malheureux concours de circonstances". C'est qu'en se limitant à la mise en place de protecteurs, le responsable de sécurité néglige une partie importante des informations que peuvent lui apporter les arbres des causes dont il dispose. Une question se pose donc à lui : existe-t-il des faits, des liaisons ou des configurations caractéristiques situés causalement bien en amont de la blessure et sur lesquels il pourrait faire porter son action de prévention ? Les résultats des recherches menées par quelques équipes de psychologues durant les dernières années (Faverge, Leplat, ...) donnent à cette question fondamentale une réponse affirmative :

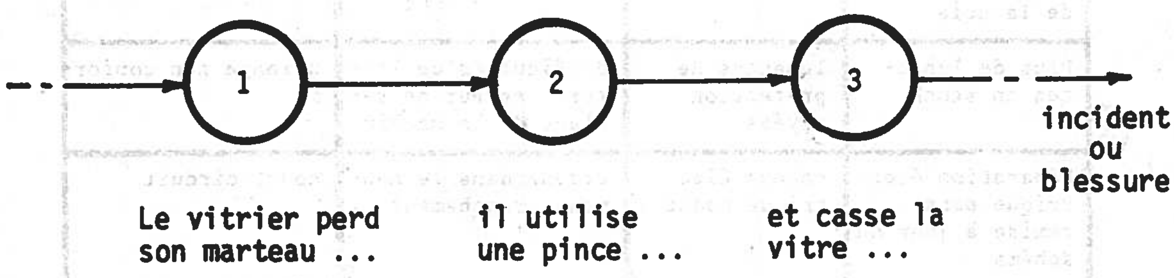
L'accident est la conséquence d'une situation de travail qui se dégrade d'abord très progressivement, ensuite plus rapidement, pour se terminer soudainement par la blessure. Les situations qui précèdent la blessure, même très en amont, ne sont pas quelconques, mais, au contraire, caractéristiques et spécifiques. On peut les décrire, les nommer et les classer. C'est précisément cette spécificité qui justifie la notion de facteurs potentiels d'accidents.

L'existence d'un nombre important de F.P.A. à peine soupçonnés et même totalement inconnus ainsi démontrée, on doit imaginer une méthode qui permette de les recenser.

Le responsable de sécurité cherchera dans la diversité infinie des cas particuliers les similitudes et les invariants par voie de généralisation et de classement dans des catégories cohérentes et utiles. L'exemple suivant illustrera cette typologie :

Soit la succession d'événements, fictifs mais vraisemblables, suivante :

Un vitrier perd le marteau qu'il utilise habituellement pour fixer les vitres ; il se sert alors d'une pince. Le carreau casse. L'incident est à l'origine d'autres incidents et même d'un accident.
Cet enchaînement partiel d'événements, extrait du compte-rendu de l'enquête-accident, peut se schématiser de la façon suivante :



Il s'agit là d'une "histoire" particulière mais qui, déjà, dans le cadre restreint de la profession de vitrier présente une certaine généralité. En effet, cet enchaînement peut apparaître dans plusieurs arbres conduisant à des accidents de vitrier, mais à des niveaux très divers, plus ou moins en amont de la blessure. La séquence (1) ⟶ (2) annonce une situation dangereuse. Elle constitue un indicateur utile et peut entraîner un comportement correctif du vitrier averti.

Par extension, en changeant les termes vitrier, marteau, vitre et pince, il est permis d'envisager le cas d'autres professions, tout en conservant la notion d'utilisation d'un outil mal adapté qui entraîne une perturbation de la tâche.

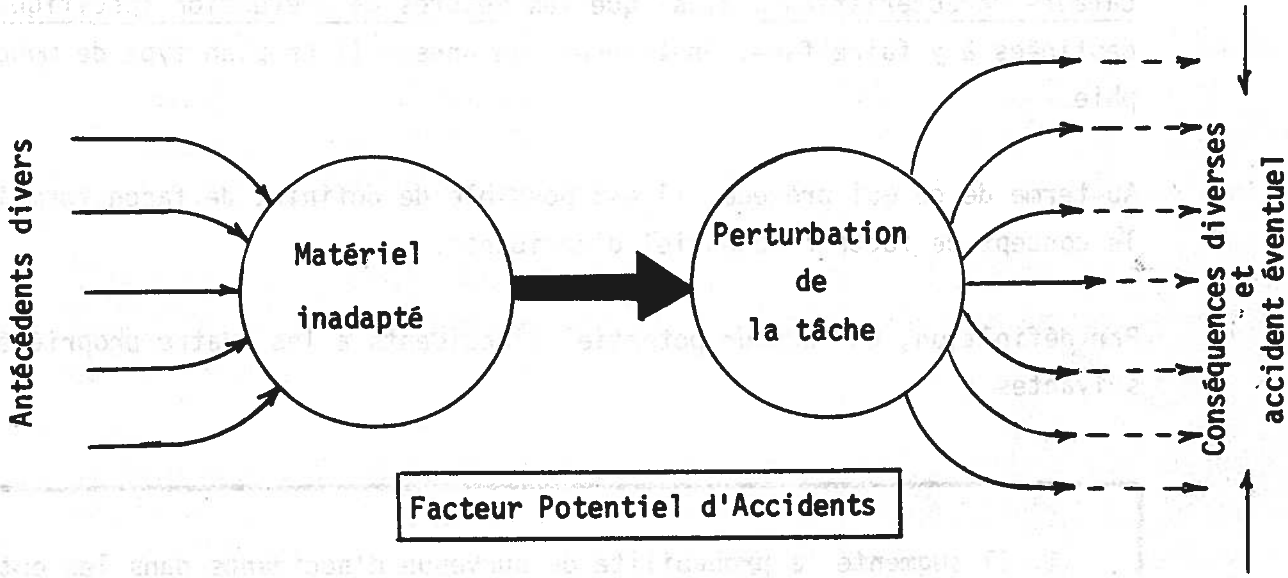
Enfin, en éliminant les éléments circonstanciels du récit, ne se préoccupant ni des antécédents, ni des conséquences de l'utilisation d'un matériel inadapté, on ne retiendra que la notion :

Matériel inadapté ⟶ perturbation de la tâche.

Le tableau suivant donne un exemple des récits homologues relevant de ce type de séquence :

ANTECEDENTS DIVERS	MATERIEL INADAPTE	PERTURBATION DE LA TACHE	CONSEQUENCES DIVERSES
Tournevis prêté à un collègue	burin (pour dévisser)	ripage	coupure
Pas d'affûtage de la scie	scie usée	sciage difficile	incident de sciage
Plus de lunettes en stock	lunettes de protection rayées	difficultés de lecture, erreur de réglage de la machine	usinage non conforme
Réparation électrique sans remise à jour du schéma	schéma électrique caduc	erreur dans le nouveau branchement	court-circuit

L'ensemble de ces récits peut se schématiser comme suit :



Cette séquence mérite d'être isolée et considérée en elle-même. En effet, les enquêtes montrent qu'elle intervient dans nombre d'accidents. Elle se retrouve, par exemple, dans beaucoup d'accidents de manutention qui présentent à eux seuls 40 % des accidents du travail avec arrêt.

Une telle séquence qui est commune à plusieurs arbres des causes ayant donné naissance à un accident sera appelée "FACTEUR POTENTIEL D'ACCIDENTS". Elle a été mise en évidence et explicitée au terme de deux étapes :

- La première est l'extension d'un cas concret : cette étape permet de s'affranchir des circonstances particulières dans lesquelles sont apparus le ou les éléments de la situation de travail à l'origine d'un accident ;

- La seconde consiste à isoler, sous forme de configuration plus ou moins complexe, les éléments ainsi dégagés et à les utiliser comme des indications de risque potentiel.

Pour chaque facteur potentiel d'accident, il peut être établi une monographie qui, dans un véritable cadre nosologique, regroupe l'ensemble des indicateurs caractéristiques ainsi que les mesures de prévention spécifiques destinées à y faire face. On trouvera en annexe II un plan type de monographie.

Au terme de ce qui précède, il est possible de définir, de façon formelle, le concept de facteur potentiel d'accidents.

Par définition, un facteur potentiel d'accidents a les quatre propriétés suivantes :

1. Il augmente la probabilité de survenue d'accidents dans les entreprises car il est susceptible de participer, de près ou de loin, à leurs réalisations ;

2. Il présente un caractère de généralité telle qu'on le rencontre dans un grand nombre d'entreprises ou de situations de travail ;

3. Son identification dans le système appelle des mesures préventives spécifiques ;

4. Sa suppression est compatible, ou peut être rendue compatible avec la réalisation des objectifs (production, ...).

Deux exemples vont permettre de préciser le type de facteurs potentiels d'accidents qui méritent l'attention. Ils sont situés très loin des événements à prévenir et, de ce fait, sont mal connus et peu décrits.

Le premier concerne la "coactivité". On dira qu'il y a coactivité dans un système quand deux équipes sont employées à des tâches différentes dans un même lieu de travail. Comme leur tâche respective s'effectue en parallèle, les communications instituées entre les deux équipes peuvent être insuffisantes ou inexistantes.

Chaque équipe est supposée travailler dans de bonnes conditions de sécurité. A priori, l'enchaînement particulier des événements relatifs à chacune des tâches ne devrait pas conduire à l'incident ou l'accident.

Mais, la coactivité crée une situation nouvelle : elle apporte un risque potentiel qui lui est propre. Par exemple, les membres de l'équipe n° 1 (appartenant au service Roulage d'une usine sidérurgique) communiquent entr'eux (coup de sifflet) et ce signal est perçu par les membres de l'équipe n° 2 (maçons et manoeuvres construisant un nouvel atelier); il est mal compris ("arrêt" au lieu de "marche"). D'où une réponse inadaptée d'un des membres de l'équipe n° 2 (ne se dégage pas des voies) et accident.

Il apparaît à la lumière de cet exemple, délibérément simpliste, que la coactivité provoque et facilite des séquences d'événements caractérisés qui peuvent conduire à des accidents. Ce risque n'est pas couvert par la règlementation en vigueur concernant le travail des deux équipes pris individuellement ; il se rapporte à une situation en fait inédite dont le caractère dangereux échappe aux opérateurs. Les mesures supplémentaires de prévention à mettre en oeuvre n'ont rien de commun avec celles qu'aurait pu imaginer chaque équipe pour son propre compte (par exemple : réduire la distance hiérarchique entre les cellules de travail appelées à travailler en coactivité afin de faciliter la coordination).

Il va de soi que cette situation peut également déclencher d'autres séquences dangereuses d'événements du fait d'autres incompatibilités latentes entre les deux équipes en coactivité.

La coactivité est un facteur potentiel d'accidents au sens développé ci-dessus.

Un second exemple concerne l'incompatibilité de matériels de générations différentes. Il s'agit de la juxtaposition, dans le même processus de fabrication, de deux ou plusieurs matériels (outils, installations, ...) d'âges technologiques différents. Ce facteur potentiel d'accidents est décrit dans la monographie abrégée donnée comme exemple, en annexe III.

Les cas cités paraissent assez hétérogènes. Les termes qui les désignent sont provisoires ; de plus, ils sont insuffisamment décrits. Mais, ils montrent l'importance que joue, ou peut jouer, un facteur potentiel d'accidents dans la genèse d'accidents. Ils montrent aussi les limites des possibilités d'actions techniques et réglementaires actuelles, face à ce type de risque.

Il faut remarquer l'extraordinaire diversité que recouvre l'expression unique de "facteur potentiel d'accidents". A l'une des extrémités de l'échelle, on trouvera des facteurs très particuliers comme le manque de protection sur une machine dangereuse, à l'autre extrémité, des facteurs plus généraux, mettant en jeu des situations globales et abstraites (coactivité, incompatibilité de matériel et de technologie). Il existe même des facteurs qui traduisent une configuration regroupant de nombreux sous-facteurs : une situation de récupération, par exemple, se caractérise par une urgence qui incite les opérateurs à faire appel à des outils de fortune, à des modes opératoires informels ou proscrits, à la coactivité temporaire entre l'équipe de production et celle d'entretien, ... Il faut savoir que les facteurs potentiels d'accidents relèvent d'une typologie hiérarchisée, ce qui n'est pas sans présenter de grandes difficultés pour leur recensement et leur description.

La démarche qui conduit à la découverte des facteurs potentiels d'accidents, si elle s'appuie sur l'étude objective et méthodique des accidents, n'en reste pas moins, à l'heure actuelle, <u>empirique</u>. Elle demande beaucoup à l'expérience et à l'intuition de l'analyste ; c'est pourquoi, la mise au point des <u>algorithmes de recherche</u>, en même temps que la <u>composition de monographies</u>, seront deux soucis majeurs de l'I.N.R.S. dans les années à venir.

X X

X

Quelles méthodes utiliser pour appliquer dans le cadre même de l'entreprise les notions et les actions développées ci-dessus ? C'est probablement aux yeux du praticien la question fondamentale. On peut en préconiser deux :

La première méthode s'appuie sur l'examen de quelques accidents sans gravité, survenus dans l'entreprise et dont on aura tracé préalablement l'arbre des causes. Il est préférable de choisir des accidents bénins, car il est difficile de se dégager des éléments affectifs et passionnels qui accompagnent l'examen d'un accident grave (du moins quand l'enquête suit de peu l'accident). De plus, rien ne distingue les chaînes événementielles qui précèdent les deux types d'accidents.

Une réflexion en groupe des membres du Comité d'Hygiène et de Sécurité de l'entreprise (C.H.S.), des généralisations, souvent faciles, permettent de mettre en évidence des facteurs potentiels d'accidents propres à l'entreprise, mais restés ignorés jusque là comme tels (on pouvait, en effet, connaître l'existence de ces situations sans mesurer leur capacité à engendrer des accidents). On trouvera en annexe I les conclusions d'une de ces réunions au sujet de l'accident qui a déjà servi d'exemple dans cette note. Un commentaire accompagne l'arbre des causes ainsi qu'une des pages du "carnet de bord" de gestion de la sécurité où sont notés les différents moments intéressants de cet arbre, les mesures curatives immédiates proposées et les facteurs potentiels d'accidents qui ont été dégagés. Ceux qui, parmi ces derniers, apparaissent comme suffisamment généraux seront systématiquement recherchés dans d'autres postes ou dans d'autres ateliers.

Cette première méthode, d'ores et déjà opérationnelle, sera appliquée l'an prochain par l'I.N.R.S. à de nombreuses entreprises. Elle permet aux membres du C.H.S. de se familiariser avec la notion abstraite de facteur potentiel d'accidents. Elle conduit aussi très directement à la seconde.

La seconde méthode consiste à examiner systématiquement les lieux et les situations de travail pour repérer des facteurs potentiels d'accidents déjà recensés et décrits par ailleurs, notamment sous la forme des monographies mentionnées ci-dessus.

Les deux méthodes sont complémentaires, la première est assez facile à mettre en oeuvre par une équipe en formation, la seconde la complètera au fur et à mesure des progrès de cette formation et des connaissances acquises. La participation des membres du Comité d'Hygiène et de Sécurité que préconise la première méthode fait de la sécurité l'affaire de tous, non pas pour laisser endosser à chacun une part de responsabilité, mais pour que tous puissent accéder au niveau de conscience et de connaissance nécessaire à la maîtrise des situations dangereuses. Cet objectif ne saurait être atteint sans la participation intelligente de chacun à l'analyse des conditions mêmes du travail. A l'époque où la maturité technique tend à s'universaliser, il est loisible de souhaiter qu'une maturité plus simplement humaine prenne à son compte les menaces que l'environnement industriel et technique fait peser sur l'homme. Ce n'est pas là le moindre des mérites de la méthode proposée.

ANNEXE I

EXEMPLE D'ANALYSE D'UN ACCIDENT

"Nettoyage à chaud sous pression"

Alors qu'il s'apprêtait à nettoyer un filtre avec un jet, M. X. reçut l'eau chauffée à 85°C, sous 50 kg de pression, au niveau de l'entrejambe.

Le complément d'analyse a permis d'avoir une connaissance plus étendue et plus précise du mode opératoire suivi par la victime et du matériel qu'elle utilisait. Le poste concerné était confié à un responsable (la victime) disposant d'une "machine à laver" qui, après avoir chauffé l'eau à 85°C, la propulse sous 50 kg de pression . L'opérateur venait de terminer le lavage d'un chariot élévateur et devait ensuite nettoyer un filtre. Pour ce faire, il devait sortir le chariot du local où s'effectue le lavage. Afin d'interrompre l'écoulement de l'eau pendant le déplacement du chariot, la victime a posé l'extrémité (B) du tuyau sur le sol et s'est dirigée vers la vanne d'arrêt située en A. Sous l'effet de la pression, l'extrémité B du tuyau s'est redressée dirigeant le jet vers la victime qui ne portait pas de tablier protecteur, ce jour-là. Le système mural qui maintenait le tuyau enroulé s'est donc révélé insuffisant.

Il est apparu au cours de l'analyse que l'extrémité B avait été pourvue d'un pistolet d'arrêt, supprimé par la suite.

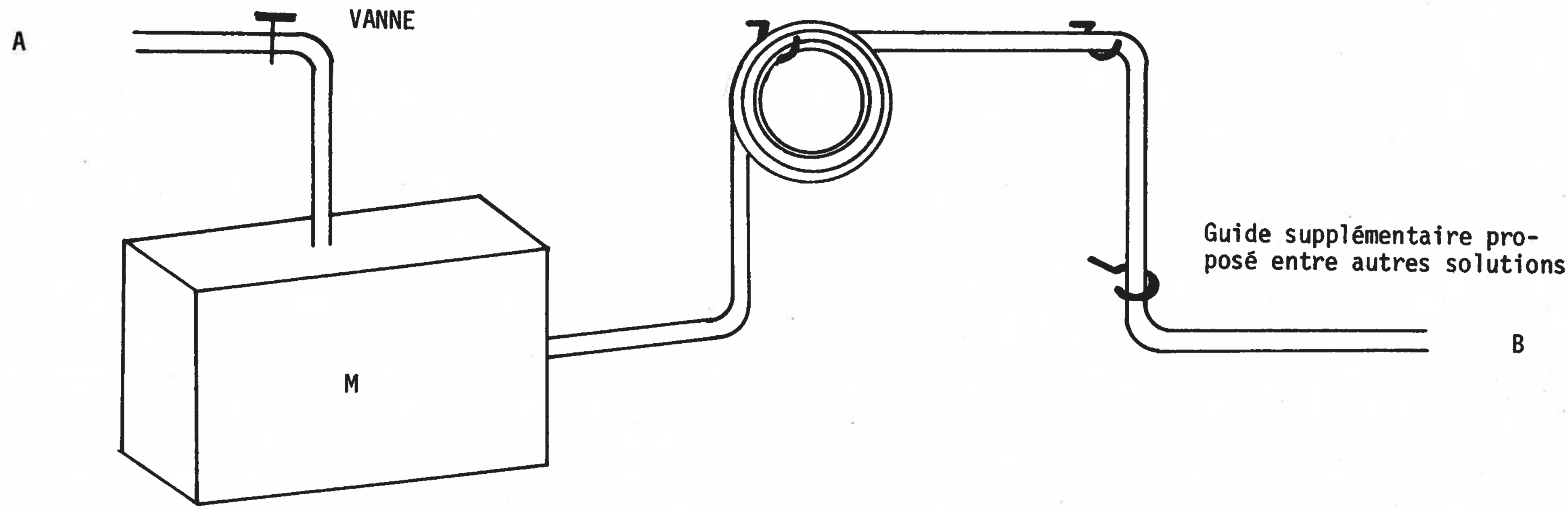
La discussion qui eut lieu en réunion de C.H.S. a permis d'éclaircir ce point important. En effet, avant que la machine ne soit confiée à un seul utilisateur, ce matériel était à la disposition de tous les services. Le fait apparait clairement dans l'arbre des causes prolongé (page 17).

Personne n'en étant responsable, ni particulièrement informé du mode d'emploi, la plupart des employés arrêtaient le jet uniquement au moyen du pistolet sans fermer systématiquement l'alimentation en eau de la machine. De ce fait, l'eau contenue dans la machine continuait à chauffer ce qui eut pour effet de détériorer progressivement l'ensemble de la machine. Pour remédier à cet inconvénient, le pistolet fut supprimé ce qui rendit obligatoire l'usage de la vanne d'arrêt A.

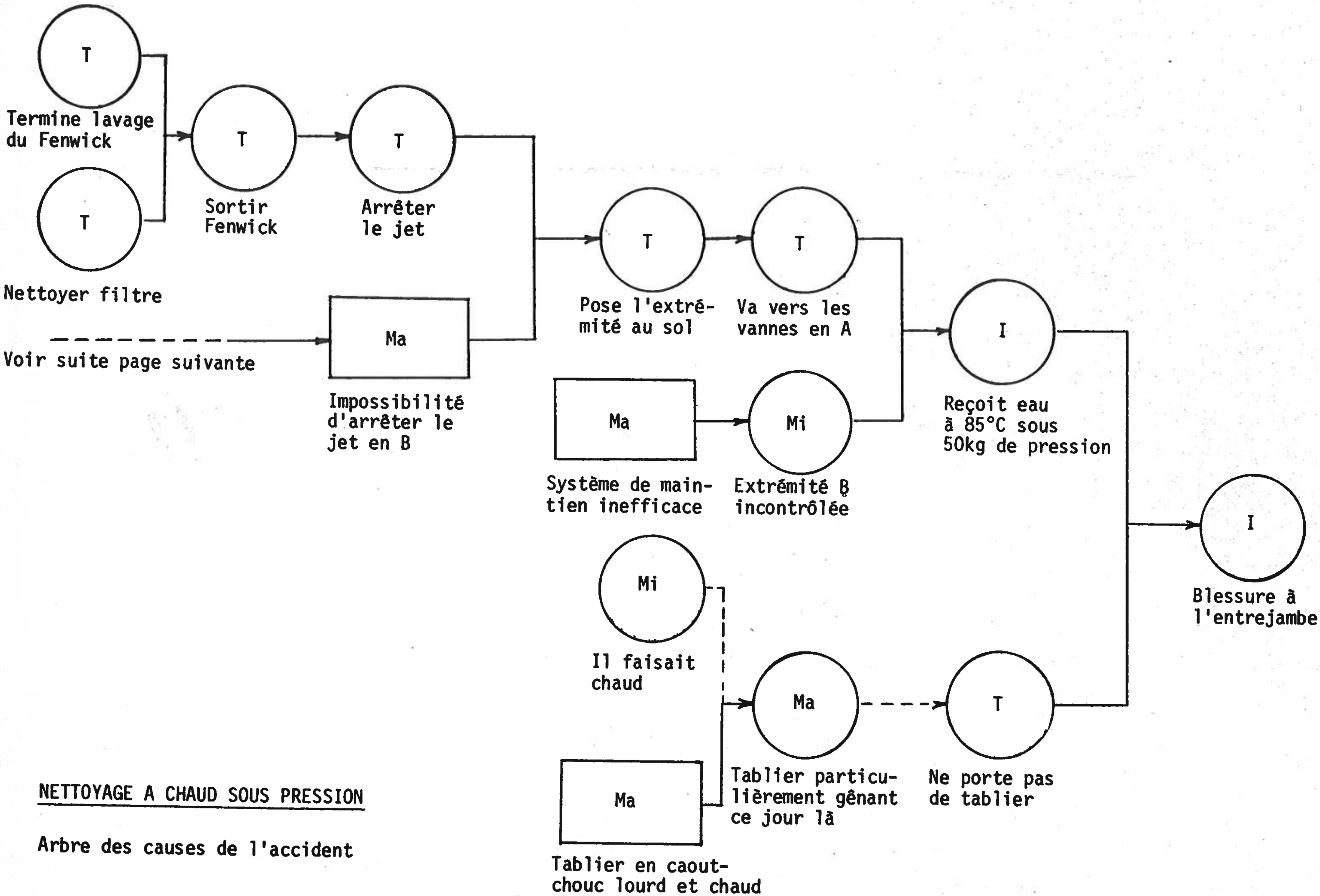
Par la suite, ce poste fut confié à un seul employé qui devint responsable du matériel, mais, le pistolet ne fut pas remplacé (il semblerait que cette absence n'ait pas été signalée). Tout ceci explique que, même pour un bref arrêt, M. X. était dans l'obligation de manoeuvrer la vanne placée en A.

Cette analyse est intéressante à plus d'un titre, notamment la suite du diagramme réalisée en réunion du C.H.S., car elle illustre la dégradation progressive d'une situation de travail, dégradation qui, finalement, donne lieu à un accident.

Par ailleurs, elle rend parfaitement compte de la diversité de mesures curatives qu'un tel type d'analyse permet d'obtenir. L'éventail de ces mesures s'étend du confort des protections individuelles, à l'organisation de l'utilisation d'un matériel en passant par la mesure purement technique.

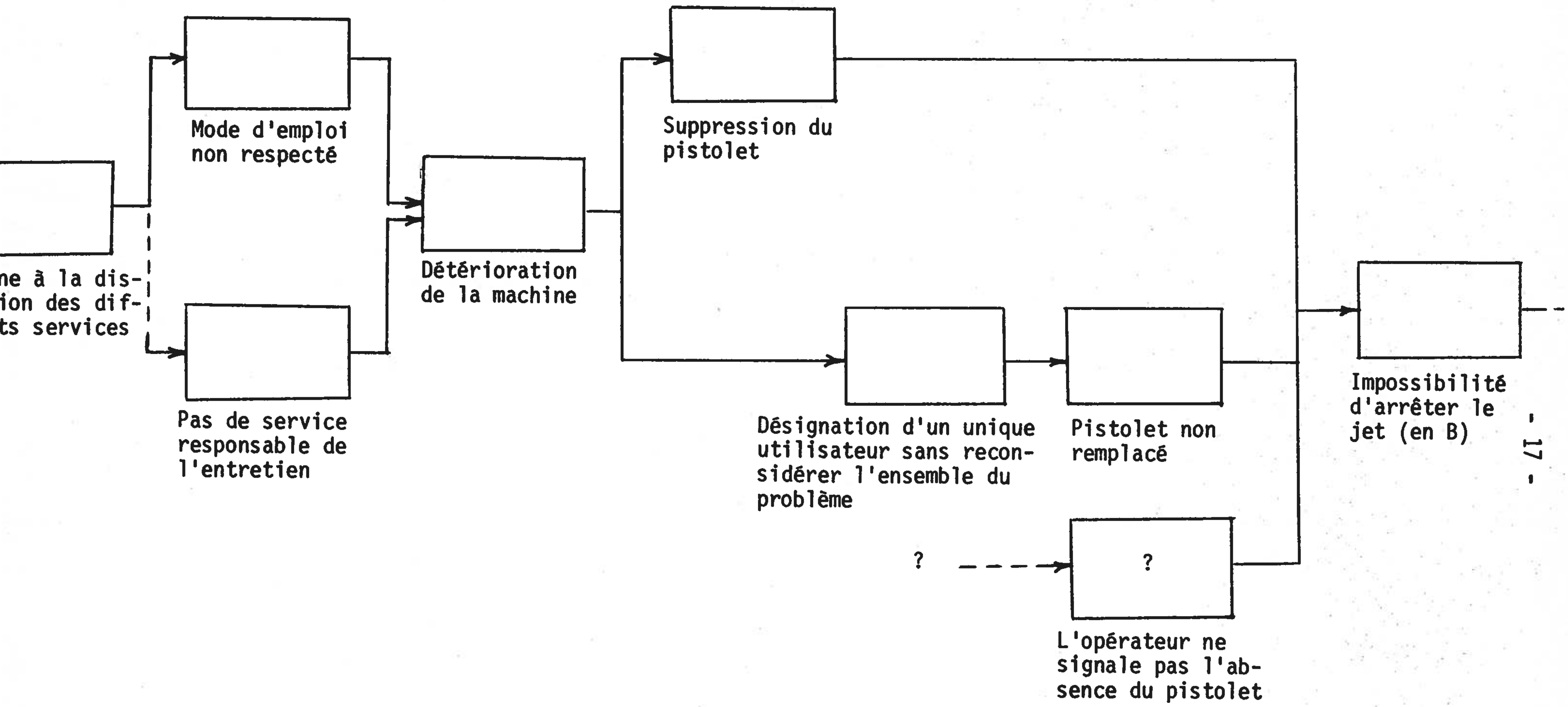


SCHEMA DE L'INSTALLATION DE NETTOYAGE A CHAUD SOUS PRESSION



NETTOYAGE A CHAUD SOUS PRESSION

Arbre des causes de l'accident



COMPLEMENT A L'ARBRE DES CAUSES PRECEDENT

ENSEIGNEMENT TIRE DE L'ACCIDENT

T	POSTE	LIBELLES DES FACTEURS D'ACCIDENTS	MESURES CURATIVES PARTICULIERES IMMEDIATES	FACTEURS POTENTIELS D'ACCIDENTS
	Lavage du matériel	Machine à laver à la disposition des différents services de l'usine.	- Affecter et former un seul responsable au nettoyage, - Lui confier l'entretien courant de la machine à laver, - Lui attribuer une machine à laver en bon état .	Utilisation anarchique d'un même matériel pour plusieurs services, équipes ou individus.
		Suppression du pistolet. Nouveau mode opératoire.	Mettre un pistolet dont la fermeture arrête également l'alimentation en eau de la machine.	Modification du matériel supprimant une sécurité (1).
		L'absence du pistolet n'a pas été signalée .	Encourager auprès du personnel d'exécution et de la maîtrise le signalement des anomalies en matière de sécurité. 1. en l'invitant à le faire, 2. en donnant suite aux propositions pertinentes.	Mauvaise circulation de l'information ascendante.
		Tablier lourd et chaud.	- Mettre à la disposition des opérateurs des tabliers plus confortables, - Tenir compte du confort au moment de l'achat des tabliers.	Protections individuelles incompatibles.
		Système d'enrouleur mural peu fiable.	- Renforcer le système en posant un guide orienté vers le bas et placé près du sol (voir figure page 15).	Dispositif de sécurité insuffisant par conception.

(1) Cette mesure présente l'avantage sur la précédente d'être plus fiable, à la condition que le dispositif surajouté soit lui-même fiable.

ANNEXE II

PLAN TYPE DE MONOGRAPHIE

Titre, Type, N° dans le type

1 - <u>Connaissance du facteur potentiel d'accidents</u>

1.1 - Définition

1.2 - Exemples concrets :

Description de situations types où le facteur potentiel d'accidents étudié joue un rôle essentiel et concourt à la genèse d'un incident ou d'un accident.

1.3 - Commentaires :

- Importance et rôle du facteur incriminé
- Spécificité et originalité
- Généralisation et limites

2 - <u>Pratique : Reconnaissance et prévention</u>

2.1 - Eléments de diagnostic (séméiologie)

- Eléments nécessaires au diagnostic précoce
- Questions essentielles à poser

2.2 - Prévention spécifique :

Mesures préventives auxquelles on n'aurait pas fait appel s'il n'avait pas reconnu le facteur potentiel d'accidents.

Bibliographie

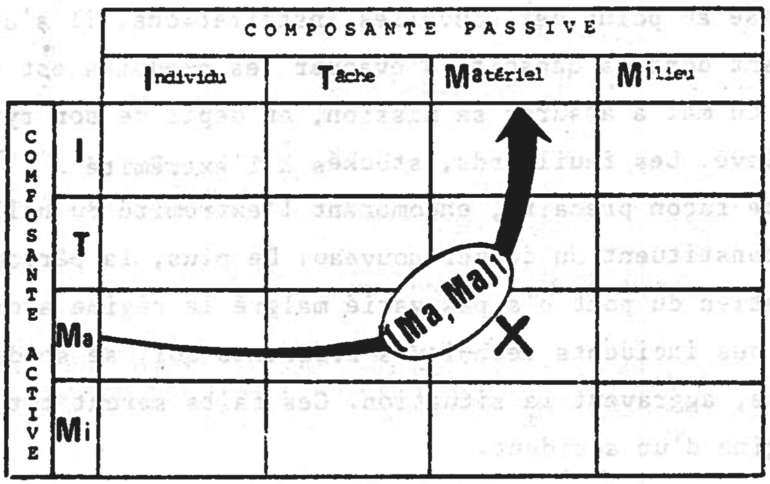
exemple

ANNEXE III

LES FACTEURS POTENTIELS D'ACCIDENTS

MONOGRAPHIE n°

Extrait du rapport I.N.R.S. n° 200/RE - septembre 1975



Facteur potentiel d'accidents étudié :
INCOMPATIBILITE DE MATERIELS OU DE TECHNOLOGIES

1 - CONNAISSANCE DU FACTEUR POTENTIEL D'ACCIDENTS

1.1 - Définition

Juxtaposition dans un même processus de fabrication de deux ou plusieurs matériels (outils, installations...) d'âge technologique différent.

1.2 - Exemples concrets

Les trois cas suivants illustrent le rôle du facteur étudié, aux trois niveaux que sont le poste de travail, l'équipe, le service.

Premier exemple :

Au niveau du poste de travail, les deux cas les plus courants sont d'une façon générale, l'intégration d'un élément neuf à un ensemble usé ou l'inverse (élément usé, ensemble neuf). Cet état de fait peut entraîner un mauvais fonctionnement du matériel qui risque de se solder

Les exemples les plus connus se rapportent notamment à l'entretien des véhicules (cas du changement d'un seul pneu).

Deuxième exemple :

Evacuation des produits laminés par pont-roulant. Un laminoir vient d'être modernisé. A son extrémité, les feuillards sont évacués sur une aire de stockage par un pont-roulant. Après la période de mise au point des nouvelles installations, il s'avère que le pont-roulant dont la capacité d'évacuer les produits est restée inchangée, a du mal à assurer sa mission, en dépit de son rythme de travail élevé. Les feuillards, stockés à l'extrêmité du laminoir de façon précaire, encombrent l'extrêmité du hall de laminage et constituent un danger nouveau. De plus, la périodicité de l'entretien du pont n'a pas varié malgré le régime accru. Il s'en suit des incidents techniques fréquents qui, se soldant par des arrêts, aggravent la situation. Ces faits seront tôt ou tard à l'origine d'un accident.

Troisième exemple :

Transport du minerai dans une mine de fer.
De petites berlines, anciennes, de faible capacité (1,5 t) destinées à l'évacuation du minerai par voie ferrée sont chargées par des camions dont le rendement élevé oblige à prévoir des longueurs de rames très importantes. Le freinage des berlines ne peut être commandé de la locomotive de telle sorte que, lorsque la voie est en pente, il faut freiner les rames de façon intensive dès le départ pour éviter un entraînement dangereux. Il en résulte une usure accélérée des matériels : rames, rails, attelages des berlines, locomotives.
Tous ces faits sont à l'origine de nombreux déraillements et incidents multiples, se répercutant aussi bien en amont du processus de travail, qu'en aval.
En résumé, il y a, à la fois, endommagement du matériel et diminution de la sécurité.

1.3 - Commentaires

Le facteur potentiel d'accidents incriminé apparaît fréquemment à la suite d'une modernisation partielle ou progressive d'une unité de travail (atelier, poste). Il s'en suit un décalage qui se traduit le plus souvent par une différence de performance (vitesse, capacité, rendement) de résistance ou de fiabilité des matériels juxtaposés. Cette différence, acceptée au point de vue technologique, est en fait génératrice de multiples incidents.

Ce facteur potentiel d'accidents est d'autant plus répandu que les efforts de modernisation sont constants. Or, rares sont les cas où la modernisation concerne simultanément l'ensemble d'un système. Il faut noter que ce facteur apparaît souvent graduellement ; il sera alors d'autant moins perçu que les opérateurs s'habituent à une détérioration progressive, qu'ils tentent naturellement à compenser.

Ce facteur potentiel d'accidents représente un cas particulier d'un phénomène plus général : il se manifeste à l'occasion d'un changement, voulu et organisé, d'un élément d'un système, changement dont toutes les répercussions ne sont pas toujours envisagées ou dont l'importance est sous-estimée.

Enfin, il faut noter que ce facteur joue un rôle, souvent très en amont des accidents qu'il peut déclencher.

2 - PRATIQUE : RECONNAISSANCE ET PREVENTION

2.1 - Eléments de diagnostic : inventaire des faits susceptibles d'annoncer l'apparition ou d'indiquer la présence du facteur potentiel d'accidents

La liste suivante n'a pas un caractère exhaustif ; elle présente les éléments les plus fréquemment observables :

- achat de matériel (s) neuf (s) ;
- innovation technologique ;
- usure inégale et/ou prématurée des matériels ;
- incidents localement plus nombreux (pannes) ;
- vitesse de fabrication des produits très variable (rupture de stock, création de stocks intermédiaires, goulots d'étranglements) ;
- relation conflictuelle entre opérateurs.

En définitive, deux questions essentielles sont à poser :

- Quelles sont les limites de tolérance de chaque élément du système ? Ces limites se recouvrent-elles ?
- Quel est l'ordonnancement des opérations de modernisation et quels sont les délais ?

2.2 - Prévention spécifique.

- Admettre explicitement des "phases de transitions", notamment au point de vue de la production et en prévoir les limites (on appelera "phase de transitions" la période pendant laquelle il y a coexistence de matériels de générations différentes) ;
- Surveiller les points où il y a coexistence de matériels de générations différentes ;
- Ne pas dépasser les capacités maximum de l'élément le plus faible ;
- Planifier les opérations de modernisation dans l'entreprise.

A multidisciplinary study of the consequences of night work on industrial mental stress. Consequences regarding safety.

by P. CAZAMIAN (Paris)

This problem is studied in factories with "unceasing fire" (thermal power plants, steel industries), workplaces having shiftwork with a weekly job rotation. The method, multidisciplinary, associates psycho-physiological investigations and psycho-sociological inquiries. The mental stress is measured from the variations of the electro-encephalographical data : the average visual or auditive evoked potential.

One first study concentrates on about 20 supervisors at a thermal power plant. They are observed at three different workplaces ; the potentials are recorded before and after work, which is analysed by the persons involved. The after-work potential is significantly diminished compared to the before-work potential (this points to the existence of a professional mental stress) ; but for the same amount of work the détérioration is much more obvious at the morning workshift and at the night workshift than at the afternoon one (this proves the intervention of the restoring property of the previous sleep). A study on a simulator confirms this result ; this allows us to study the effects on the performance of the psycotropes and of the drugs, otfen used by night workers.

Another study also done in a power plant has been using a van-laboratory, which has made possible to record, by telemetry, electro-encephalogram, electro-cardiogram, electro-oculogram, electro-myogram. The supervisors can in this way be continuously recorded, at the factory, performing their work (the three workshifts are observed one after another), at home, during their sleep at night or at daytime according to the case. This method confirms the results of the first study ; and also completes this study in analysing the fluctuations of the vigilance during the work itself ; above all we are informed of the changes in the night time sleep shortened by the morning workshift : the paradoxical sleep, making up for the mental fatigue is amputated in both cases, which explains the over-fatigue observed in these two shifts.

Finally a last study suggests that the disturbances of the sleep due to older age is to be added on top of the previous ones. Belated decompensations have been observed after 15 to 20 years of nightwork.

This will be followed by a discussion about the consequences on work safety and travel safety of the factors mentioned.

This study has been performed in collaboration with G. DEVEZE, J. GUERIN and C. P[illegible]RNITIS. It has been supported by Commissariat au Plan (CORDES), by l'Institut National de Recherches et de Sécurité and by Commission des Communautés Européennes.

Etude multidisciplinaire des incidences du travail de nuit sur la fatigue mentale industrielle. Conséquences en matière de sécurité.

par P.CAZAMIAN (Paris) (I)

Le problème est étudié dans des industries à feu continu (centrales thermiques, usines sidérurgiques) où le travail se déroule en horaires alternants avec rotation hebdomadaire. La méthode, multidisciplinaire, associe des investigations psycho-physiologiques et des enquêtes psycho-sociologiques. La fatigue mentale est mesurée à partir des variations d'un indice électro-encéphalographique: le potentiel évoqué moyen visuel ou auditif.

Une première recherche porte sur une vingtaine de surveillants de centrale thermique, suivis aux trois postes; les potentiels sont enregistrés avant et après le travail, qui est analysé par les intéressés eux-mêmes: le potentiel d'après-travail est significativement diminué par rapport à celui d'avant-travail (ce qui signe l'existence d'une fatigue mentale professionnelle); mais, à charge de travail égale, la détérioration est beaucoup plus marquée au poste du matin et au poste de nuit qu'au poste de l'après-midi (ce qui démontre l'intervention de la qualité réparatrice du sommeil antécédent). Une étude sur simulateur confirme ce résultat; elle permet d'étudier les effets sur la performance des psychotropes et des toxiques souvent utilisés par les travailleurs de nuit.

Une autre recherche, menée également dans une centrale, utilise un camion-laboratoire qui permet d'enregistrer, par télémétrie, l'électro-encéphalogramme, l'électro-cardiogramme, l'électro-oculogramme, l'électro-myogramme et les potentiels évoqués moyens visuels ou auditifs; les surveillants peuvent ainsi être enregistrés en continu, à l'usine, au cours de leur travail (on explore, tour à tour, les trois postes) puis, à leur domicile, pendant toute la durée du sommeil, nocturne ou diurne selon le cas. La méthode confirme les résultats de la première recherche; elle les complète en analysant les fluctuations de la vigilance au cours même du travail; surtout, elle renseigne sur les altérations du sommeil diurne correspondant au poste de nuit et du sommeil nocturne écourté par le poste du matin : le sommeil paradoxal, qui répare la fatigue mentale, est amputé dans les deux cas; ce qui explique la surfatigue observée dans ces deux postes.

A signaler enfin qu'une dernière recherche suggère que les perturbations que l'âge apporte au sommeil se surajoutent aux précédentes pour donner les décompensations tardives observées après I5 ou 20 ans de travail de nuit.

On discute en terminant des répercussions sur la sécurité du travail et sur la sécurité des trajets, des facteurs ainsi mis en évidence.

(I) L'étude a été réalisée avec la collaboration de G.DEVEZE, J.GUERIN et C.PTERNITIS. Elle a bénéficié d'aides financières de la part du Commissariat au Plan (CORDES), de l'Institut National de Recherches et de Sécurité et de la Commission des Communautés Européennes.

M. Y. CHICH

SAFETY AT WORK AND ROAD SAFETY :
A draft of a comparative analysis illustrating the case of professional drivers.

SUMMARY of a Report presented to the Seminar on Safety at Work (STOCKHOLM, September 1976).

Amongst death and incapacity causes, accident mortality and morbidity occupy an important place in industrialized contries, which is so much the more alarming as they strike, often electively, the youngest population groups.

Road traffic accidents and accidents at work can be considered as direct and typical products of our society; negative undesired products, certainly, about which one can wonder if they do not continue to be accepted according to the proverb stating that you can't make an omelet without breaking eggs. Anyhow, the road and work kill and maim enough people to take and develop different actions in safety policy more ou less organized.

This paper is a draft of a comparative analysis of technical, economic and and social conditions of safety actions and strategies in the field of work and in the field of road traffic; to this effect, the accent is laid upon an investigation into the case of road transport because the professional driver has the special characteristic of doing his work on the road : accordingly, most often, the accident at work is then a road traffic accident, not only because it occurs on the road but also because it frequently implies road users who are not engaged in a producing activity.

In works, as technology and organization is developping, the producing procedure is conceived in a more and more integrated way in order to get highly standardized products and also to have a perfect control of the volume and rythm : the reliability of the product, but first of all the reliability of the producing procedure is a central value. In this sense, the accident at work is the recognition and manifestation of a failure in the producing procedure. Then, under the responsability of the employer, who conceives and puts into effect the producing procedure, a very wide range of actions tending to increase the reliability of the procedure, under all its aspects, is taken (technical choices: commande and control posts; fail-safe devices: contents of working posts and methods; selection and training policy; and even for the most enlightened people working "ergonomics"...).

This more or less ideal pilot line of action in the field of industrial safety cannot be fully understood if the social and legal aspects of the phenomenon are omitted. As responsible for work and its organization, the employer, for different reasons and at various levels, is also responsible for safety; as far as workers and their labour unions are concerned, they make pressure in order to have this ultimate responsability of the employer fully recognized in the field of safety.

But the road is not a works : if road transport of goods and passengers can be analyzed in system terms, the fundamental characteristics of industrial organization cannot, or to a very low degree. As public property open to every one (or almost every one) at any time, the road offers itself to a great number of actors, whose behavior can be only roughly controlled by the very general rule of the road much less defined and controlled than railway and air traffic control. Accordingly, the uniformity preceeding the conception and management of an industrial procedure being absent, responsability, particularly in case of an accident, will be extremely less concentrated and will essentially have a tendency to incumb upon the individual actors. Hence, the particular difficulties of a safety policy in the field of road traffic illustrated by the case of road transport.

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SEÇURITE DU TRAVAIL ET SECURITE ROUTIERE :

Esquisse d'une analyse comparative à propos de cas des conducteurs professionnels.

RESUME de la Communication présentée au Colloque Sécurité du Travail (STOCKHOLM, Septembre 1976).

Parmi les causes de décès et d'incapacité, la mortalité et la morbidité accidentelle occupent, dans les pays industrialisés une place de choix, d'autant plus préoccupante qu'elles frappent, souvent électivement, les classes les plus jeunes de la population.

Les accidents de la route et les accidents du travail peuvent être considérés comme des produits directs et typiques de nos sociétés ; produits négatifs non désirés, certes, mais dont on peut se demander s'ils ne continuent pas à être acceptés en vertu du proverbe qui constate qu'on ne fait pas d'omelette sans casser d'oeufs. Toutefois, route et travail tuent et mutilent assez pour que diverses actions, plus moins organisées en politiques de sécurité, s'imposent et se développent.

L'exposé est consacré à l'esquisse d'une analyse comparative des conditions technologiques, économiques et sociologiques des actions et politiques de sécurité, dans le domaine du travail et dans le domaine de la circulation routière ; à cette fin, on s'appuie sur l'examen du cas du transport routier puisque le conducteur professionnel a la particularité d'effectuer son travail sur la route : en conséquence, le plus souvent, l'accident du travail est alors un accident de la route, non seulement parce qu'il survient sur la route, mais aussi parce qu'il implique fréquemment des usagers non engagés dans un acte de production.

Dans l'usine, au fur et à mesure du développement technologique et organisationnel, le processus de production est conçu d'une manière de plus en plus intégratrice, de telle sorte que les produits soient hautement standardisés, de telle sorte aussi que le volume et le rythme soient parfaitement contrôlés : la fiabilité du produit, mais d'abord celle du processus productif est une valeur centrale. En ce sens l'accident du travail est l'aveu et la manifestation d'un échec du processus de production. Dès lors, sous la responsabilité de l'employeur qui conçoit et met en oeuvre le processus productif, une très large gamme d'actions qui tendent à accroitre la fiabilité du processus, sous tous ses aspects, est mise en oeuvre (choix technologiques ; postes de contrôle et de régulation ; dispositifs de sécurité intégrés ; contenu des postes et méthodes de travail ; politique de sélection et de formation ; et même, pour les plus éclairés conception "ergonomique" du travail...).

Cette ligne directrice, plus ou moins idéale, de l'action en matière de sécurité industrielle ne peut être pleinement comprise si l'on omet une lecture sociologique et juridique du phénomène. Responsable du travail et de son organisation l'employeur, à des titres et des degrés divers est aussi responsable de la sécurité ; quant aux travailleurs et à leurs syndicats ils exercent leur pression pour que cette responsabilité ultime de l'employeur soit pleinement vérifiée en matière de sécurité.

Mais la route n'est pas une usine : si la circulation routière des biens et des personnes peut être analysée en termes de système, les caractéristiques fondamentales de l'organisation

French-Swedish Symposium
Occupational Accidents Research

The Swedish Work Environment Fund

Carin Hultin
Bo Oscarsson
Erling Ribbing
Ylva Tivéus

L'ambassade de France
Association Française-Suédoise pour la Recherche

Jean-Pierre Chevillot
Jeanette Nilsson
Gérard Rivière
Philip Royère

Délégation Générale à la Recherche Scientifique et Technique
DGRST.

Dominique Jerome
Christina Miquel

French participants

Xavier Cuny
Francis Jankovsky
Jean-Jacques Jarry
Jaunet
Jacques Le Plat
E Quinot
Norbert See
Alain Wisner

Swedish participants

Urban Kjellén
Jan Kronlund
Carl Lager
Elisabeth Lagerlöf
Nils Lundgren
Bo Pettersson
Carin Sundström-Frisk
Leif Svanström
Håkan Teljstedt
Ulf Åberg

The Board of the Swedish Work Environment Fund

Friday, September 10th

9.00 a.m. - General methodological aspects on occupational accidents research (organization research, statistical empirical methods, experimental technical research development)
The discussion will take place at Industrihuset, Storgatan 19, Stockholm

12.00 - LUNCHEON

13.30 - Concluding discussion. Further French-Swedish co-operation in occupational accidents research.

Pressconference (prel.)

-:-:-:-:-

Location: Hotel MORNINGTON
Nybrogatan 52
Stockholm

PROGRAM

Wednesday,
September 8th

08.15 a.m.	Visit to Oxelösunds Järnverk, Oxelösund. (One of the biggest iron-works factories in Sweden, about 120 kilometers south of Stockholm). M.M. Brännström. Bus leaves from your hotel at 08.15 a.m. Return to Stockholm about 16.30 p.m.
10.00	Arrival.
	Coffee - General introduction to the company.
10.30	The company from the point of view of the employees. Statistics concerning the employees Among others: The number of employees Distribution women-men Foreign employees Absenteeism Accident statistics, etc
11.00	Company health service: Organization Work organization Cooperation Education, etc.
11.30	Special activities within the accident area. Questions - discussion.
12.00	LUNCHEON at the company lunch-room.
13.15	Visit to the iron-works.
14.30	Coffee - Questions and answers Ready for departure.
15.00	Departure for Stockholm.

-o-o-o-

SOME RESEARCH TENDENCIES IN THE FIELD OF WORK SAFETY IN FRANCE - A FACTUAL APPROACH

Alain WISNER

1.0 A biological view on the working class

Big differences in life expectancy, in ageing between manual workers and clerical workers.

These differences are not only related to working conditions but also to the general life conditions (food, housing, medical care).

The part of working conditions is anyway very important and specially the work accidents.

During the life of a manual worker, we may observe:

- 5 accidents followed by a rest period
- 0,5 severe accidents
- 5 % permanent incapacity degrees

These values are multiplied by 2 (at least) in building and public works industries and by 3 or more in lots of agricultural activities.

To these work accidents, we have to add the road accidents: 15.000 killed and 300.000 wounded every year in France. A high proportion of these road accidents are, in fact, work accidents.

The accidents and the general conditions at work and in life accelerate the ageing of workers. One can make a distrinction between "normal ageing" and "marks of life".

2.0 New trends in the main fields of research on work safety in France

2.1 The worker

- Reduction in the tendency to use personal selection
- Increasing interest for the characteristics of the different categories of the workers population
  - women 40 %
  - ageing people (>40 years old) 50 %. These people have aged

more quickly than the rest of the population in relation to their past working conditions (marks of life) C.N.A.M.

- Handicaped people. A handicap has no absolute value. It is strictly related to the task and has to induce changes in the task and/or environment.

- Increasing interest for the body and mind changes inducing higher risks and related to the working conditions: (AUDRAN, ROHR, SZEKELY, MONTEAU, JARRY)
  - toxics (INRS), drugs
  - monotonous work
  - overload (LAVILLE, CAZAMIAN)
  - shift work inducing lack of sleep and low vigilance (CAZAMIAN, FORET)

- Increasing interest for some types of limitation that have not yet been enough explored
  - effects of peak menial and physical load
  - short term memory
  - body image and space representation though visual and vestibular inputs - training and ageing of these abilities (C.N.A.M. - C.N.R.S.)

2.2 Task and technical layout

- Legislation, standardisation, reinforcement
- Psychophysiological studies of the technical layout
  - theoretical layout (as it is conceived in the engineering department)
  - real layout (how things are now working at the shop floor) TEIGER
  - operational image (how the worker understands the things working) PAILHOUS
  - training related to these analyses (real layout and operational image) and the knowledge of the permanent contribution of the workers' initiative to the smooth functioning of the technical layout.

- 3 criteria for the machine design and the evaluation of the individual protective devices:
  - protection efficiency (JAUNET) with many researches in the field of biomechanics (IRCOBI, ONSER, INRS), ventilation (INRS), noise (CNAM - CNRS).
  - comfort
  - easy performance at work
- An interesting approach of the real mode of utilization of the machines and individual protective devices is the careful examination of used machines and I.P.P. (FAVERGE, RNUP, ONSER, INRS)

2.3 Communications

- Formal or informal
- Verbal or non-verbal

} JANKOVSKY

3 main aspects:

- perception (acoustics)
- identification (phonetics)
- meaning (semantics)

Verbal communication (ROSTOLLAND - CNRS - CNAM)
How foreign workers understand verbal orders shouted in a noisy place: important safety problem in France, where many foreigners are working in building industry and steel works.

2.4 Psycho-sociological problems

- Type of supervision
- Attitude of management toward safety
- Study of safety problems with the workers
  - committees for hygiene and safety
  - ERACT (Research and action teams for working conditions (UIMM)
- Type of management action (?) on safety
  - rewards or punishment
  - teaching or advertisement
- Image of the plant among the workers, their interest for the jobs.
- Type of salary (piece rate ...)
- Pressure on quantity or quality of production

2.5 Systems research

- Accidents as a symptom of organization failure (FAVERGE, LEPLAT, CUNY)
- Description of potential factors of accident (MERIC, MONTEAU, QUINOT, SZEKELY)
- Decision and action trees (C.E.A., Atomic Energy Center)
- Use of these extensive approaches in special areas:

road (CHICH), agriculture (SÉE)

UDDEHOLM
UDDEHOLMS AKTIEBOLAG

Tjänsteställe, handläggare
KCS, H Teljstedt, erp

SYNOPSIS
Datum
1976-08-28

Experience of practical difficulties in accident prevention

Concerning accident prevention it may be said that Uddeholm represents approximately what is normal for major Swedish companies.

Accident prevention activities may in point of principle fall under the following heads:

- Discovery of risks

- Elimination of or protection against risks

- Improvement of the consciousness of risks

- Decrease in the taking of risks.

There are many difficulties involved in practical accident prevention work. Better methods are needed to increase the consciousness of risks. A change in attitude towards risks is devoutly to be wished, especially among youngsters. There is a need for improved methods for the performance of investigations in connection with industrial accidents. For practical safety work accident statistics ought to be made in a different way to give a better basis for activities of prevention. Accident statistics should also make it possible to control if the precautionary measures taken have had the desired effect. Methods are needed for the work of analyzing risks in project work. New forms of protective work ought to be considered in connection with the increased industrial democracy.

Research as to industrial accidents is at least from a practical point of view faulty. There is a need for knowledge of both fundamental connections and practical protective measures. In the latter case the trade associations ought to play a more active role, i.e. act as a connecting link between experience and research work.

THE INDUSTRIAL MEDICAL OFFICER AND ACCIDENT PREVENTION

Dr Robert Audran, Dr Daniel Rohr, M. Jean Szekely, M. Michel Monteau, Dr Jarry
Institut National de Recherche et de Sécurité pour la prévention des accidents du travail et des maladies professionnelles

Traditionally, the work of the industrial medical officer has been limited to routine hygiene tests and the supervision of workers' health. In some cases, however, he is required by law to carry out periodic inspections of workshops in order to locate risks of occupational illness, or installations and tasks representing a potential danger to the physical well-being of workers.

Now, provided he acquires the necessary technical knowledge, the industrial medical officer, with his professional know-how, can collaborate most effectively with accident prevention teams.

Accident prevention proceeds either from the judicious application of labour legislation in order to eliminate obvious accident factors (machine-guarding, nuisances control ...) or from the detection of abstract and hidden "potential accident factors" which have slowly been defined over the past two decades, from detailed examination of the "accident phenomenon". These potential accident factors are conditions representing a non-negligible long-term risk of provoking accidents of the type usually attributed to an unfortunate combination of circumstances.

The potential accident factors are scattered throughout the relevant literature, and the I.N.R.S. has undertaken the task of classifying them and grouping them in a series of monographs, defining their semiology and specific prevention methods.

The industrial medical officer can play a double role in this work :

a) he can identify the "potential accidents factors" which involve persons, (either actively or passively), leaving to the technicians the analysis of factors in which machines, materials or environmental conditions dominate ;

b) he can play an active part in the firm's prevention team, in the analysis of industrial situations, such analyses being carried out along the same lines and with the same methods as those used in preventive medicine.

RECONSTRUCTION OF THE ORIGIN OF ACCIDENTS: ADVANTAGES, DIFFICULTIES AND LIMITATIONS

J. LEPLAT

Work Psychology Laboratory of the Practical Higher Studies School

SUMMARY

An accident can be considered as a symptom of malfunction of a system (man-machine or socio-technical system). To study the origin of an accident is to describe the events leading from such malfunction to the accident and to determine the mechanics of such process. The accident report is an initial way of accounting for the origin the inadequacies of which are well recognized. An effort has been made to remedy them by proffering various types of analysis the major characteristics of which will be brought out through a few examples.

Mention will first be made of certain justifications for study of the origin. There will then be gone into the modi operandi and difficulties specific to such study. There will be taken up at this point the problems posed by the choice of facts: plurality of frames of reference, relation of the analyst to the accident and position of such analyst in the company, action methods. Coding of the facts necessitates determination of the position of the categories used on the specificity-generality axis. Reconstruction and interpretation of the origin will lead to consideration of the definition of types and sources of malfunction.

Finally, there will be taken up in a final part certain limitations inherent in the analysis of the origin of accidents in safety studies. It will be demonstrated in particular that this type of analysis focussed on the special event in the system which is the accident scarcely provides the means of locating the regulation processes which sometimes result in cancelling out the effect of certain steps taken to improve safety. This type of analysis also risks overlooking the defensive mechanisms sometimes set up to eliminate the harmful consequences of certain malfunctions.

In conclusion, the link between origin analysis and study of risk factors will be discussed.

AN ACCIDENT ANALYSIS METHOD: TEACHING AND EVALUATION EXPERIMENT

X. CUNY

Work Psychology Laboratory of the Practical Higher Studies School

SUMMARY

We have designed and developed with the coöperation of the National Research and Safety Institute a practical accident analysis method. The principle on which it is based considers an accident as a symptom of one or more malfunctions affecting a socio-technical system. Thus the analysis proceeds recursively from the accident to its proximate, and then remote determinants, to the discovery of the malfunctions. It is proffered to company executives in order to facilitate prevention tied in with improvement of the condition of the system by elimination of malfunctions and their sources. A characteristic of this method lies in the graphic representation of the factors of an accident and of their interrelations by means of a logical procedure, both clear description of the sometimes highly complex process leading up to the accident and investigatory technique to try to identify a maximum number of factors.

An experimental traineeship was set up in the I.N.R.S. Research Centre, with a group of safety officials, to determine the conditions favourable to broad application of this method in companies. The traineeship covered initiation into the use of accident analysis according to the method procedure. It went forward in two separate sessions of four months devoted to in-works use trials. The results indicate that satisfactory handling of the method requires a minimum of systematic training. A program and teaching aids have been suggested. In addition, acceptance by companies requires broad prior information of the executives, management and supervisory staff.

OCCUPATIONAL ACCIDENT PREVENTION

Research and description of potential factors of accidents

M. MERIC - M. MONTEAU - E. QUINOT - J. SZEKELY

This report follows up the accounts of Mr LEPLAT and Mr CUNY who have shown by scientific investigation and taking all the previous events into consideration, i.e. all the accident causes, how the structural analysis of accident could be tackled.

The activity space is described from four components : people, task, tools, physical or social environment. But these categories are not essential. They are only convenient and usual. Such a procedure can be applied to the study or any event genesis (it may be unlucky or not, it may concern either the professional world or the all-day life). By this right it might be taught already in primary school.

The present state of a system depends on all the previous states and, reciprocally, every event is fraught with the whole future of the system. An event belongs to two cause trees, the first is constituted of all the branches which converge on the event in question, the second, of all the branches which proceed from it. If accident investigation is especially interested in determining the former (ascending procedure), prevention will analyse the latter in order to recognize and check off some hazard factors even before they are revealed by accident (descending procedure).

Accident results from a working situation which degrades very progressively first, quickly then and ends suddenly in injury. The situations which precede it are not any situations but characteristic and specific on the contrary. We can name and describe them. It is this very specificity which leads to the notion of potential factors of accidents.

A potential factor of accidents has the four following properties :

1. It increases the probability of accident occurrence in the firms because it is likely to take part in its occurrence closely or distantly ;
2. It is so widespread that it may be met in a number of firms and working situations ;
3. Its identification in the system calls for specific preventive measures ;
4. Its suppression doesn't prevent its objects from being realised.

In case of obviously hazardous situations,there is a large number of hazards that the prevention already covers by the legislation application and the settlement of a technical checking. These measures mostly arrive on antecedents that are close to accident, but when it is a question of reducing the probability of occurrence ofaccidents which are generally considered as the result of chance, it is essential to act "further" from it. Whence the necessity of going back as far as possible in the accident analysis and of hunting out the sequences which are worth being isolated and studied for themselves.

These sequences compose or enclose so many potential factors of accidents whose revelation and recording demand two stages :

- The former is the extension of a special studied case : this stage enables to break free from the peculiar circumstances under which appear one or several elements of the working situation from which the accident originates ;
- The latter consists in an isolation, in form of a more or less complex situation, of the shown elements in order to be used as potential hazard information. Thus for each potential factor of accidents a monograph can be made out which regroups in a real nosological context all the characteristic symptoms as well as the specific preventive measures which are meant for facing it.

Two methods are appropriate to isolate the potential factors of accidents peculiar to a firm :

- To analyse some accidents occurring in the firm and draw for each one an adequat diagram. A joint thought from the responsibles for safety and often obvious generalizations reveal potential factors of accidents which were unknown until then ;
- To examine systematically the work places and situations and to search for the already recorded and in another connection described potential factors of accidents.

These two methods are complementary. The first one is the easier to be used by a building up staff, the latter takes place of the former as this learning progresses.

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Development of a model for occupational accident research and practical safety-work

During 1974 an epidemiological survey of occupational accidents was conducted in Malmö, Sweden. The aims were two; firstly an epidemiological study of the occurence of accidents during a certain period in a certain population as a function of different factors described according to a host-agent-environment view; secondly development of a model for further steps in research. In this view the epidemiological method showed to have its limitations, mainly in the causal dimension. We therefore tested our material on the basis of a model described by Surry (1969) and modified by the Swedish Environment Fund (1973). This model was based on system-theoretical grounds but even this showed up to be too narrow. We therefore tried to further develop the model and based the theoretical work on Faverge´s (1968) view of accidents being an error in the expected cause of production cycle; i.e. the objective danger is not derived from a study of different individuels behaviour but from the working process as a general abstraction.

At present we are trying to develop a program based on the above presented model that could be used in practical safety work.

A B S T R A C T

SAFETY IN FORESTRY REMUNERATIVE SYSTEM AND RISKTAKING

Carin Sundström-Frisk
National Board of Occupational Safety and Health, Stockholm

In Sweden both the number and the severity rate of accidents in forestry are very high. The motor-manual working operations are responsible for 75 % of the accidents.

It is known from reports and statistics up to 1974 made by the Forestry Inspectorate, that many accidents occurred when using risky methods in certain critical work operations, e.g. bringing down lodged trees. In these work operations the cutters can choose between alternative working methods, some of them risky and some of them less risky. The risky methods are strictly forbidden according to safety directions. In an interview cutters were asked about their attitudes towards these and some other safety rules on working behaviour. They all considered most of the rules to be important (the average was 4 on a 5-degree scale, 5 indicating a very important rule). In spite of a positive attitude to the rules, the cutters admitted to not following them, due to practical circumstances. They considered the rules not fitted to their everyday situation, mostly because the recommended methods are time-consuming.

We obtain the same kind of answers in a second study, when the cutters have been asked which are the reason for using methods one <u>knows</u> to be risky. We thus asked about deliberate risktaking.

The main reason given by the cutters was that the risky methods are far more rapid and demand less physical effort. To save time is equivalent to better earnings when working in a piece rate system. The straight piece rate system also influences the motivation to use methods that are less physically energy-consuming.

Obviously the acceptability to a certain person of the risk of a certain activity is related to the real or imaginary benefits that the person expects from the activity. The benefits of risktaking can thus be controlled py the type of remunerative system.

There are other effects on behaviour due to the remunerative system, some of which I will discuss in my speech.

- Effects on the learning process
  The remunerative system as a reinforcer.

- Effects on the human organism
  The remunerative system can create stress in the organism as reflected by some form of neurological, physiological or behavioural disruption or disorganisation

- Effects on safety actions
  The remunerative system can effect the desire and possibility of the individual to use the knowledge he recieves from safety training and information, to use personnel safety equipment, to follow safety directions etc. It can through this facilitate the safety work for supervisors and safety officers.

M. N. SEE

ACCIDENTS AND WORKLOAD IN AGRICULTURE

It is important to consider the origins of accidents in the field of agriculture which is seriously affected by this problem. If we refer to a document published by the INRA we can see that paid agricultural workers are subjected to considerable danger in their work.

On first analysis, the most dangerous work tasks fall into 3 categories : mechanized agricultural work (in 1974 the frequency of fatal accidents for 10^6 hours shows a ratio of : 0,32), forestry (0,26), mixed farming and stock farming (0,22). For these 3 branches of work, the ratio of accidents is higher than that encountered in construction work. In 1973, accidents in public works showed a ratio of 0,20. Moreover, when we consider that the hours worked by agricultural wage-earners represent only 12% of the total number of hours and that these workers utilize the mechanical equipment less than the cultivator, we can see the seriousness of the problem.

In order to take into account this particular aspect of agricultural work, we began our ergonomic research with a study of stock farming, a field where there are a significant number of accidents.

If we focus our attention on the study of an ensilage yard for corn, we will not establish a direct link between production conditions and accidents. However, there are a number of closely interwoven factors which contribute to work accidents and the ergonomic approach makes it possible to uncover such important contributing factors.

The observations we were able to make show an important variation between agricultural and industrial work : technical modifications introduced by the operator, rotation on the work posts, general responsibility for the work site, the mutual help of a continually changing group of farm workers.

But there also exists a fundamental similarity between agricultural and industrial work : the time limits imposed upon the workers when performing their work tasks in order to ensure the profitability of the operation.

If we examine the work performed in a silo where corn is stocked, we can observe that there are 3 different kinds of operators. First, there is the compressor operator on a tractor whose work cycle is short (20 to 40 seconds) but whose workload is high. Then there is the transport operator responsible for unloading the harvested forage and for whom the work cycle is considerably longer (18 to 25 minutes). Finally, there are also manual operators present.

In addition to a heavy workload, the equipment being used often does not have safety devices, i.e., tractors without roll bars, transmission shafts without protectors, lighting systems insufficent for night work, etc. Finally, the organisation and even the method of stockpiling creates conditions conducive to accidents.

Three elements contribute to making this particular activity potentially very dangerous : 1) the workload, 2) the organisation of the work, and 3) the characteristics of the equipment used.

Alongside the direct approach to the problem of agricultural accidents can be placed an indirect approach such as laboratory studies or statistical analyses.

Ensilage : Method of preserving green fodder without drying.

I.N.R.A. : National Institute for Agronomic Studies

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A B S T R A C T

RISKIDENTIFICATION , RISK-CONSCIOUSNESS AND WORK ORGANIZATION - THREE CONCEPTS IN JOB SAFETY

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It is a well-accepted fact that most accidents in industrial systems are caused by people. In the modern research, i. e. the systems approach, the human errors are analyzed in terms of the man- machine - system. What is more seldom considered is that the human being - besides his role in the system - is also a victim of the system, i.e. that factors in the system control the human behaviour in a way which may initiate risk- taking. Therefore, in order to increase job safety it is not enough only to try to identify the risks in the system and to motivate the people to work safely, but also to try to analyze the control actions in the system which may lead to risk-taking. This will lead to a better understanding of the human element in systems safety so that appropriate actions can be taken.

Up to date the corrective actions made by the safety organization have mainly been of a technical nature or through motivating the worker, i.e. education and information. However, this does not seem to have solved the problem of accident reduction. Our assumption in our theoretical frame of reference is that this is due to a lack of consensus between the employer and the employee regarding safety work. Now the considerations of safety will be rigidly controlled by the dictates of production, i.e. no interest is taken in changing the control factors if they do not increase production. As long as the employee has no personal control over and influence on his own job the prerequisites for consensus will always be lacking. Therefore, inorder to improve job safety, the safety work must be organized so as to involve employees in shaping the environment in which they work.

A project in forestry will be presented , where a method has been developed for risk identification, for improving the employees' risk-consciousness and for changing control factors in the system, i.e. work organization, pay system , in order to improve job safety.

This has been done by a near- accident reporting method,in which the employees have been engaged in the reporting as well as in making decisions about the corrective actions to be taken as a result of the reports.

Urban Kjellén
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ABSTRACT

ACCIDENT PREVENTION IN THE EXPLOSIVES INDUSTRY

As a phase in the research on accident prevention in the Swedish Explosives Industry, an interdisciplinary work-environment project has been going on since 1973 on the initiative of the Swedish Inspectorate of Explosives. The research is beeing carried out by the National Defence Research Institute in cooperation with the National Board of Occupational Safety and Health.

The first year of the project has included a general study of risks at work and of the safety organization in the explosives industry. During this first year a general inventory of the explosives industry was carried out. The inventory was followed by studies of the work environment and attitudes of 600 workers and supervisors at nine factories.

The results from the general inventory show that the mortality rate of explosives workers is high, in spite of the technical and organizational safety measures that have been made. Furthermore, the results from the attitude study indicate that in several cases there are problems as regards information and communication concerning safety. In this study a widespread instrumental attitude to their work has also been found among the workers, indicating low morale and low job satisfaction. A possible interpretation of the results from the attitude study and the study of the work environment is that there is a conflict between the way in which the production and safety systems are organized today and the workers ego-needs, such as needs for independence and responsibility.

The results from the first part of the project constitute the background for the further research, where means to activate the employees in the safety work and to develop the cooperation between management, experts and employees on safety problems are applied and evaluated. This research is planned to be completed during 1976 and includes problem identification (by means of disturbance-reporting, interviews and direct observations of the production), and the development and implementation of safety measures at places of work at three factories. These factories represent different sizes and different production areas. The researchers cooperate at each factory with a joint-consultation group with representatives from the workers, the supervisors and the management. Examples of problem areas that have been treated in the groups are technical safety measures in the production, the development and introduction of new equipment in the production (including the elaboration of check-lists), and the safety education of newly employed as well as experienced workers.

COMMUNICATIONS WITHIN WORKING GROUPS

F. JANKOVSKY

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Work analysis in oil drilling teams (A. LAVILLE, F. JANKOVSKY 1972) has shown that particular problems of communication between the workmen appear in this kind of situation.

Similar problems have been raised again by observations of other working teams like, for instance, between the crane-drivers and the ship-loaders on wharfs, between the crane-drivers and the workers in plants, between the bulldozer-drivers and the ditch-diggers in open-constructions and, even, between some workmen on assembly-lines in car-manufactory.

From these observations and after a bibliographical study about the communications, we draw up the hypothesis that the communications between the opérators of working groups are based on three systems :

1° The primary message system

In this system the messages are constitued by the visible activities of the operators or by the visible result of the activities either on the working-stock or on the tools, or on the operator himself facing the postures he has to take up during the job.

2° The secondary message system

This system encloses all the formal or informal gesture signs accomplished by the operators during the job.

3° The third message system

This system includes all the messages emitted by the operators with the voice.

This hypothesis must be checked by a systematic analysis of the communications in different working groups.

One shall verify also that the primary message system is the most used in "normal" work situation because it is the most simple. But, if the complexity of the messages increases, for example, because incidents occur in the job, the operators remove the messages to the secondafy system and afterwards to the third system.

The utilization and the effectiveness of the three systems must be estimated in reference with the training level of the operators in the working team.

The primary message system is of high importance towards the safety of work, particularly in the case of team work.

Indeed, this system where the messages transmitted are founded upon the activities of the operators is marginal versus the communication theories.

One operator is able to send out a message by performing an activity without the purpose of communication with his co-workers and without the knowledge that the activity performed is also an action of communication. Nevertheless receiving this message, the co-workers set in motion their own activities.

Therefore it is necessary to study the risks created by the use of the primary message system in working teams and the ways to reduce or to eliminate this hazard. For example, instead of limiting the training of the operators at their specific activities in the job, it is possible to extend the training at the level of the team and to show the function of the different activities in the sight of inter- personnal communications.

It is also possible to express the hypothesis that the use of the primary message system is privileged, and then the risks are increased, when the job requires rapidity, either when the communications by the two other systems are difficult :

1° because the two hands of the operators are occupied during the tasks (thus, it is impossible to send out gestual signs with the upper limbs)

2° when verbal communications are inoperative because the workers are far from each other, or because there is a high noise level in the work situation, or, at last, because the workers do not speak the same language. (D. ROSTOLLAND ; C. PARANT 1975).

ETUDE COMBINEE DE LA SECURITE ET DU BRUIT
SUR PETITES PRESSES D'EMBOUTISSAGE

Les problèmes posés par les presses

Les presses d'emboutissage et de découpe présentent des risques importants d'accidents. Parmi ces risques, les contacts avec les outils, s'ils ne sont pas les plus nombreux sont les plus importants en raison de la gravité des blessures par écrasement. La prévention de ce risque doit se conformer à une règlementation très précise sur l'homologation des machines et les visites d'entretien, et des recherches d'amélioration de la sécurité sont menées constamment, comme par exemple la conception et la fiabilité des circuits électriques.

Mais les presses présentent également un risque important de surdité professionnelle. En effet, le niveau sonore au poste atteint fréquemment des niveaux sonores élevés surtout sur les petites presses modernes automatiques. En voici deux exemples :

- petites presses (force 80 t) équipées d'une évacuation des pièces par jets d'air comprimé : niveau de 105/108 dB.A.
- presses rapides de force jusqu'à 160 t., capables de travailler à près de 400 cycles par minute : niveau variable suivant les pièces produites et la cadence utilisée, souvent 105 dB.A.

Les solutions réalisées

Dans les installations récentes les deux problèmes, accident et niveau sonore, ont été traités simultanément par les spécialistes de sécurité et de lutte contre le bruit présents au sein de la même équipe d'amélioration de conditions de travail. En effet, l'acousticien seul aurait eu beaucoup de difficultés pour résoudre avec entière satisfaction les problèmes de sécurité et vice versa.

La règle de base pour la prévention des accidents par contact avec les outils est indiquée dans la législation : nous devons obtenir "que les opérateurs ne puissent, de leur poste, atteindre, même volontairement, les organes de travail en mouvement". Notons que le mot opérateurs doit avoir un sens très large et doit inclure toutes les activités de production, de réglage, d'entretien. En plus des dispositifs de sécurité incorporés à la machine par le constructeur, les moyens les plus fréquemment utilisés sont l'occupation des deux mains avec des dispositifs de commande approprié, et les écrans fixes ou mobiles agissant sur des boutons d'arrêt.

Pour la réduction du niveau sonore, la source ne pouvant pas, dans la plupart des cas, être modifiée, l'acousticien intervient pour couper la propagation à l'aide d'enveloppes dont les caractéristiques principales sont la valeur d'isolation de la paroi, la rigidité et l'amortissement vibratoire de cette paroi, l'étanchéité acoustique et l'absorption phonique intérieure. L'objectif est d'obtenir un niveau inférieur à 85 dB.A.

Tous ces équipements complémentaires conçus pour la sécurité et la réduction du bruit doivent évidemment permettre une exploitation normale de la machine, sans fatigue supplémentaire pour le personnel.

Le traitement combiné des presses a conduit à 4 types de réalisations possibles :

1) Les dispositifs de sécurité habituels ont été conservés dans leurs dimensions et emplacements mais la nature des écrans a changé : les grillages ou "épingles" ont été remplacés par des parois pleines avec des parties transparentes et un éclairage intérieur. Mais ces capotages fixés sur la machine ne permettent pas une atténuation suffisante car malgré les précautions ils réemettent une partie de l'énergie sonore. Le gain est d'environ 12 dB, au mieux de 15 dB pour les spectres à dominante dans les fréquences aigües.

2) Les dispositifs de sécurité sont également conservés mais la réduction du bruit est obtenue par une cabine largement dimensionnées, posée au sol et permettant d'obtenir l'objectif de niveau sonore fixé. Mais cette cabine complique l'usage de la machine et en particulier les accès et l'on constate que le personnel laisse ouvertes les portes d'accès et séjourne parfois à l'intérieur. La réduction du "niveau équivalent", donc du risque de surdité est alors très faible.

3) Une cabine, comme précédemment, mais placée au ras de la machine pour que personne ne trouve une place à l'intérieur a ensuite été étudiée pour permettre tous les accès nécessaires, et en y incorporant les dispositifs de sécurité. Cette solution, plus complexe, plus coûteuse, donne satisfaction mais ne s'applique bien qu'aux presses modernes à bâti à arcade, de forme parallélipipèdique.

.../...

4) La solution précédente constitue en pratique une double paroi de la machine. Nous avons alors demandé au constructeur de réétudier la conception du bâti pour y incorporer cette deuxième paroi. Un premier résultat intéressant a été obtenu, et encore perfectible.

Cependant, il reste environ 10 dB à gagner, ce qui ne sera pas facile.

P. JAUNET

1976-08-27
Bo Pettersson

LOGGING RESEARCH FOUNDATION (FORSKNINGSSTIFTELSEN SKOGSARBETEN) - APPLIED RESEARCH AND DEVELOPMENT FOR FORESTRY

Background

Skogsarbeten is a research organisation established to carry out applied research and development for Swedish forestry. Almost all forest enterprises, the Swedish Forest Service and the Forest Owners´ Associations are interested parties.

Since 1964 research work has been carried out in this form but similar structures have been used for about 40 years. At present Skogsarbeten has 70 employees and a total turnover of more than 10 million Swedish Crowns. Of this amount approximately 60 % are contributions from various forest enterprises and about 40 % is financed by the Government. Financial contributions are also forthcoming from public and private funds, for instance the Work Environment Fund.

One of the reasons for establishing Skogsarbeten was the fact that Swedish forest enterprises found it more advantageous to co-operate than to compete in the field of research and development. Of course this does not mean that they do not compete otherwise - when it comes to wood supply we have for instance a keen competition.

Objectives

The objectives are

- to contribute to the development of machines and methods for silviculture, logging and transportation
- to contribute to increased safety, health and job satisfaction and to the adaptation of working techniques and methods to the varying conditions and limitations of man
- to provide a basis for recruitment of specialist personnel by the interested parties.

Means

For fulfilling our activities we have certain means, for instance a close co-operation with our interested parties in chosing projects as well as in solving problems. To secure special information and to maintain and increase the mutual knowledge we have seven advisory groups, consisting of about 15 specialists each from the interested parties. They follow our work in each field.

The main part of our tests are carried out at forest enterprises (interested parties) with assistance of their people.

We also co-operate with manufacturers of forest machines and other equipment. We study the machines at an early stage and try to give our opinion of the design, for instance out of an ergonomic point of view. In some cases we assist when the forest enterprises want to formulate common requirements on forest machines, for instance safety requirements, which then serve as a pressure on the manufacturers.

We also have an effective distribution of results comprising courses, conferences, various publications, instruction films and manuals. Usually a research project is not finished with just a research report but with actions to change conditions at the forest enterprises.

A project on safety

The project of immediate interest in this connection is called "Increased safety in forestry – an action program for a branch of industry". The aim of this project is to reduce the number of accidents and the severeness of the accidents within forestry during a four year period. This project is financed by the Work Environment Fund.

In this connection I am most interested in discussing one important question:

How should a program be built up within a forest enterprise in order to systematically increase safety?

Nils Lundgren:

PLANS FOR FUTURE ACCIDENT RESEARCH AT THE NATIONAL BOARD OF OCCUPATIONAL SAFETY AND HEALTH

The National Board of Occupational Safety and Health has the responsibility for issuing directions and notices on the application of the Workers´ Protection Act. Within the Board, the Occupational Health Department has the task of providing - through own research or otherwise - knowledge needed as a background to such directions and notices.

So far, chemical and certain physical hazards have been the dominating objects of the research of the Department. In the field of accident research, the activities have been mainly concerned with certain socio-pshychological and ergonomical aspects, as will be dealt with by other speakers from the Department. In the technical prevention field, resources for research have been rather limited. It may be mentioned, however, that the Supervision Department of the Board in spite of this fact has managed to promote a quite considerable amount of technical development work in certain areas, e.g., regarding excenter presses.

In order to strengthen the resources for more profound research in the technical field, a Section for Technical Accident Research is just being established within the Department of Occupational Health, under the leadership of an Associate Professor. Plans are at present being developed for this new Section.As a start, an integrated project will be taken up in cooperation with the Supervision Department. A choice will be made between certain industrial areas with serious accident problems. These problems will be taken up for analysis on an interdisciplinary basis, in which the research of the new section will be combined with resources for ergonomical and psychological research already existing within the Department of Occupational Health. In cooperation with the Supervision Department, the results of the research will - to the greatest extent possible - be translated into recommendations for such standards and directions as the Board has the power to issue. Also other channels for application will be considered, e.g., via the occupational health services

Sverigesymposium om arbetsolyckor

Den franske professorn Alain Wisner kommer till Sverige i början av september för att delta i ett symposium anordnat av arbetarskyddsfonden.

— Det ska bli mycket intressant att få en redogörelse av Wisners undersökning av skiftarbetare, säger Bo Oscarsson på arbetarskyddsfonden.

Symposiet pågår den 6—11 september och ska huvudsakligen behandla olycksfall i arbetslivet. Alain Wisner ingår i den grupp franska forskare som ska utbyta erfarenheter med svenska forskare. Både tekniker, medicinare och psykologer ingår i forskargruppen.

Professor Wisner är ett välkänt namn bland arbetslivsforskare. Han är chef för ett institut i Paris som behandlar arbetarskyddsfrågor.

— Att han sysslar med studier som rör både skiftarbetarnas villkor och olycksfall på arbetsplatser visar bredden i hans forskning, säger Bo Oscarsson.

Arbetarskyddsfonden prioriterar forskning som rör arbetstiden. För närvarande är flera projekt igång som studerar skiftarbete.

Paula Papkai på psykologiska institutionen i Stockholm undersöker hur man påverkas av oregelbunden sömn i sömnlaboratorium.

Dr Jan Fröberg på Karolinska institutets stresslaboratorium basar för en grupp som studerar hur skiftarbetare fysiskt och psykiskt klarar av att arbeta på oregelbundna tider. Man kontrollerar ett par tusen personer, av dem ett hundrtal mycket noggrant. De kartlägger hur olika arbetstider påverkar människors roller som make, maka. Hur arbetet påverkar fritiden och om de får tid över till utbildning och politiskt arbete osv.

Psykotekniska institutet i Göteborg har undersökt skiftarbetares villkor inom Mölnlyckekoncernen, ett projekt som redan gett praktiska resultat. De intervjuade arbetare om hur de upplevde sina arbetstider och kunde genomföra förändringar i arbetstiderna som passade arbetarnas egen dygnsrytm.

— Alla erfarenheter vi lyckas skramla ihop ska samlas i en skrift som vi hoppas ska kunna stimulera debatten om skiftarbete och kunna användas som påtryckningar i avtalsförhandlingar, säger Bo Oscarsson.

I Sverige arbetar ungefär 20 procent av den yrkesverksamma befolkningen på tider som faller utanför den vanliga dygnsrytmen. Inom industrin arbetar ca 150 000 människor i skift. En grov uppskattning visar att ungefär lika många skiftarbetare är igång på den statliga och kommunala sektorn. Och skiftarbeten har blivit allt vanligare inom andra näringsgrenar t ex sjukvården, transportväsendet, nyhetsmedia, dataindustrin och kontor.

Natt- och skiftarbete

Läkare inte säkra på skadligheten

Uppgifterna om att natt- och skiftarbete skulle vara mer skadligt för människan än dagarbete tas emot med tvekan av läkare som sysslar med yrkesmedicin.

— Det stämmer inte med de erfarenheter vi känner till, trots att det forskats mycket i de här frågorna, säger LO-läkaren Erik Bolinder, Ricardo Edström på arbetarskyddsstyrelsen och Sven Yllner, läkare på SAF.

De framhåller alla tre att det är svårt att uttala sig om resultatet innan de sett själva utredningen och tagit ställning till vilket underlag man grundar sig på.

— Människans naturliga dygnsrytm är ju att arbeta och vara aktiv på dagen och vila på natten. En omställning ger naturligtvis svårigheter, men de brukar gå över på en vecka ungefär, säger Sven Yllner.

Sömnsvårigheter

Ricardo Edström framhåller att de problem som kan infinna sig inte i allmänhet är rent medicinska.

— Det rör sig om sociala problem, sömnsvårigheter, problem i umgänget med familj och vänner. Att kunna vara fackligt och kulturellt aktiv är naturligtvis svårare om man arbetar på natten, säger han.

I den forskning om skiftarbete

finns ingenting som tyder på att skiftarbete eller nattarbete skulle vara mer skadligt än dagarbete.

— Det är klart att vissa människor klarar av omställningen sämre än andra, säger Erik Bolinder.

Han framhåller också att det är viktigt att veta hur urvalet av intervjuade skiftarbetare har gått till.

— En anledning till att de tidigare undersökningarna visat att skiftarbetare inte är mer drabbade av sjukdomen än dagarbetare kan vara att de som mår direkt dåligt av nattjobb ofta tvingas byta arbete.

I Sverige i dag finns lagar och bestämmelser som reglerar skiftarbete.

— Både arbetarskyddslagen och arbetstidslagen har bestämmelser som avser att hålla tillbaka onödigt skiftarbete. Men det kan ändå förekomma skiftarbete som inte är tekniskt eller samhällsnyttigt motiverat, säger Erik Bolinder.

Fransk utredning kritiserar tre-skift

Den franska regeringen har offentliggjort en statlig utredning som hårt kritiserar förhållandena för de två miljoner fransmän som arbetar tre-skift och kontinuerligt skift.

— Jag är mycket förvånad att en högerregering som den nuvarande är så positiv till rapporten, säger professor Alain Wisner.

— De fackliga organisationerna får nu en mycket stark ställning gentemot arbetsgivarna när det gäller att kräva reformer, säger han.

Professor Wisner konstaterar i sin rapport att den nuvarande politiken vad gäller nattarbete är djupt omoralisk. Vitala kroppsliga funktioner påverkas av nattarbete därför att det är stor skillnad på det värde man får ut av att sova under dagen eller natten. Den psykiska tröttheten bekämpas betydligt effektivare av nattsömnen.

Dessutom kräver arbetet under natten, för att nå samma resultat, en större fysisk och framför allt psykisk insats. Det nya med rapporten är att den visar att människan inte helt förmår återhämta sig efter stadigvarande nattarbete, och att återhämtningsförmågan minskar med stigande ålder.

Till slut tvingas människor upphöra med skiftarbete och riskerar då arbetslöshet.

Det kontinuerliga skiftarbetets skadliga effekter är i och för sig väl kända sedan många år. Det anmärkningsvärda är att den franske arbetsmarknadsministern Durafour nu reagerat så starkt.

Under en presskonferens sa ministern att han fann det omoraliskt att så många industrier tillämpade tre-skift och kontinuerligt skift utan att det egentligen var nödvändigt, bara för att tjäna en smula mer pengar. Han var också upprörd över att så många industrier gjorde så litet för arbetarnas hälsa.

I Frankrike är nattarbete förbjudet för kvinnor och ungdomar och arbetare med kontinuerliga skift går i pension vid 60 års ålder.

Arbetsmarknadsminister Durafour konstaterade att detta var helt otillräckligt och att det måste till djupgående reformer. De kommer att genomföras dels genom lagstiftning och dels genom avtal mellan arbetsmarknadens parter. Dessa har redan börjat förhandla i frågan. Minister Durafour utlovade reformer inom två år. Bl a måste lönerna för s k grovarbete höjas.

— Vi har ju en högerregering i Frankrike, säger professor Alain Wisner som står för rapporten. Därför förvånar det mig mycket att regeringen stöder den så pass kraftigt.

— Jag har en känsla av att de enskilda industrierna är redo att acceptera reformer, även om de kan bli kostsamma, för de vet att problemen är allvarliga. Det går inte att utnyttja arbetskraften så hårt som nu sker, i längden.

Slår ifrån sig

— Däremot är arbetsgivarna på förbundsplanet mer rädda. De slår ifrån sig och pekar på de höga kostnaderna som reformer skulle kosta industrin, säger professor Wisner.

— Men de fackliga organisationerna får nu en mycket stark ställning när förhandlingarna återupptas efter semestrarna. De kan ju peka på stödet från regeringen.

— Men, säger professor Wisner, man måste ha klart för sig att regeringens intresse har krassa orsaker. Vi har omkring en och en halv miljon arbetslösa i Frankrike och tre miljoner invandrare.

— Regeringen måste få bukt med arbetslösheten. Då måste man få fransmän att överta invandrarnas arbeten. Invandrarna har accepterat usla förhållanden. Därför måste arbetsmiljön förbättras, skiftarbetet minskas och lönerna för grovarbete höjas, slutar professor Wisner.

PETER BRATT

"Bara frisk och stark klarar av nattskift"

— För att klara av att jobba nattskift måste man vara frisk och stark, ha en god sömn och leva ett sunt liv. Det säger Olle Johansson, skiftarbetare i Dagens Nyheters sätteri.

Olle Johansson är maskinsättare. Nu jobbar han dagskift ena veckan och kvällsskift nästa vecka. Tidigare har han jobbat nattskift i 20 år.

— Jag har inte haft några större problem med nattjobbet, säger han. Det är klart, när barnen var små var det jobbigt. Då kom jag hem klockan tre på natten. Sedan vaknade barnen vid sjutiden. Man fick inte så mycket sömn, men det gick rätt bra, man var ju ung.

Han påpekar dock att det är viktigt att man är frisk och stark om man ska orka jobba nattskift någon längre tid.

— Jag har klarat mig bra, säger han. Det beror nog mycket på att jag har en så god sömn och levt ett sunt liv. Men en del har fått dåliga magar.

— När jag gick nattskift jobbade vi varannan vecka, och var lediga varannan. Då blev den lediga veckan väldigt viktig, den skulle innehålla allt.

Olle Johansson talar också om de sociala problem som uppstår när man arbetar när andra sover och sover när andra är vakna.

— Man kan ju aldrig vara med på några kurser. Nu finns det ju dagkurser för skiftarbetare, men på trettitalet när jag började, fanns inte det. Sedan blev det jobbigt för hustrun också, att hålla ungarna tysta för att jag skulle sova. Men man träffade ju barnen mer när man var ledig på dagarna. Dessutom kunde jag hjälpa till mer hemma.

Andra problem med arbetsplatser där man jobbar i skift är fackliga möten.

— Vi kan ju aldrig samlas allihop, säger Olle Johansson. Man får pussla ihop det så gott det går när skiften byter av varandra.

Vid ett tillfälle slutade Olle Johansson som skiftarbetare på Dagens Nyheter.

— Då jobbade jag dagtid på ett tryckeri. Men jag slutade efter några år. Jag hade nog jobbat för länge på tidning, jag trivdes aldrig med lugnet, säger han.

Gillar nattskift

Gustav Blomquist har jobbat nattskift i 30 år. Han är maskinsättare, och har varit på Dagens Nyheter i sammanlagt sex år.

— Jag gillar att jobba nattskift. Under hela den tid som jag har jobbat har jag jobbat dagtid sammanlagt åtta månader. Det tyckte jag inte alls om, säger han.

— Men så är det inte för alla. En del har svårt att sova. Det är viktigt att man kan sova bra även på dagen. Och när man har småbarn är det ansträngande att jobba natt. De flesta har problem med sömnen, säger han.

Gustav Blomquists skift går i 14-dagarsperioder. Han jobbar sju nätter mellan fem och halv ett. Dagen efter jobbar han mellan klockan elva och halv fem. Han jobbar dag i tre dagar, sedan är han ledig fyra dagar.

— Dagjobbet är besvärligt. Man gruvar sig för det. När man jobbar dag är arbetstiden en timme längre mot nattarbetstiden. Det känns. Första dagen vid skiftbytet är svårast. Den natten är det svårt att sova. Då är det bättre att jobba bara natt säger han.

Sten Yngborn, maskinsättare, tycker att sena nattskiftet mellan 11 på kvällen och sex på morgonen är väldigt bra.

— Det skulle vara mycket värre att jobba halv fem till halv ett. Som jag jobbar kan man leva ett helt normalt umgängesliv. Jag träffar min sammenboende precis lika mycket som om vi hade samma arbetstider. Det är bara det att vi sover på olika tider.

Han framhåller dock att förutsättningen för nattarbete är att man kan sova så mycket man behöver.

— Jag kan sova hur mycket som helst, säger han. Men jag har en kompis som var lättväckt. Om han vaknade efter att ha sovit bara några timmar kunde han inte somna om igen. Då orkar man ju inte.

— Det är också väldigt viktigt att man är positiv till jobbet och inte tycker att det är plågsamt att ha sådana arbetstider. Det får inte kännas som ett tvång, säger han.

EVA ANDERSSON

Presentation of the Swedish participants in the

FRENCH-SWEDISH MEETING

In Stockholm 7:th to 10:th of September, 1976

Arranged by: The Swedish Work Environment Fund

Association Française-Suèdoise pour la Recherche, Stockholm

Délégation Générale à la Recherche Scientifique et Technique, Paris

Urban Kjellén, Civil Engineer
National Defence Research Institute
Box 416
S-172 04 SUNDBYBERG

Age 27. Received the degree of Civil Engineer in 1971 from the Department of Physics of the Royal Institute of Technology. Since 1972 a research officer at the Department of explosives Technology of the National Defence Research Institute. Works since 1973 on a project on accident prevention in the explosives industry. The project includes a survey study of the work environment and the safety organization in the Swedish explosives industry and the identification of safety problems and the development and introduction of safety measures at three places of work.

Problems of interest for discussion:

1. The study of disturbances:
   a) the organization of the reporting of disturbances in different applications and in different types of production.
   b) the analysis of reported disturbances in a system as a basis for the development of safety measures and decisions of priority.
   c) the use of the intensity rate of different types of disturbances in the valuation of the effect of safety measures on the accident risk.
   d) the study of disturbances in accident research in e.g. studies of risk factors. Research results?

2. Results from studies of the consequences on the accident risk of different characteristics of the work environment such as: degree of mechanization, the control of the repetition rate and the quality of the work (by technological and organizational means), opportunity of social contact etc.
   The application of this type of results in the planning of changes in existing places of work and in the planning of new ones. Conflicts between different types of safety measures, e.g. increased control of the work behaviour and improved psychological climat.

3. The safety organization:
   a) alternative types of organization
   b) the effects of industrial democracy on the accident risk

4. Safety education for newly-appointed and experienced employees. Results from the valuation of different types of education programs (affect on knowledge, risk-taking etc)

5. Pre-requisites and difficulties in the introduction of accident research results in industry.

Jan Kronlund,Dr.Phil.,professor of Architecture,Royal University of Technology,Stockholm,Sweden.

Born 24/3 1936.1955 - 1964 different employments and studies. 1964 - 72 studies in behavioral sciences,spec Psychology. Phil. Dr. of Psychology at the University of Stockholm 1972. 1966 - 1972 leader of a research team at the Institute for Applied Psychology,University of Stockholm.
1972 - 1976 senior lectaurer at the Department of Economics and management,University of Technology,Linköping ,Sweden.
1975 Phil.Dr. in Industrial Organisation at the University of Technology,Linköping.
1976 - 1977 Professor of Architecture,Royal University of Technology,Stockholm.

Some articles in english:

Evaluations of Technical Aids:A conceptual model.in Murdoch,G. Prostethic and Orthotic practice.London,1970.

Paysystem,Production and Safety - A study in a Swedish Iron Ore Mine.Ergonomics ,vol 16,nr 3,1973.

Applied ergonomics:Workers participation and power relations. in La Progrettazione Ergonomica dell´ambiente e del posto di lavoro.Strutture ambientali n. 23-24,Pio Manzú,Rimini,1974.

Production Control and Safety Control.Some theoretocal implications.in Swedish Work Environment Fund:

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_________________. Stockholm ,1976.

The Internal Indústrial Environment.Analysis of the problems and trends in governmental action.A summary report to the OECD.Research report n.o 48, University of Linköping,Sweden,1976.

Carl Lager, Ph D in psychology, Stockholm univ, statistician, 1949-69 bureaudirector RSAF Safety Dep, Analysis and Statistics bureau, from 1966 lecturer at the Royal Institute of Technology in "Technical Safety courses" and project leader (a o "Calibration of Stress Measure Instruments" 1964-74), lecturer at the Int Institute of Aviation 1968-73 and from 1974 at The Board of Work Safety. Senior consultant psychologist at the Sw Board of Civ Aviation since 1974. At present projectleader ASF project "Work with public Danger".

Elisabeth Lagerlöf
National Board of Occupational Safety and Health
Fack
S-100 26 STOCKHOLM, Sweden

Psychologist at the National Board of Occupational Safety and Health. Has studied accidents in forestry, especially through near - accident reporting, has been secretary general of the Swedish Committee of Occupational Injuries Statistics 1973-1976, and is now working on her thesis.

Main interests:
1. Occupational injuries statistics
2. Methods in accident research - especially near-accident reporting
3. The individual's concept of risk/subjective riskestimation/risk-taking
4. The organization of the safety work in the industry

Nils Lundgren ,Professor, MD
Head, Department of Occupational Health
National Board of Occupational Safety and Health
S- 100 26 STOCKHOLM, Sweden

The role of the Department within the National Board is illustrated from the attached leaflet ("L´administration nationale de sécurité et d´hygiène du travail").

The main tasks of the Department consist of research, training and consultant work.

Current research projects are shown in the attached list (dated 1975-12-31).

So far, accident research performed in the Department has been mainly concerned with analysis of near accidents (Lagerlöf), socio-psychological aspects (Lagerlöf, Baneryd, Sundström-Frisk), payment systems and accident risks (Sundström-Frisk), and physiological and ergonomical studies of personal protective devices (Hansson, Holmér).

As a complement to the already existing resources for accident research, a section for technical accident research is just being created in the Department, under the leadership of an Associate Professor. Plans are at present being developed for a research programme to be run jointly by this new section and specialists from other fields, such as work physiology and psychology. The selection of problems to be taken up is being made in cooperation with the Supervision Department of the National Board. The research programme is intended to be integrated with a follow-up programme in which results will be utilized as a basis for occupational safety standards, etc.

Bo Pettersson
Skogsarbeten (Logging Research Foundation)
Drottninggatan 97
S-113 60 STOCKHOLM, Sweden

Mr Bo Pettersson, Forester, is research leader for all projects in the "work environment" field at Skogsarbeten. Together with Prof Bengt Ager he is heading the project "Increased safety in forest work - an action programme for Swedish Forestry", sponsored by the Work Environment Fund. The aim of this project is to decrease the number of accidents in forest work as well as the severeness of the accidents. Forestry is one of the branches topping the list of accidents per million working hours.

The project aims at decreasing the accident rate through improved production technique - better felling equipment, better design of machines, improved protective clothing etc - and also better organization of safety work, i.e. better involvement of the workers in the safety job. In order to reach better involvement by the forest workers a near-accident-reporting routine and work-place meetings on safety in felling will be introduced in Swedish forestry.

The project has a budget for the first year of one million Swedish Crowns and will run over a four year period.

Carin Sundström-Frisk
National Board of Occupational Safety and Health
Work Psychology Unit
Fack
S-100 26 STOCKHOLM, Sweden

Master of Science 1976. Since 1973 psychologist and research assistant at the National Board of Occupational Safety and Health, Stockholm. Working with field and survey research connected with behavioural and motivational factors bearing on worker safety in the logging operation.

Main writings: Factors influencing the use of personnel protective equipment; work behaviour in situations critical from a safety point of view.

At present working on a follow-up study, where the effects of changes in renumeration systems are being evaluated. The main variables to be studied are patterns of accidents and injuries, quantity and quality of work performance and psychosocial conditions.

Problems of interest for me to discuss at the workshop in September.

1. Learning processes

   How to teach people that something is dangerous when their own experiences tell them it is´nt, or put another way: what happens when a person takes a risk and no accident or injury follows?

2. Attitudes to safety of the management and supervisors

3. Evaluation of safety programs

Leif Svanström, B A; M D
Landstingets Hälsovård
Sjukhuset
Sjukhusgatan
S-541 00 SKÖVDE

Doctor´s thesis: Epidemiology on accident in defined community.

Main scientific interest: Epidemiology and preventive medicine, mainly occupational Health and accident prevention.

Scientific production: About 50 articles in the field of social and preventive medicine.

Present status: Physician at Department of preventive medicine, County of Skaraborg, Sweden, mainly responsible for occupational Health in this area.

Present work in occupational accident prevention: Project-leader for a project which tries to unite epidemiological and system-ergonomic approaches in a theoretical modell for further research in the field as well as practical application in daily safety-work in industry.

UDDEHOLM
UDDEHOLMS AKTIEBOLAG

Tjänsteställe, handläggare

CURRICULUM VITAE
Datum
1976-08-31

Ink/ASF
1976 -09- 0

Name	Håkan Teljstedt	
Age	32	
Address	Villavägen 2, S-683 00 HAGFORS	
Education	Graduate Forester	1969
	Course of Environmental management	1968
	"- Ergonomics for Technical planners	1969
	Safety engineer	1971
	Doctor's Degree	1975
Research work	Artificial lighting in forest machine operations - ergonomic aspects	
Employments	Research assistant, National Institute of Occupational Health, department of Work Physiology, Stockholm	1969-1971
	Safety director, Uddeholm's Steel Division	1971-1975
	Environment manager, Uddeholm	1976-
Interested in	Concerning accident prevention work I am interested in effects of ergonomic measures and of organizational questions with reference to safety work.	

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Ulf Aberg
Royal Institute of Technology
Laboratory of Industrial Ergonomics
Drottn. Kristinas väg 47
S-114 28 STOCKHOLM, Sweden

Graduated as an electrical engineer from the Royal Institute of Technology, 1945, Ph.D.(tekn.lic.) 1959 (thesis on the intelligibility of speech)

Scholarship for studies at the Massachusetts´ Institute of Technology, Cambridge, Mass., of information theory, speech transmission and acoustics, 1949-50.

Guest researcher at the Haskins Laboratories, New York City, 1957-1958 (speech perception).

Member of the Council of the Ergonomics Research Society of England since 1975.

Now professor of industrial ergonomics at the Royal Institute of Technology, Stockholm, and at the same time director of the Laboratory of Industrial Ergonomics.

Main interests in industrial safety and accident prevention research:

1. Theoretical considerations of the origin of accidents
2. Profylactic design of production systems

NOTICE

Jacques LEPLAT
Né le 19.10.21
Docteur es lettres et sciences humaines
Directeur du Laboratoire de Psychologie du Travail
de l'Ecole Pratique des Hautes Etudes
Co-Directeur et rédacteur de la revue "Le Travail Humain"
Vice-Président de la Société d'Ergonomie de Langue Française
Membre du Comité directeur de l'Association Internationale de
Psychologie Appliquée.

Publications :
Attention et incertitude dans les travaux de surveillance et d'inspection
(Dunod 1968).
Participation au Traité de Psychologie Expérimentale de Fraisse et Piaget
(un chapitre) et au Traité de Psychologie Appliquée de Reuchlin (4 chapitres)
En collaboration
avec Faverge et Guiguet : l'Adaptation de la machine à l'homme (1958)
avec Cl. Enard et Weill-Fassina : La formation par l'apprentissage (1970)
avec X. Cuny : Les accidents du travail (1974)

Soixentaine d'articles sur des problèmes de psychologie du travail.

Colloque Franco-Suédois

Sur

LES ACCIDENTS DU TRAVAIL

STOCKHOLM 7-10 Septembre 1976

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Sous l'égide de l'Association Franco-Suédoise pour la Recherche (A.F.S.R.)

Organisateur français : D.G.R.S.T.
Dominique JEROME

Organisateur suédois : A.S.F.
Bo OSCARSSON

-:-:-:-:-:-

LISTE DES PARTICIPANTS FRANCAIS

ET TITRES DES COMMUNICATIONS

Professeur P. CAZAMIAN
Directeur du Département d'Ergonomie et d'Ecologie
Université de Paris I
35, rue Broca
75005 - PARIS.

- Etude multidisciplinaire des incidences du travail de nuit sur la fatigue mentale industrielle. Conséquences en matière de sécurité.

- A multidisciplinary study of the consequences of night-work on industrial mental stress. Consequences regarding safety.

Monsieur Yvon CHICH
Directeur du Laboratoire de Psychologie de la Conduite
O.N.S.E.R.
Autodrome de Linas
91310 - MONTLHERY.

- Sécurité du travail et sécurité routière : Esquisse d'une analyse comparative à propos de cas des conducteurs professsionnels.

- Safety at work and road safety : a draft of a comparative analysis illustrating the case of professional drivers.

Monsieur Xavier CUNY
Laboratoire de Psychologie du travail de l'EPHE
41, rue Gay-Lussac
75005 - PARIS

- Une méthode d'analyse des accidents. Expérience d'enseignement et d'évaluation.

- An accident analysis method : teaching and evaluation experiment.

Monsieur Francis JANKOVSKY
C.N.A.M.
Laboratoire de Physiologie du Travail et Ergonomie
41, rue Gay-Lussac
75005 - PARIS

- Les communications dans les équipes de travail.

- Communications within working groups.

Docteur Jean-Jacques JARRY
Conseil Médical
I.N.R.S. - Institut National de Recherche et de Sécurité
30, rue Olivier Noyer
75680 - PARIS CEDEX 14.

- La part du médecin du travail dans la prévention des accidents.

- The industrial medical officer and accident prevention.

Monsieur JAUNET
Service 0071 (Conditions d'Emploi et de Travail)
Régie Nationale des Usines Renault
8-10 Avenue Emile Zola
92109 BOULOGNE-BILLANCOURT

- Etude combinée de la sécurité et du bruit sur petites presses d'emboutissage.

- Combined study of safety and noise on small stamping power presses.

Professeur Jacques LEPLAT
Directeur du Laboratoire de Psychologie du Travail de l'EPHE
41, rue Gay-Lussac
75005 - PARIS.

- La reconstitution de la genèse des accidents : intérêt, difficultés et limites.

- Reconstruction of the origin of accidents : advantages, difficulties and limitations.

Monsieur E. QUINOT
Directeur Scientifique
I.N.R.S.
30, rue Olivier Noyer
75680 PARIS CEDEX 14.

Centre de Recherche de l'I.N.R.S.
Avenue de Bourgogne
54500 VANDOEUVRE-LES-NANCY

- La prévention des accidents du travail. Recherche et description des facteurs potentiels d'accidents.

- Occupational accident prevention. Research and description of potentional factors of accidents.

Monsieur Norbert SÉE
Laboratoire de Physiologie du Travail et Ergonomie
C.N.A.M.
41, rue Gay-Lussac
75005 - PARIS.

- Accidents et charge du travail en agriculture.
- Accidents and work-load in agriculture.

Professeur Alain WISNER
C.N.A.M., Laboratoire de Physiologie du Travail et Ergonomie
41, rue Gay-Lussac
75005 - PARIS.

- Quelques tendances en matière de sécurité du travail.
- Some tendencies regarding work safety.

N O T I C E

Xavier CUNY
Chargé de recherche au C.N.R.S.
Laboratoire de Psychologie du Travail de l'E.P.H.E.
Doctorat de troisième cycle, mention Psychologie Industrielle.
Doctorat d'état en préparation.

PRINCIPALES PUBLICATIONS

- Recherche sur la sécurité dans la sidérurgie française. Publication de la Commission des Communautés Européennes. Collection "Physiologie et Psychologie du Travail". Vol. 3, fasc. 9, 344 p., Luxembourg 1966 (avec J. LEPLAT et E. KAHN).

- Synthèse des recherches sur la sécurité menées dans la sidérurgie européenne. Publication dº précédente, vol. 4, 231 p., Luxembourg 1967 (avec J. LEPLAT).

- Recherches sur le contrôle à distance (revue de synthèse). In "Travail Mental et Automatisation". Publication dº précédente, vol. 6, 88 p., Luxembourg 1968 (avec J. LEPLAT).

- Sémiologie et étude ergonomique des communications de travail. Le Travail Humain, 1969, 32, 3-4, pp. 177 - 198.

- Eléments de formalisation pour servir à l'analyse psychologique d'un travail de contrôle. Le Travail Humain, 1972, 35, 1, pp. 1 - 16 (avec P. DERANSART).

- L'approche psycho-sémiologique : étude d'un code gestuel de travail. Cahiers de Linguistique théorique et appliquée, 1972, 9, 2, pp. 261 - 275.

- Les accidents du travail. Paris, PUF, coll. "Que-sais-je ?" 1974 (avec J. LEPLAT).

- Les intermédiaires graphiques dans le travail : principes de caractérisation des codes. Le Travail Humain, 1974, 37, 2, pp. 213 - 228 (avec J.M. HOC).

- Le psychologue et l'étude des accidents. Psychologie Française, 1975, 20, 4, pp. 191 - 197.

- Plus quinze autres articles de Psychologie du Travail.

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ACTIVITES HORS RECHERCHE

- Membre du Bureau de la Société d'Ergonomie de Langue Française ; rédacteur en chef du Bulletin de la Société.
- Conseils scientifiques : Institut National dé Recherche et de Sécurité, Service des Phares et Balises, Institut National de Recherche et de Documentation Pédagogique, Centre National d'Etude des Télécommunications, Société Saint-Gobain - Pont à Mousson, etc.

CURRICULUM VITAE de A. WISNER (Juin 1976)

A. WISNER, né le 2 Novembre 1923, a d'abord eu une orientation médicale, docteur en médecine en 1952, oto-rhino-laryngologiste qualifié, il pratiqua cette spécialité dans un hôpital parisien. Il s'est orienté ensuite vers la psycho-physiologie, il est diplômé de psychologie appliquée de l'Université de Paris (1954) et docteur de l'Université de Paris (Sciences) en 1955.
De 1954 à 1962, A. WISNER crée et dirige le laboratoire de Physiologie et de Biomécanique de la Régie Nationale des Usines Renault où il participe à l'amélioration des différents produits de l'entreprise en introduisant des données relatives à l'homme dans les travaux du bureau d'études. Les principaux travaux du laboratoire de la R.N.U.R. portent sur la structure dimensionnelle du poste de conduite, l'étude de l'homme comme système de masses suspendues, l'étude biomécanique des chocs, l'évolution de la vigilance en situation de conduite.

De 1962 à 1966, A. WISNER est chargé de recherche au Centre Nationa de la Recherche Scientifique et sous-directeur du laboratoire de Physiologie du Travail de ce même organisme. Les équipes du laboratoire sont orientées vers la compréhension de la parole en milieu bruyant, les paramètres physiologiques au cours des vibrations et l'étude de la posture dans les travaux exigeant une grande attention.

En 1966, A. WISNER est nommé Professeur de Physiologie du Travail et Ergonomie au Conservatoire National des Arts et Métiers où il crée des enseignements à trois niveaux : formation de techniciens supérieurs, formation d'ingénieurs et filière conduisant au titre d'Ergonomiste C.N.A.M. Chaque année, un cycle de Méthodologie Ergonomique porte sur un thème différent : génie industriel, conception du produit, production de masse, charge mentale ...
Un cycle d'un an à temps plein permet aux diplômés de l'enseignement supérieur français et étrangers (ingénieurs, médecins, psychologues, administrateurs) d'acquérir une formation d'ergonomiste praticien en langue française. En outre, des réunions scientifiques régulières permettent de discuter des problèmes de recherche étudiés au laboratoire.

Les travaux actuellement conduits au Laboratoire de Physiologie du Travail et Ergonomie du CNAM portent sur les thèmes suivants :

- évaluation de la charge de travail en situation industrielle par des mesures électrophysiologiques, des analyses du travail et des enquêtes psycho-sociologiques,
- caractéristiques du sommeil des travailleurs de nuit, et, plus généralement, des personnes dont les périodes de sommeil sont déterminées par l'organisation sociale,
- étude du vieillissement, en particulier ostéo-articulaire, des travailleurs d'âge moyen (40/45 ans)
- intelligibilité de la parole sur fond de bruit intense,
- effet des vibrations et des secousses sur le mouvement volontaire,
- évaluation de l'importance de l'environnement mobile,
- méthodologie ergonomiques dans l'ingénierie et l'aménagement des activités secondaires et tertiaires.

Outre ses activités propres à sa charge, A. WISNER a eu des responsabilités internationales :

- Secrétaire général - fondateur de la Société d'Ergonomie de Langue Française,
- Membre du Conseil de l'Ergonomics Research Society, 1963-1969
- Membre du Bureau de l'Association Internationale d'Ergonomie 1964-1972,
- Conseiller Scientifique de la Recherche Communautaire Ergonomique, 1965-1973
- Secrétaire général - fondateur de l'International Research Commitee on Biokinetics of Impact (IRCOBI)
- Cofondateur du groupe PROMSTRA (ergonomie dans l'ingénierie)

Sur le plan National, A. WISNER a été Conseiller à l'Institut National de Recherche et de Sécurité. Il est Conseiller Scientifique à l'Organisme National de Sécurité Routière et a été Membre du Conseil Scientifique de l'Institut de Recherche des Transports.
A. WISNER est également Membre de la Commission de l'Emploi et du Travail du VII Plan, du Conseil National de la Statistique et du Comité National de la Recherche Scientifique (23ème Section Psycho-physiologie et Psychologie).

French-Swedish Symposium on
Occupational Accidents Research

P R O G R A M

Monday, September 6th

- Arrival

Tuesday, September 7th

9.00 a.m.	- Visit to the National Board of Occupational Health and Safety (Arbetarskyddsstyrelsen). Prof Nils Lundgren, Dr Elisabeth Lagerlöf (Leave hotel by car at about 8.30)
12.00	- LUNCHEON
13.30	- Visit to the Royal Technical University of Stockholm, Institute for Aviation Technology and Institute for Industrial Ergonomy. Prof Carl Lager, Prof Ulf Åberg
19.00	- Reception and dinner at Wenner-Gren Center, 23rd floor, Sveavägen 166, Stockholm

Wednesday, September 8th

8.15 a.m. - Visit to Oxelösunds Järnverk, Oxelösund (One of the biggest iron-works factories in Sweden, about 120 kilometers south of Stockholm). M.M. Brännström. Bus leaves from your hotel 8.15 a.m. Return to Stockholm about 16.30 p.m.

10.00 Arrival

Coffee - General introduction to the company

10.30 The company from the point of view of the employees

Statistics concerning the employees
Among others: The number of employees
Distribution women-men
Foreign employees
Absenteeism
Accident statistics etc

11.00	Company health service:
	Organization Work organization Co-operation Education etc
11.30	Special activities within the accident area
	Questions - discussion
12.00	Luncheon at the company lunch-room
13.15	Visit to the ironworks
14.30	Coffee - Questions and ansvers - Ready for departure
15.00	Departure for Stockholm

Thursday, September 9th

9.00 a.m. - Seminar

The seminar will take place at Industrihuset, Storgatan 19, Stockholm

9.00-12.00 - Session. Presentation of and discussion on different projects in France and Sweden. Each of the presentations should take about 10-15 minutes whereafter a discussion of about 10 minutes will take place.

- Research and development regarding work safety in Sweden
  by Elisabeth Lagerlöf, Sweden
- Some tendencies regarding work safety
  by Alain Wisner, France
- Practical experiences of difficulties in accident prevention
  by Håkan Täljestedt, Sweden
- The industrial medical officer and accident prevention
  by Jean-Jacques Jarry, France
- Reconstruction of the origin of accidents: advantages, difficulties and limitations
  by Jacques Leplat, France
- An accident analysis method: teaching and evaluation experiment
  by Xavier Cuny, France
- Occupational accident prevention. Research and description of potentional factors of accidents
  by E Quinot, France

- Development of a method of occupational accident research and practical safety work
  by Leif Svanström, Sweden

- Dangerous work. Experimental methods for control of workload and man/machine adaptation
  by Carl Lager, Sweden

  This project will be presented Tuesday Sept. 7th. 13.30 p.m.

12.00 LUNCHEON

13.00-17.00 Session continues

- Power relations, behavioral control system and safety in industry
  by Jan Kronlund, Sweden

- Safety in Forestry. Remunerative system and risk-taking
  by Carin Sundström-Frisk, Sweden

- Accidents and work load in agriculture
  by Norbert See, France

- Identification, risk consciousness and work organization. Three concepts in job safety
  by Elisabeth Lagerlöf, Sweden

- ~~Safety at work and road safety: a draft of comparative analysis illustrating the case of professional drivers~~
  ~~by Yvon Chich, France~~

- Accident prevention in explosives industry
  by Urban Kjellén, Sweden

- Communications within working groups
  by Francis Jankovsky, France

- Combined study of safety and noise on small stamping power presses
  by Monsieur Jaunet, France

- ~~A multidisciplinary study of the consequenses of night work on industrial mental stress. Consequences regarding safety~~
  ~~by P Cazamian, France~~

- Logging research from basis - applied research and development for forestry
  by Bo Pettersson, Sweden

- Future plans for accident research at the National Board of Occupational Safety and Health
  by Nils Lundgren, Sweden

17.00 DINNER

18.30 Evening session (prel.)

Friday, September 10th

9.00 a.m.	-	General methodological aspects on occupational accidents research (organization research, statistical empirical methods, experimental technical research development) The discussion will take place at Industrihuset, Storgatan 19, Stockholm
12.00	-	LUNCHEON
13.30	-	Concluding discussion. Further French-Swedish co-operation in occupational accidents research.

Pressconference (prel.)

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Location: Hotel MORNINGTON
Nybrogatan 52
Stockholm

ARBETARSKYDDSSTYRELSEN
NATIONAL BOARD OF OCCUPATIONAL
SAFETY AND HEALTH
International Secretariat
Byrådirektör G Warnbeck, CA

Ink/ASF
1976-09-0

1976-09-01 074.63

Visit by French research scientists to the Board of Occupational Safety and Health, Industrivägen 5, 5th floor, 1976-09-07

09.00 - 10.00	Gunnar Danielson, Director General.
	General presentation of the Board.
	Present and future Swedish Work Environment Legislation and Administration.
	Discussion.
10.00 - 10.30	Coffee break.
10.30 - 11.00	Elisabeth Lagerlöf, Psychologist at the National Board of Occupational Safety and Health
	The report from the Committee on Occupational Injuries Statistics.
	Discussion.
11.00 - 11.30	Nils Lundgren, Professor, Head of Occupational Health Department.
	Work Environment Research.
	Discussion.
11.30 - 12.00	Bengt Knave, Associate Professor, Head of Physical Occupational Hygiene Section.
	Visit to laboratory.

Program for meeting
on September 7th, 1976.

13.30 Visit to the Royal Institute of Technology, Dept: Aero-nautics.
Main entrance: Valhallavägen 79 (Drottning Kristinas väg 11), Stockholm.

Program for studies in "Work-Science" for technical students.

"System-Ergonomic" and "Technical Safety" courses.

Research and education policy in "Accident Research". Risk theories.

Technical provocations on man as accident cause factor.

Physical and physiological degradations in man as cause factors.

Individual risk variance.

Lager project:
1. Dangerous work.
2. Experimental methods for control of workload and man/machine adaptation.

15.00 Visit to the Laboratory of Industrial Ergonomics.

Coffee break and Presentation of accident prevention projects.

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Work with public Danger.
(Allmänfarligt arbete)

Carl Lager

Purpose

The project is set out to specify work conditions in jobs involving a risk that disfunctions may cause accidents to "third man" and human environment.

The specification should be a base to actions for central control and reduce the risk for such accidents.

Background

Work conditions involving general danger are normally found in complex technical systems. The complexity is logically related to a high technical disfunction frequency. Complex systems are also often vulnerable to environmental interferencies. With the background of "system instability" human control components "on the line" are often required in the production. Systems of this type are more or less normally found in transportation but also in other industries, e.g. chemical and nuclear production. The job as system control component will in the present development be more and more common.

In technical systems involving public danger Society must claim and control a high system reliability. The system reliability is mainly a function of the reliability in the human control components.

The work conditions, as one of the bases for the reliability of man in the system, must be controlled by the Society not only for the general wellfare but also to guarantee the work hygiem and sound aging of the individual in the system where the specific workload, physical risk and the responsibility can be vitally destructive.

Plan

In the first project part, now under work, the human control component's function, workload and risk in instable technical systems is defined in a theoretical model.

The next part will be a control and development of the theoretical model in some real work situations, also with discussions of the definition of "general danger".

A third step is development of empirical and experimental methods by which work conditions can be "measured" to change the character of the model from theoretical to "numerical".

The model can then be directly used for central interference and necessary modifications by regulations in the real work situations.

The Model

The accident is defined as a sudden unwanted proceeding with sad consequences.

We are here concerned with accidents related to the operation of technical systems with human control components. The accident is caused by one or several disfunctions in the system. Normally in modern systems several disfunctions must occur in a chain-reaction to form an accident potential. In a wast majority of the disfunction chains we find at least one described as a control component disfunction. System reliability is defined as the inverted risk for disfunctions. The system reliability is then in these systems a main function of the reliability in the human control component.

Human reliability (the inverted risk for disfunction)varies in three different dimensions. The first is the grade of man-machine-adaptation. In this dimension we have many unsolved problems which more or less uncontrollable initiates "human" disfunctions. The development of the "safe" control station is of course under progress.

The other dimension is the interindividual reliability variance. This can generally be described as an individual capacity to adjust to the specific job situation and to be happy in it. A failure means as demonstrated a dramatically raised disfunction risk. The interindividual reliability variance is most probably not a continuum but a dictrotomized distribution in a normal and an abnormal risk level. In dangerous systems we have to accept routines of discrimination in terms of physical and mental fitness for the responsibility, of training control, of periodic checks and of job circulation as an expected procedure. These routines are with proven effects mandatory in civil aviation and should be developed and applied generally where society wellfare is concerned.

The third reliability dimension is the intraindividual degradation of normal capacity with the logical degradation of reliability. The cause is mainly effects of non-tolerable workload both acute and with latent long-time effects. In the concept of workload must be involved both work-organization and aspiration. In the instable, dangerous technical system the human control component is exposed to an impact of mental workload everywhere recognized as stress-factors: complexity, monotony, emotional provocations, frequent and high psychophysiological excitaion, a high precision, to be continously controlled, effects of responsibility, the physical risk, irregular working hours, aging effects, the disqualification risk and much more. A fatal fact in the present sitaution is that we have very little, if any, knowledge of which grade of Provocation in these factors is Tolerable against the claim of Reliability we have on the individual.

It is necessary to define "workload" in the wider concept and to measure the effects on the individual reliability in cross-scientific research as a base for central limitations of working hours, especially in irregular schemes, of workload intensity, of pension age and definitions of rest as a work duty.

Methods

In Sweden an emphasis has been laid on empirical, statistical models for exploration and control of accident risks. The central accident EDB-register is under revision; unfortenately not to any degree that can make it to an effective safety tool. In special branches, especially in civil aviation, statistical analysis based on function-reports from the pilots has supplied vital information. A material is included in project part II referred under "Plan" above.

It is obvious that even with sufficient statistical materials for empirical models of function and risk, measuring under experimental conditions are necessary to effect the practical decision-makers. The project will use a psychophysiological battery both in reality and simulated function for the specification of energy mobilisation, consumption and rehabilitation. The measurements will define a specification both of workload and of the individual concerned to supply a numerical model as a base for central system modifications as in step 3 referred under "Plan".

The battery and method can (as already routine in Scandinavian Civil Aviation) then be used as a control instrument both in new systems and in work routines in the Society's necessary interest in the reliability of dangerous systems and production

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The project report part 1 och 2 (ref "Plan") are in print.

ke 15⁰⁰ —

Accident prevention projects at the Laboratory of Industrial Ergonomics, Stockholm

The work made at the Laboratory of Industrial Ergonomics (AML) has a broad ergonomic planning and purpose where the final product is aimed to be a new construction or a new organisation of a work place or a work method. This product shall accomplish a series of human criteria concerning physical as well as psychological well-being.

Among these criteria those concerning safety make an important part and with the targets given above, accident prevention becomes an integrated part in the complete construction process.

For natural reasons heavy and physiologically active work has attracted the main attention of the Laboratory in the case of accident prevention. The influence of climate is another important factor, where the extreme climate of the warm parts of the steel industry as well as the cold climate of the food industry has been an object of the efforts of the Laboratory. Within the steel industry a considerable work has been made in the casting work, that is the part of the steel production which begins with the molten steel until it has solidified in the moulds. The accident risk is here the risk of contusions and above all of burns, of which some unfortunately are fatal.

An analysis of the working process leads to the conclusion that the possibilities to decrease the accidents by protective means are very limited within the frame of the existing production systems. There is a need of a more fundamental change in the production process.

In such a new construction process there arise certain problems of a purely technical nature, which must be solved before the construction process can proceed. Essential for the work as a whole is also the need to consider the interaction between man and machine and man and process but also the interaction between the different members of a group or a work team.

The psycho-social criteria are thus a corner-stone in the safety considerations.

The works in this field have lead to completed projects, some of which have started to come into application. In this work AML has played a central role, but a fruitful cooperation has taken place between AML and the industries concerned, where both collective workers and technical personnel have made their contributions. None of these parties has been dispensable.

Within the food industry, and in this case especially the meat industry, climate is a big problem, for natural reasons conditioned by the opposition between bacteriological demands and human comfort requirements. Accident risks include two main problems, viz. slipping risks and cutting risks, where primarily cutting risks might be supposed to be correlated to low temperature. These two aspects of accidents withing the industry has been treated as essential questions in the total complex of the working conditions in the branch.

The conclusion of the preliminary analyses has been the same as for the hot industry, viz. the difficulty to achieve considerable ameliorations without a profound innovative approach. Questions like working rate, work organization, learning, skill etc. are of great importance, which makes psychological and sociological criteria very important indeed, possibly even more important than in the quoted examples from the steel industry. The works of AML in this branch have not been pursued during such a long time as within the steel industry and are thus at an earlier stage.

Ulf Åberg

ARBETARSKYDDSFONDEN
Swedish Work Environment Fund

BO/MBN 1976-08-30

To
The French participants at the
"Accident at work"-meeting
in Stockholm, September 7-10, 1976.

Referring to our last letter, please find enclosed the abstracts of the Swedish representatives for the French-Swedish Symposium on occupational accidents research in Stockholm.

With the best regards.
Yours sincerely,

Bo Oscarsson

Adress
Wenner-Gren Center
Sveavägen 166, ~~6 tr~~ 11 tr.
113 46 Stockholm

Telefon
~~08 - 30 65 00~~ 08- 15 13 00
08 - 30 06 40
08 - 30 06 50

Telegramadress
Workhealthfund

~~GATAN~~ GATAN
HAGA GATAN 25 A

31 Août 1976

Monsieur le Professeur Gardell
Psychological Laboratories
University of Stockholm
Box 6706
S-113 85 STOCKHOLM
(Suède)

Cher Bertil,

Je suis heureux que vous puissiez me recevoir à Stockholm la semaine prochaine, et puisque vous me laissez la liberté du choix, je vous propose le lundi 6 au matin, à 10 heures dans votre laboratoire.

J'arriverai dès dimanche 5 Septembre à Stockholm, où je passerai la soirée avec mon ancien élève Nils Petersson.

Mon hôtel est l'Hôtel Morington, Nybrogatan 52, à Stockholm.

En ce qui concerne mon rapport sur le travail posté, il ne comporte rien d'original, mais tend à décrire l'état de la question et à formuler des propositions correspondant à la société française actuelle. Malgré cela, je serai très heureux de discuter avec vous-même et le Docteur Bolinder.

Je crois que la seule période qu'il me reste est le dîner du lundi 6.

Veuillez agréer l'expression de mes sentiments cordiaux.

A. Wisner

PSYCHOLOGICAL
LABORATORIES

UNIVERSITY OF STOCKHOLM
Box 6706
S-113 85 Stockholm, Sweden

Stockholm, August 19, 1976

Professor Alain Wisner
Conservatoire National des Arts et Métiers
Département des Sciences de l'Homme au Travail
41, Rue Gay-Lussac
75005 PARIS
Frankrike

Dear Alain,

Since my previous note there has been some newspaper articles and comments to your report on shift work. As you may know the Swedish Work Environment Fund sponsors a number of research projects in this field. I am responsible for one of them, dealing with social and psychological aspects of irregular working hours. There is an interest in my group to hear your views and exchange experiences in this matter and also I have been asked to try to set up a meeting between you and myself and Dr Erik Bolinder of the Swedish LO. Maybe that latter meeting could be in the form of a dinner one evening. I have given Bolinder the dates I gave you in my letter. I hope that it will be possible to make these suggested arrangements.

Best regards,

yours sincerely,

Bertil Gardell

Bertil Gardell

cc Dr Erik Bolinder, LO

BG/GB

PSYCHOLOGICAL
LABORATORIES

UNIVERSITY OF STOCKHOLM
Box 6706
S-113 85 Stockholm, Sweden

Nordkoster 3/8 1976

Monsieur le Professeur Alfred Wisner
Conservatoire National Des Art Et Métiers
Departement des Sciences de lHomme au Travail
Physiologie du Travail - Ergonomie
41 Rue Gay- Lussac
75005 Paris

Dear friend,

I certainly enjoyed our brief encounter in Paris and only regret we did not have time for a more substantial conversation. I will therefore look forward very much to meeting you in Stockholm and hope that we can find a suitable time. I will be free on September 6 in the morning on September 7 in the afternoon and on September 8 in the morning. The rest of the week I will be out of town. I suggest that you write your preference to me and choose a time so that I may have the honou r and privelege to either take you to lunch or dinner. I hope that we can meet in my office and if you are interested to meet with some other people at our department, please let me know. For your information I will send some short articles under separate cover.

Looking forward to seeing you!

Yours sincerely

Bertil Gardell

Bertil Gardell

Some research tendencies in the field of work safety in France

–

A factual approach

A. WISNER

1.0. A biological view on the working class

. Big differences in life expectancy, in ageing between manual workers and clerical workers

– These differences are not only related to working conditions but also to the general life conditions (food, housing, medical care)

– The part of working conditions is anyway very important and specially the work accidents.

– During the life of a manual worker, we may observe :

- 5 accidents followed by a rest period
- 0,5 severe accidents
- 5 [%] permanent incapacity degrees

– These values are multiplied by 2 (at least) in building and public works industries and by 3 or more in lot of agricultural activities.

– To ~~those~~ these work accidents, we have to add the road accidents : 15.000 killed and 300,000 wounded every year in France. A high proportion of these road accidents are, in fact, work accidents.

– These accidents and the general conditions at work and in life accelerate the ageing of workers. One can make a distinction between „normal ageing" and „marks of life"

2.0. New trends in the main fields of research on work safety in France

2.1. The worker

- Reduction in the tendency to use personal selection
- Increasing interest for the caracteristics of the different categories of the workers population
  - women : 40 %
  - ageing people (> 40 years old) 50 % - These people have aged more quickly than the rest of the population in relation to their past working conditions (marks of life) C.N.A.M.
  - handicaped people. A handicap has no absolute value. It is strictly related to the task and has to induce changes in the task and/or environment.
- Increasing interest for the body and mind changes inducing higher risks and related to the working conditions : (AUDRAN, ROHR, SZEKELY, MONTEAU, JARRY (INRS))
  - toxics, drugs
  - monotonous work
  - overload (LAVILLE, CAZAMIAN)
  - shift work inducing lack of sleep and low vigilance (CAZAMIAN, FORET)
- Increasing interest for some types of limitation that have not yet been enough explored
  - effects of peak mental and physical load
  - ~~immediate~~ short term memory
  - body image and space representation through visual and vestibular inputs - Training and ageing of these abilities (C.N.A.M. - C.N.R.S.)

2.2 Task and technical layout

- legislation, standardisation, reinforcement
- Psychophysiological studies of the technical layout
  - Theoretical layout (as it is conceived in the engineering department)
  - real layout (how things are now working at the shop floor) TEIGER
  - operational image (how the worker understands the things working) PAILHOUS
- Training related to these analysis (real layout and operational image) and the knowledge of the permanent contribution of the workers initiative to the smooth functioning of the technical layout.
- 3 criteria for the machine design and the evaluation of the individual protective devices
  - protection efficiency (JAUNET) with many researches in the field of biomecanics (IRCOBI, ONSER INRS), ventilation (INRS), ~~transparency (INRS)~~ noise (CRAM-CNRS)
  - comfort
  - easy performance at work
- An interesting approach of the real mode of utilization of the machines and individual protective devices is the careful examination of used machines and I.P.P. (FAVERGE, RNUR, ONSER, INRS)

2.3 Communications

- Formal or informal |

- 3 main aspects
  - perception (acoustics)
  - identification (phonetics)
  - meaning (semantics)

- Verbal communication (ROSTOLLAND - CNRS - CNAM)

How foreign workers understand verbal orders shouted in a noisy place : important safety problem in France where many foreigners are working in building industry and steel works.

2.4 Psycho - sociological problems

- Type of supervision
- Attitude of management toward safety
- Study of safety problems with the workers
  - Commitees for hygiene and safety
  - ERACT (Research and action teams for working conditions) ~~CAVE~~ (U.I.M.M.)
- Type of management action (?) on safety
  - Rewards or punishments
  - Teaching or advertisement
- Image of the plant among the workers - their interest for the jobs
- Type of salary (piece rate ...)
- Pressure on quantity or quality of production.

2.5. Systems research

- Accidents as a symptom of organization failure (FAVERGE, LEPLAT, CUNY)
- Description of potential factors of accident

- Decision and action trees (C.E.A., Atomic energy Center)

- Use of ~~there~~ these extensive approaches in special areas: road (CHICH), agriculture (SÉE)

HÖGSKOLAN I LULEÅ
UNIVERSITY OF LULEÅ · SWEDEN

76-08-26

Professor Alain Wisner
Conservatoire National des Arts et Mêiers
41 Rue Gay-Lussac
75005 Paris

FRANCE

Dear Professor Wisner,

Excuse my tardiness in replying your letter which actually is due to the fact that I just arrived back to Luleå, after a spendid trip on the continent. We would be very proud to recieve you and Mr Jankovsky on the 8th of September. I hope it can still be done. We will pay you the trip between Stockholm to Luleå. There are flights leaving Stockholm early Wednesday morning and you could return the same day. Should you prefer to arrive late Tuesday night, hotelrooms can easily be reserved. A modest fee will be payed in accordance with our regulations (approx. 240 kr per lecturing hour).

I wonder if you could possible give a lecture for our students (approx. 25) on shiftwork (Circadian rythms) as applied to factory work. I understand you have been doing research in this area. Later the same day we would appreciate to discuss about developmental trends in Ergonomics. All of this can of course be quite informal as we agreed.

Could you send me a small note indicating when you would like to arrive, and we will send you the flight tickets to your address in Stockholm.

My best regards to Mr Jankovsky

Yours sincerely

Martin Helander

Martin Helander Ph.D
Dept. of Ergonomics
Luleå University of Technology
S-951 87 LULEÅ
SWEDEN

SECRÉTARIAT D'ÉTAT AUX UNIVERSITÉS
CNAM CONSERVATOIRE NATIONAL DES ARTS ET MÉTIERS
Département des Sciences de l'Homme au Travail
PHYSIOLOGIE DU TRAVAIL — ERGONOMIE

Paris, le

DAGENS NYHETER

STOCKHOLM

105 10

Mr PETER BRATT

28 Juin 1976

Monsieur Maisonnier
Service des Affaire Scientifiques
21 Bis rue Lapérouse
75016 PARIS

Monsieur,

Je vous prie de trouver ci-joint le curriculum vitae nécessaire pour la préparation du colloque franco suédois sur la prévention des accidents du travail qui aura lieu à Stockholm du 7 au 10 Septembre 1976.

C'est Madame Miquel qui m'a invité à vous adresser les documents.

Veuillez agréer, Monsieur, l'expression de ma parfaite considération.

A. Wisner

1er Juin 1976

Monsieur le Professeur J.F. Miquel
D.G.R.S.T.
35 rue St-Dominique
75700 PARIS

Copie : Mr Jérome
F. Jankovsky

Mon cher collègue,

Je vous remercie de m'inviter au colloque franco-suédois qui aura lieu à Stockholm du 7 au 10 Septembre 1976. J'ai l'intention d'y participer étant donné le prix que j'ajoute à la sécurité du travail d'une part, et à la poursuite des relations importantes que notre laboratoire entretient avec les chercheurs suédois d'autre part.

Comme vous le savez, j'ai été quelque peu déçu de la composition de la délégation. J'avais en effet espéré que Monsieur Jankovsky en ferait partie.

Monsieur Jankovsky est un boursier DGRST; il a longuement travaillé dans l'industrie et, en particulier, il a enseigné la sécurité et l'ergonomie pendant deux ans à l'U.I.M.M. Il est l'auteur d'un travail personnel sur les risques encourus par les travailleurs aux puits de forage de pétrole du fait de l'impossibilité des communications verbales (contrat CFP). Il devait faire un exposé sur les communications verbales et non verbales dans les chantiers du bâtiment et les grands ateliers bruyants.

Monsieur Jankovsky ira d'ailleurs en Suède d'ici la fin de l'année, car il est invité par le Professeur Martin Helander à donner une semaine d'enseignement au Département d'Ergonomie de l'Université de Lulea.

Toutefois, je saisis les difficultés que vous avez pu rencontrer pour composer notre délégation et accepte de représenter seul ce que mes collaborateurs et moi-même avons pu réaliser comme recherches dans le domaine de la sécurité. Il me semble, dans ces conditions, que le titre de mon exposé ne devrait pas être limitatif comme le premier que j'ai donné, mais plus large :

"Quelques tendances de recherche en matière de sécurité du travail".

.../...

Je pourrai alors exposer les travaux de biomécanique des chocs que j'ai réalisés chez Renault et qui se sont développés avec ma participation au laboratoire des Chocs de l'ONSER et au laboratoire de Physiologie et d'Ergonomie de l'INRS.

Il me sera possible également de traiter des travaux relatifs à la vigilance qui ont commencé à la RNUR et se sont développés au CNAM, ainsi que des recherches sur les communications verbales et non verbales dont j'ai parlé plus haut.

Enfin, il me sera possible d'évoquer les effets sur la sécurité du conflit oculo-vestibulaire.

Ces travaux ne sont d'ailleurs pas totalement ignorés des Suédois, puisque j'ai créé avec le Professeur Aldman de Goteborg l'IRCOBI (International Research Committee On Biokinetics of Impacts), avec le Professeur Aberg le groupe PROMSTRA (Promotion de l'ergonomie dans l'ingéniérie pour améliorer les conditions de travail et la sécurité), et qu'une heureuse collaboration s'est établie avec le Laboratoire de Physiologie de l'Institut du Travail que dirige le Professeur Lundgren dans le domaine des vibrations.

Veuillez agréer, mon cher collègue, l'expression de mes sentiments dévoués.

A. Wisner

MINISTERE DE L'INDUSTPIE
ET DE LA RECHERCHE

DELEGATION GENERALE
A LA RECHERCHE SCIENTIFIQUE
ET TECHNIQUE

~~Adjoint au Délégué Général~~

Mission Scientifique

003741 - 25 MAI 1976

Paris, le

35, rue Saint-Dominique - 75700
Téléphone : 551 74 30
551 89 10
555 52 78

TELEX : DGRST 204 643 F

N° MS/45/MG
à rappeler

OBJET :Colloque Franco-suédois sur les accidents du travail

Monsieur le Professeur,

Sous l'égide de l'Association Franco-Suédoise pour la Recherche (A.F.S.R.), la Délégation Générale à la Recherche Scientifique et Technique organise, conjointement avec l'Arbetarskyddsfonden (A.S.F. Fonds pour l'environnement du travail), un colloque sur les accidents du travail, qui doit se tenir à Stockholm du 7 au 10 Septembre 1976.

J'ai le plaisir de vous inviter à faire partie de la délégation française qui, comme la délégation suédoise, comprendra une dizaine de chercheurs concernés par les accidents du travail.

En principe, les journées des 7 et 8 septembre seront consacrées à des visites d'entreprises ou de laboratoires, tandis que les séances de travail auront lieu les 9 et 10 septembre. Ces dernières se dérouleront sous forme d'exposés d'environ 20 minutes, qui pourraient être suivis de discussions de même durée.

Si, comme je le souhaite, il vous est possible de participer à ce colloque, je vous serais reconnaissant de bien vouloir faire connaitre, dès que possible, à M. JEROME qui, à la D.G.R.S.T., se chargera de la coordination des préparatifs concernant la délégation française, le titre de la communication que vous envisageriez de présenter.

D'autre part, il serait nécessaire que vous puissiez envoyer un résum é de communication (ne dépassant pas 2 pages dactylographiées) à M. JEROME avant le 30 Juin 1976.

.../...

La langue normalement utilisée dans toutes les activités du colloque sera l'anglais ; cependant, pour les résumés, il serait souhaitable que vous puissiez envoyer un exemplaire en anglais et un en français.

Je vous prie de croire, Monsieur le Professeur, à l'assurance de mes sentiments les plus distingués.

J.F. MIQUEL
Conseiller Scientifique

Monsieur le Professeur WISNER
C.N.A.M.
41, rue Gay Lussac

75005 PARIS

C.C. Division des Affaires Internationales
D.G.R.S.T.

29 mai.

1°. Pour le stage de formation SNS en Algérie faire une lettre au Directeur du CNAM demandant que la rémunération de F. Guérin (Technicien) qui a cette occasion fait un travail d'assistant d'enseignement soit établie sur les bases de la catégorie 3. et non de la catégorie 4 qui correspond à celle de Technicien. (Cela se fait d'après information téléphonique de Mr. Thiercelin).

2°. Suite entretien avec Martin Helander du departement of Ergonomics de Lulea où j'ai exposé les enseignements faits par le labo., Martin H. a ~~[illegible]~~ demandé des précisions sur l'enseignement de l'analyse du travail et, de plus, je pourrai me déplacer une semaine à Loulea pour ~~[illegible]~~ amorcer ce type d'enseignement.

Lui-même et les étudiants sont des ingénieurs qui ne connaissent que "les mesures" au diagnostic ds le domaine ~~des~~ ~~[illegible]~~ ~~[illegible]~~ agronomique.

Jaudon -

17 Mai 1976

Monsieur Jérome
D.G.R.S.T.
35 rue St-Dominique
PARIS 7ème

Cher Monsieur,

Je vous remercie d'avoir complété les informations que j'avais sur la réunion franco-suédoise que vous organisez à Stockholm en Septembre prochain.

Si je suis amené à m'y rendre, le thème de mon exposé pourrait être le suivant :

"L'examen des moyens individuels de protection rendus après usage : une méthode objective d'évaluation de la sécurité".

Veuillez agréer, cher Monsieur, l'expression de mes sentiments dévoués.

A. Wisner

17 Mai 1976

Madame Miquel
D.G.R.S.T.
35 rue St-Dominique
PARIS 7ème

Copie : Mr Jérome

Chère Madame,

Je vous remercie de m'avoir adressé la traduction du projet suédois relatif aux accidents du travail. Je trouve ce programme intéressant et regrette que la recherche en matière de sécurité du travail soit aussi peu organisée en France, et si peu en rapport avec les grands centres de recherche universitaires ou autres.

Veuillez agréer, chère Madame, l'expression de mes sentiments dévoués.

A. Wisner

Traduction Projet Suédois

de la part de
Christina Miguel.

Crédits accordés pendant 1975 et jusqu'au 9.3 1976 dans le cadre ACCIDENTS DE TRAVAIL.

DESTINATAIRE	TITRE DU PROJET	CREDIT
75/10 Ecole des Eaux et Forêts, Garpenberg.	Diminuer les accidents de travail. Il s'agit d'une analyse globale dans une branche spécifique.	25.000
75/75 Ecole des Eaux et Forêts, Garpenberg.	Dévéloppement de méthodes d'analyse pour détecter des perturbations dans le système: homme - machine	230.000
75/103 Syndicat Suédois de la Mécanique.	Etudes des normes pour les portails et les portes industrielles.	60.000
75/114 Ecole Supérieure de Luleå.	Les explosions en phases succesives et la douleur.	45.660
75/129 Inspection des Explosifs.	La solidité du verre contre les ondes de choc ,causées par des explosions ou des détonations.	29.000
75/131 Saab-Scania, Södertälje.	Programme de profylaxie des blessures de l'oeil.	78.200
75/173 Ecole Technique Div. d'Aéronautique	Travail dangereux en général. Schéma sur les fonctions de l'homme: charge mentale et risques. Crédits pour un projet.	28.400
75/176 L'Université d'Umeå, Institut d'Hygiène.	Ana lyses des demandes d'inscription d'accidents professionels qui n'ont pas été retenus comme tels.	15.950
75/188 Santé Publique Régionale, Skövde.	Accidents dans le milieu du travail - dévéloppement d'instruments pour la protection dans le travail.	59.000
75/190 Ecole des Eaux et Forêts. Groupe de Travail.	Augmenter la sécurité dans l'exploitation forêstière. Un programme d'action pour une branche spécifique.	800.000

Crédits renouvelés, accordés pendant 1975.

72/22 Inspection des Explosifs.	Mesures préventives contre les accidents en travaillant avec des explosifs.	110.166
74/105 L'Université de Göteborg. Institut d'Anatomie	Blessures des mains survenues au travail. Facteurs de risques, extérieurs et individuels. Zones de risque, espace,	93.194

31 Août 1976

Monsieur Nils Petersson
c/o Furu
Östervägen 18A
171 39 SOLNA

Cher Petersson,

J'ai reçu votre lettre avec un peu de tristesse, car je vois que vous êtes dans une période difficile. On sait que le bien peut sortir du mal, mais cette transformation est difficile.

Je suis cependant heureux de vous revoir à Stockholm où j'arriverai le dimanche 5 Septembre à 12 h 35 par le vol A.F. 790.

Nous pourrions peut-être dîner ensemble ce jour-là, si vous êtes à Stockholm. Je risque en effet de ne pas être disponible de façon prolongée le reste de la semaine.

J'arriverai à l'Hôtel Morington, Nybrogatan 52 - Stockholm.

Recevez, cher Petersson, l'assurance de toute mon amitié.

A. Wisner

Stockholm le 25 Aout 1976

Cher Monsieur,

Je vous remercie de votre lettre du 29 Juiellet et je regret que je n´ai pas repondu plus vite. J'ai quitté mon travail il y a un mois et donc n'ai pas recu votre lettre. En outre je viens de separer de ma fiancée et les derniers jours j´ai demenager et la vie a éte un peu sens dessus dessous mais commence de se stabiliser.

Comme j´ai quitté mon travail je ne serais pas en principe au laboratoire le 7 septembre mais comme je ne fais rien pour le moment je peux sans probleme y aller et montrer le laboratoire pour Jankovsky et aussi arranger quelques rendevous avec des gens que vous n'avez pas eu la possibilité de voir lautre fois.

Je serais aussi tres heureux de vous voir et surtout comme j'ai une idée d'aller en Amerique Latin (ou Central) et peut etre vous connaissez quel ques laboratoires auquel je peux m'adresser.

Si vous ou Jankovsky voulez que je fasse des preparation en avance pour faciliter votre sejour je les ferais avec plaisir et sans problemes.

Si possible je vais essayer d'aller vous ecouter. Je suis tres interesse de votre recherche dont j'ai lu souvent dans les journeaux suedois le dernier mois.

Veuillez agréer, cher Monsieur, mes salutations les meilleurs.

Nils F Petersson

adresse: c/o Furu

Östervägen 18A V

171 39 SOLNA

Tel 82 61 71

26 Mars 1976

Monsieur le Professeur Miquel
D.G.R.S.T.
35 rue St-Dominique
75007 PARIS

Cher Monsieur,

Je suis persuadé que les échanges que vous prévoyez avec nos collègues suédois dans le domaine de la sécurité du travail vont permettre une relance de la recherche dans un domaine très gravement négligé actuellement.

Je vous propose les noms suivants :

- Professeur Leplat et Monsieur Cuny C.R. CNRS, pour présenter les conceptions françaises dans le domaine des relations entre sécurité et organisation de l'entreprise, et dans celui du réseau formel et informel des communications.

- Monsieur N. Sée, boursier DGRST dans le domaine des conditions de travail en agriculture (détaché au laboratoire), pour exprimer l'importance des accidents dans l'agriculture française et présenter une ou deux études localisées qu'il a réalisées.

- Monsieur Y. Chich, Directeur du laboratoire de psychologie de la conduite de l'ONSER, ancien chercheur du groupe Ergonomie des Charbonnages de France, dirige depuis plusieurs années le plus grand laboratoire européen de psychologie en rapport avec la sécurité routière. Monsieur Chich pourrait donner une vue générale des conceptions de son laboratoire en matière de sécurité, en particulier dans le domaine des transports routiers qui posent clairement des problèmes de sécurité du travail.

- Monsieur Quinot, Directeur scientifique de l'INRS, ancien épidémiologiste des Charbonnages de France dans le domaine de la silicose, dirige l'ensemble des laboratoires de l'INRS. Monsieur Quinot pourrait exprimer la politique générale de cet organisme.

- Un autre membre de l'INRS pourrait éventuellement l'accompagner pour évoquer les problèmes du contrôle des machines du point de vue de la sécurité.

.../...

- Monsieur F. Jankovsky, boursier DGRST RESACT (détaché au laboratoire) qui a travaillé à Air-France, dans l'industrie du pétrole et à l'UIMM, pourrait évoquer les problèmes posés par les communications entre les travailleurs dans les conditions défavorables d'espace et de bruit (chantiers, grandes halles) en ce qui concerne les communications verbales et non verbales.

- Si je suis invité et que les dates retenues sont compatibles avec mon calendrier, je pourrais évoquer une méthode d'étude de l'origine des accidents que j'ai appelée anatomo-pathologique. Il s'agit de l'examen des pièces, en particulier des moyens individuels de protection, restituées au magasin après usage ou portées par le travailleur au moment de l'accident.

J'ai pensé également aux personnes suivantes :

- Monsieur Bisseret, responsable de l'unité de recherche sur les contrôleurs de la navigation aérienne (Secrétariat Général à l'aviation civile) et le Professeur Sperandio qui s'est également intéressé à cette question,

- Le Professeur Cazamian, ancien responsable du service Ergonomie des Charbonnages de France, pourrait évoquer les relations entre la sécurité et le travail par équipes alternantes,

- Monsieur Martin (de l'I.R.E.P. à Grenoble), qui a travaillé certains aspects économiques de la sécurité du travail.

Cette liste n'est pas limitative. Je suis même persuadé d'avoir oublié des personnalités importantes. Je ne manquerai pas de vous écrire à nouveau si d'autres noms me viennent à l'esprit.

Veuillez agréer, cher Monsieur, l'expression de mes sentiments dévoués.

A. Wisner

26 Mars 1976

Madame Miquel
5 rue Henri Thirard
94240 L'HAY LES ROSES

Chère Madame,

Je vous remercie vivement de m'avoir porté vous-même le texte de Monsieur Hjalmers que vous avez traduit.

Ce qui est dit sur notre laboratoire est très bienveillant. Certains détails ne sont pas exacts mais, comme ces erreurs sont en notre faveur, pourquoi les corriger ?

Veuillez agréer, chère Madame, l'expression de mes sentiments dévoués.

A. Wisner

ce 22 mars.

CHRISTINA MIQUEL

Voici la traduction relative au CNAM du rapport Hjalmers.

5, RUE HENRI THIRARD 94240 L'HAY-LES-ROSES

RAPPORT SUR LE VOYAGE D'ETUDE EN FRANCE
LE 10 - 16 DECEMBRE 1975

FOLKE HJALMERS

publié par IVA le 30 jan. 1976

I. Politique de recherche.

- DGRST: M Sevin, M Bruneau, M Douillet et M Miquel.
- ANVAR: M Rognon.

II. Le milieu du travail.

- DGRST: M Miquel
- CNAM: M Wisner
- Regie Renault: M Thomas et M Lucas

III. Recherche sur les matériaux.

- CNRS: M Winter
- Ecole Nationale Supérieure des Mines à Paris; M Laffite et M Turpin.

IV. Océanographie.

- COMEX: M Herbaux, M Wide, M Ory, M Bousquet et M Firronti.

V. Planification.

- DATAR: M Durand
- SESAM

RESUME.

Points essentiels des expériences acquises pendant le voyage en France.

A. Politique de recherche.

Importance de la recherche fondamentale et l'ambiance qui règne autour: pas d'études profondes, mais un travail intensif de groupe.

- L'idée d'exploiter la recherche et le developpement dans l'économie française.
- Les organisations spécifiques dans le cadre du Ministère de l'Industrie et de la Recherche, lesquelles ensemble couvrent les possibilités de promouvoir différents projets. Par exemple: DGRST et ANVAR.

B. Le milieu du travail.

I. Un intérêt croissant en France pour tous les problèmes du milieu du travail. La réunion prévue entre La France et la Suède a des grandes chances de réussir. Les questions de formation doivent être discutées à cette occasion ou à une date ultérieure, car les deux pays semblent être au même niveau dans ce domaine.

2. L'activité très importante de Renault dans le milieu du travail. C'est à souhaiter que les responsables de cette activité viennent une fois en Suède.

C. Recherche sur les matériaux.

1. L' accent mis sur les matériaux, considerés comme une conception d'ensemble, était particulièrement intéressant. Une recherche identique doit commencer en Suède.

2. La recherche sur les polymères en France. Il semble que sur le plan de la recherche les deux pays se ressemblent et que chez nous aussi nous devrions miser davantage sur les polymères, que ce qui a été fais jusqu'à présent.

3. L'accent sur la collaboration entre différents projets. de recherche. Il semble qu'ici, la France a bien mieux réussit que la Suède.

D. <u>Océanographie</u>.

1. CNEXO semble avoir obtenu de bons résultats.

2. La raison pour laquelle la France a si bien réussit dans ce domaine doit être étudié de plus près. La raison ne tient pas seulement au fait que La France a acheté des zones de recherche de pétrole à l'étranger.

3. Il faut suivre à l'avenir l'activité de la COMEX.

E. <u>La Planification en France</u>.

DATAR doit pouvoir donner des idées pour des études équivalentes en Suède.

CNAM
le 11 décembre 1975
M Wisner, Professeur et Directeur des laboratoires.

CNAM peut être comparé à une "Grande Ecole" sur les Conditions du Travail. L'enseignement vient en premier lieu, mais il y a également des recherches. L'enseignement se fait à travers une centaine de centres dont CNAM est responsable. Environ 25.000 étudiants participent aux cours de durées différentes. Les cours les plus longs peuvent s'étendre sur plusieurs années. La recherche se poursuit dans divers laboratoires. Une de ces laboratoires se trouve à Paris.

<u>L'enseignement</u>.

L'enseignement s'adresse aux ingenieurs et aux ingenieurs des Grandes Ecoles. Comme en Suède,le but est d'intégrer les conditions de travail dans l'enseignement téchnique étant donné que la plupart de ces ingenieurs vont occuper par la suite des postes importantes dans l'industrie.

Comme les professeurs sont dans toute la France, ils peuvent prendre des initiatives pour créer une nouvelle forme de pensée dans le domaine des conditions du travail.

On parle beaucoup du "Movement Volvo" en France. Ceci a commencé il y a environ IO ans et il s'agit maintenant de transmettre ces idées aux jeunes étudiants. On essaie également d'obtenir une collaboration entre techniciens et psycologues.

Il est aussi important d'augmenter les connaissances des medecins sur les problèmes concernant les conditions du travail. Comme en Suède on discute des possibilités pour que les medecins puissent être impartiaux lorsqu'ils sont attachés à une entreprise. Pour que les medecins puissent comprendre les problèmes spécifiques des medecins d'entreprise il faut que tous les futurs medecins étudient le milieu du travail.

Une tâche importante pour le Laboratoire est de choisir les professeurs qui vont être responsables de l'enseignement. Dans certains cas il suffit de contrôler leurs connaissances, dans d'autres cas on leurs demande de suivre des cours organisés par CNAM.

Le Laboratoire est aussi responsable pour la définition des cours fondamentaux dans la centaine de centres où l'on excerce l'enseignement. Le Laboratoire a aussi régulièrement des cours sur plusieurs sujets. M Wisner, lui-même est responsable d'une cinquantaine d'étudiants chaque année.

La question, si la position des étudiants vis-à-vis leurs études a changé depuis 1968 a été discuté. M Wisner pense que oui,contrairement aux representants de l'Ecole des Mines. Il donne comme exemple certains étudiants travaillant dans son laboratoire qui avaient changé d'une école classique pour une école spécialisée sur les conditions du travail.

La recherche dans les laboratoires de CNAM.

15 à 20 personnes participent aux recherches du Laboratoire. En plus de l'enseignement et de la recherche, l'Institut mène également une activité d'information pour augmenter la comprehension dans la société pour les problèmes du milieu du travail. De ces 15 à 20 chercheurs, environ 10 sont engagés à plein temps à l'école et environ 5 sur contract de DGRST.

La recherche s'oriente vers les aspects sociologiques de l'homme au travail. On étudie par exemple le problème de mener de très grandes groupes de personnes ainsi que les problèmes ergonomiques.

L'activité principale de l'Institut est l'étude sur la relation entre "les movements de l'homme et l'espace à sa disposition." Ceci est à moitié psycologie practique et à moitié psycologie théorique.

Un autre projet, mené en collaboration avec des chercheurs des Etats Unis et de l'Union Soviétique, est de créer des systèmes de communications adaptés à l'homme au travail. Un nouveau système doit être utilisé pendant environ 40 ans. C'est pour cela qu'il faut bien réflechir comment le construire afin d'être aussi bien adapté aux besoins de l'homme que possible.

Un autre problème est "l'homme et la machine". Dans les études on tient compte du fait que le groupe de personnes en contact avec les machines est beaucoup plus grand maintenant que les groupes sur lesquels les études ont été faites autrefois.

Un sujet très important pour le Laboratoire est le developpement de méthodes ergonomiques appliqués à un groupe plus étendu que les travailleurs. On discute comment on va pouvoir exploiter les connaissances acquises sur le milieu du travail dans l'industrie pour des études en dehors de l'industrie.Le nombre de calculateurs a augmenté considérablement et on oriente certaines des études vers ce domaine.

Plusieurs de ces études ont de l'intérêt pour la Suède. M Wisner a collaboré, entre autres, avec Professeur Nils Lundgren du Departement de la Medecine du Travail dans le cadre de "Arbetarskyddsstyrelsen". Nils Pettersson qui a participé à cette collaboration a fait une étude intéressante dans le cadre du Laboratoire. Professeur Ulf Åberg a intérêt pour une collaboration accrue avec plusieurs pays, entre autre avec la Suède. 5 à 6 chercheurs étrangers participent actuellement aux recherches.

M Wisner est intéressé pour commencer une recherche sur "comment créer le milieu du travail dans le tiers monde". Maintes chercheurs de ces pays ont exprimé un désir de mettre en route une recherche pour pouvoir permettre d'éviter les erreurs commises dans les pays industriels.

Une discussion a été menée sur les possibilités de commencer des projets plusidisciplinaires. M Wisner pense que pour pouvoir faire cela, il faut avoir un but très précis de cette activité et avoir un responsable de projet.

Monsieur

Le Professeur WISNER

Crédits accordés pendant 1975 et jusqu'au 9.3 1976 dans le cadre ACCIDENTS DE TRAVAIL.

DESTINATAIRE	TITRE DU PROJET	CREDIT
75/10 Ecole des Eaux et Forêts, Garpenberg.	Diminuer les accidents de travail. Il s'agit d'une analyse globale dans une branche spécifique.	25.000
75/75 Ecole des Eaux et Forêts, Garpenberg.	Dévéloppement de méthodes d'analyse pour détecter des perturbations dans le système: homme - machine	230.000
75/103 Syndicat Suédois de la Mécanique.	Etudes des normes pour les portails et les portes industrielles.	60.000
75/114 Ecole Supérieure de Luleå.	Les explosions en phases succesives et la douleur.	45.660
75/129 Inspection des Explosifs.	La solidité du verre contre les ondes de choc ,causées par des explosions ou des détonations.	29.000
75/131 Saab-Scania, Södertälje.	Programme de profylaxie des blessures de l'oeil.	78.200
75/173 Ecole Technique Div. d'Aéronautique	Travail dangereux en général. Schéma sur les fonctions de l'homme: charge mentale et risques. Crédits pour un projet.	28.400
75/176 L'Université d' Umeå, Institut d'Hygiène.	Ana lyses des demandes d' inscription d'accidents professionels qui n'ont pas été retenus comme tels.	15.950
75/188 Santé Publique Régionale, Skövde.	Accidents dans le milieu du travail - dévéloppement d' instruments pour la protection dans le travail.	59.000
75/190 Ecole des Eaux et Forêts. Groupe de Travail.	Augmenter la sécurité dans l'exploitation forêstière. Un programme d'action pour une branche spécifique.	800.000

Crédits renouvelés, accordés pendant 1975.

72/22 Inspection des Explosifs.	Mesures préventives contre les accidents en travaillant avec des explosifs.	110.166
74/105 L'Université de Göteborg. Institut d'Anatomie	Blessures des mains survenues au travail. Facteurs de risques, extérieurs et individuels. Zones de risque, espace, temps,âge,éducation etc.	93.194


Höjd över havet i m
Elevations in metres
Höhen in Metern
Campingplats
Campingplace
Zeltplatz
OK motorhotell
OK-bilvårdsanläggning
OK-filling Station
OK-Tankstelle
Länsbokstav
County registration letter
Länsgräns
County boundary
Bezirksgrenze
Siljan
FALUN
BORLÄNGE
SÄTER
HEDEMORA
AVESTA
LUDVIKA
FAGERSTA
SANDVIKEN
GÄVLE
ÖSTHAMMAR
UPPSALA
SALA
ENKÖPING
VÄSTERÅS
KÖPING
ARBOGA
KARLSKOGA
ÖREBRO
KUMLA
HJÄLMAREN
ESKILSTUNA
STRÄNGNÄS
SÖDERTÄLJE
STOCKHOLM
SOLNA
SUNDBYBERG
LIDINGÖ
NACKA
NYNÄSHAMN
KATRINEHOLM
FLEN
NYKÖPING
OXELÖSUND
NORRKÖPING
Bråviken
SÖDERKÖPING
LINKÖPING
MOTALA
VADSTENA
MJÖLBY
ASKERSUND
LINDESBERG
VISBY
E4
E18
E3

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ABSTRACT

ACCIDENT PREVENTION IN THE EXPLOSIVES INDUSTRY

As a phase in the research on accident prevention in the Swedish Explosives Industry, an interdisciplinary work-environment project has been going on since 1973 on the initiative of the Swedish Inspectorate of Explosives. The research is beeing carried out by the National Defence Research Institute in cooperation with the National Board of Occupational Safety and Health.

The first year of the project has included a general study of risks at work and of the safety organization in the explosives industry. During this first year a general inventory of the explosives industry was carried out. The inventory was followed by studies of the work environment and attitudes of 600 workers and supervisors at nine factories.

The results from the general inventory show that the mortality rate of explosives workers is high, in spite of the technical and organizational safety measures that have been made. Furthermore, the results from the attitude study indicate that in several cases there are problems as regards information and communication concerning safety. In this study a widespread instrumental attitude to their work has also been found among the workers, indicating low morale and low job satisfaction. A possible interpretation of the results from the attitude study and the study of the work environment is that there is a conflict between the way in which the production and safety systems are organized today and the workers ego-needs, such as needs for independence and responsibility.

The results from the first part of the project constitute the background for the further research, where means to activate the employees in the safety work and to develop the cooperation between management, experts and employees on safety problems are applied and evaluated. This research is planned to be completed during 1976 and includes problem identification (by means of disturbance-reporting, interviews and direct observations of the production), and the development and implementation of safety measures at places of work at three factories. These factories represent different sizes and different production areas. The researchers cooperate at each factory with a joint-consultation group with representatives from the workers, the supervisors and the management. Examples of problem areas that have been treated in the groups are technical safety measures in the production, the development and introduction of new equipment in the production (including the elaboration of check-lists), and the safety education of newly employed as well as experienced workers.

A B S T R A C T

RISKIDENTIFICATION , RISK-CONSCIOUSNESS AND WORK ORGANIZATION - THREE CONCEPTS IN JOB SAFETY

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It is a well-accepted fact that most accidents in industrial systems are caused by people. In the modern research, i. e. the systems approach, the human errors are analyzed in terms of the man- machine - system.What is more seldom considered is that the human being - besides his role in the system - is also a victim of the system, i.e. that factors in /the system control the human behaviour in a way which may initiate risk- taking.Therefore,in order to increase job safety it is not enough only to try to identify the risks in the system and to motivate the people to work safely,but also to try to analyze the control actions in the system which may lead to risk-taking.This will lead to a better understanding of the human element in systems safety so that appropriate actions can be taken.

Up to date the corrective actions made by the safety organization have mainly been of a technical nature or through motivating the worker, i.e. education and information.However,this does not seem to have solved the problem of accident reduction.Our assumption in our theoretical frame of reference is that this is due to a lack of consensus between the employer and the employee regarding safety work.Now the considerations of safety will be rigidly controlled by the dictates of production,i.e. no interest is taken in changing the control factors if they do not increase production. As long as the employee has no personal control over and influence on his own job the prerequisites for consensus will always be lacking.Therefore, inorder to improve job safety,the safety work must be organized so as to involve employees in shaping the environment in which they work.

A project in forestry will be presented ,where a method has been developed for risk identification,for improving the employees' risk-consciousness and for changing control factors in the system, i.e. work organization,pay system ,in order to improve job safety.

This has been done by a near- accident reporting method,in which the employees have been engaged in the reporting as well as in making decisions about the corrective actions to be taken as a result of the reports.

1976-08-27
Bo Pettersson

Ink/ASF
1976 -08- 30

LOGGING RESEARCH FOUNDATION (FORSKNINGSSTIFTELSEN SKOGSARBETEN) - APPLIED RESEARCH AND DEVELOPMENT FOR FORESTRY

Background

Skogsarbeten is a research organisation established to carry out applied research and development for Swedish forestry. Almost all forest enterprises, the Swedish Forest Service and the Forest Owners´ Associations are interested parties.

Since 1964 research work has been carried out in this form but similar structures have been used for about 40 years. At present Skogsarbeten has 70 employees and a total turnover of more than 10 million Swedish Crowns. Of this amount approximately 60 % are contributions from various forest enterprises and about 40 % is financed by the Government. Financial contributions are also forthcoming from public and private funds, for instance the Work Environment Fund.

One of the reasons for establishing Skogsarbeten was the fact that Swedish forest enterprises found it more advantageous to co-operate than to compete in the field of research and development. Of course this does not mean that they do not compete otherwise - when it comes to wood supply we have for instance a keen competition.

Objectives

The objectives are

- to contribute to the development of machines and methods for silviculture, logging and transportation
- to contribute to increased safety, health and job satisfaction and to the adaptation of working techniques and methods to the varying conditions and limitations of man
- to provide a basis for recruitment of specialist personnel by the interested parties.

Means

For fulfilling our activities we have certain means, for instance a close co-operation with our interested parties in chosing projects as well as in solving problems. To secure special information and to maintain and increase the mutual knowledge we have seven advisory groups, consisting of about 15 specialists each from the interested parties. They follow our work in each field.

The main part of our tests are carried out at forest enterprises (interested parties) with assistance of their people.

We also co-operate with manufacturers of forest machines and other equipment. We study the machines at an early stage and try to give our opinion of the design, for instance out of an ergonomic point of view. In some cases we assist when the forest enterprises want to formulate common requirements on forest machines, for instance safety requirements, which then serve as a pressure on the manufacturers.

We also have an effective distribution of results comprising courses, conferences, various publications, instruction films and manuals. Usually a research project is not finished with just a research report but with actions to change conditions at the forest enterprises.

A project on safety

The project of immediate interest in this connection is called "Increased safety in forestry - an action program for a branch of industry". The aim of this project is to reduce the number of accidents and the severeness of the accidents within forestry during a four year period. This project is financed by the Work Environment Fund.

In this connection I am most interested in discussing one important question: How should a program be built up within a forest enterprise in order to systematically increase safety?

A B S T R A C T

SAFETY IN FORESTRY REMUNERATIVE SYSTEM AND RISKTAKING

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In Sweden both the number and the severity rate of accidents in forestry are very high. The motor-manual working operations are responsible for 75 % of the accidents.

It is known from reports and statistics up to 1974 made by the Forestry Inspectorate, that many accidents occurred when using risky methods in certain critical work operations, e.g. bringing down lodged trees. In these work operations the cutters can choose between alternative working methods, some of them risky and some of them less risky. The risky methods are strictly forbidden according to safety directions. In an interview cutters were asked about their attitudes towards these and some other safety rules on working behaviour. They all considered most of the rules to be important (the average was 4 on a 5-degree scale, 5 indicating a very important rule). In spite of a positive attitude to the rules, the cutters admitted to not following them, due to practical circumstances. They considered the rules not fitted to their every-day situation, mostly because the recommended methods are time-consuming.

We obtain the same kind of answers in a second study, when the cutters have been asked which are the reason for using methods one <u>knows</u> to be risky. We thus asked about deliberate risktaking.

The main reason given by the cutters was that the risky methods are far more rapid and demand less physical effort. To save time is equivalent to better earnings when working in a piece rate system. The straight piece rate system also influences the motivation to use methods that are less physically energy-consuming.

Obviously the acceptability to a certain person of the risk of a certain activity is related to the real or imaginary benefits that the person expects from the activity. The benefits of risk-taking can thus be controlled py the type of remunerative system.

There are other effects on behaviour due to the remunerative system, some of which I will discuss in my speech.

- Effects on the learning process

  The remunerative system as a reinforcer.

- Effects on the human organism

  The remunerative system can create stress in the organism as reflected by some form of neurological, physiological or behavioural disruption or disorganisation

- Effects on safety actions

  The remunerative system can effect the desire and possibility of the individual to use the knowledge he recieves from safety training and information, to use personnel safety equipment, to follow safety directions etc. It can through this facilitate the safety work for supervisors and safety officers.

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Development of a model for occupational accident research and practical safety-work

During 1974 an epidemiological survey of occupational accidents was conducted in Malmö, Sweden. The aims were two; firstly an epidemiological study of the occurence of accidents during a certain period in a certain population as a function of different factors described according to a host-agent-environment view; secondly development of a model for further steps in research. In this view the epidemiological method showed to have its limitations, mainly in the causal dimension. We therefore tested our material on the basis of a model described by Surry (1969) and modified by the Swedish Environment Fund (1973). This model was based on system-theoretical grounds but even this showed up to be too narrow. We therefore tried to further develop the model and based the theoretical work on Faverge´s (1968) view of accidents being an error in the expected cause of production cycle; i.e. the objective danger is not derived from a study of different individuels behaviour but from the working process as a general abstraction.

At present we are trying to develop a program based on the above presented model that could be used in practical safety work.

Accident prevention projects at the Laboratory of Industrial Ergonomics, Stockholm

The work made at the Laboratory of Industrial Ergonomics (AML) has a broad ergonomic planning and purpose where the final product is aimed to be a new construction or a new organisation of a work place or a work method. This product shall accomplish a series of human criteria concerning physical as well as psychological well-being.

Among these criteria those concerning safety make an important part and with the targets given above, accident prevention becomes an integrated part in the complete construction process.

For natural reasons heavy and physiologically active work has attracted the main attention of the Laboratory in the case of accident prevention. The influence of climate is another important factor, where the extreme climate of the warm parts of the steel industry as well as the cold climate of the food industry has been an object of the efforts of the Laboratory. Within the steel industry a considerable work has been made in the casting work, that is the part of the steel production which begins with the molten steel until it has solidified in the moulds. The accident risk is here the risk of contusions and above all of burns, of which some unfortunately are fatal.

An analysis of the working process leads to the conclusion that the possibilities to decrease the accidents by protective means are very limited within the frame of the existing production systems. There is a need of a more fundamental change in the production process.

In such a new construction process there arise certain problems of a purely technical nature, which must be solved before the construction process can proceed. Essential for the work as a whole is also the need to consider the interaction between man and machine and man and process but also the interaction between

The psycho-social criteria are thus a corner-stone in the safety considerations.

The works in this field have lead to completed projects, some of which have started to come into application. In this work AML has played a central role, but a fruitful cooperation has taken place between AML and the industries concerned, where both collective workers and technical personnel have made their contributions. None of these parties has been dispensable.

Within the food industry, and in this case especially the meat industry, climate is a big problem, for natural reasons conditioned by the opposition between bacteriological demands and human comfort requirements. Accident risks include two main problems, viz. slipping risks and cutting risks, where primarily cutting risks might be supposed to be correlated to low temperature. These two aspects of accidents withing the industry has been treated as essential questions in the total complex of the working conditions in the branch.

The conclusion of the preliminary analyses has been the same as for the hot industry, viz. the difficulty to achieve considerable ameliorations without a profound innovative approach. Questions like working rate, work organization, learning, skill etc. are of great importance, which makes psychological and sociological criteria very important indeed, possibly even more important than in the quoted examples from the steel industry. The works of AML in this branch have not been pursued during such a long time as within the steel industry and are thus at an earlier stage.

Ulf Åberg

Work with public Danger.
(Allmänfarligt arbete)

Carl Lager

Purpose

The project is set out to specify work conditions in jobs involving a risk that disfunctions may cause accidents to "third man" and human environment.

The specification should be a base to actions for central control and reduce the risk for such accidents.

Background

Work conditions involving general danger are normally found in complex technical systems. The complexity is logically related to a high technical disfunction frequency. Complex systems are also often vulnerable to environmental interferencies. With the background of "system instability" human control components "on the line" are often required in the production. Systems of this type are more or less normally found in transportation but also in other industries, e.g. chemical and nuclear production. The job as system control component will in the present development be more and more common.

In technical systems involving public danger Society must claim and control a high system reliability. The system reliability is mainly a function of the reliability in the human control components.

The work conditions, as one of the bases for the reliability of man in the system, must be controlled by the Society not only for the general wellfare but also to guarantee the work hygien and sound aging of the individual in the system where the specific workload, physical risk and the responsibility can be vitally destructive.

Plan

In the first project part, now under work, the human control component's function, workload and risk in instable technical systems is defined in a theoretical model.

The next part will be a control and development of the theoretical model in some real work situations, also with discussions of the definition of "general danger".

A third step is development of empirical and experimental methods by which work conditions can be "measured" to change the character of the model from theoretical to "numerical".

The model can then be directly used for central interference and necessary modifications by regulations in the real work situations.

The Model

The accident is defined as a sudden unwanted proceeding with sad consequences.

We are here concerned with accidents related to the operation of technical systems with human control components. The accident is caused by one or several disfunctions in the system. Normally in modern systems several disfunctions must occur in a chain-reaction to form an accident potential.
In a wast majority of the disfunction chains we find at least one described as a control component disfunction. System reliability is defined as the inverted risk for disfunctions. The system reliability is then in these systems a main function of the reliability in the human control component.

Human reliability (the inverted risk for disfunction)varies in three different dimensions. The first is the grade of man-machine-adaptation. In this dimension we have many unsolved problems which more or less uncontrollable initiates "human" disfunctions. The development of the "safe" control station is of course under progress.

The other dimension is the interindividual reliability variance. This can generally be described as an individual capacity to adjust to the specific job situation and to be happy in it.
A failure means as demonstrated a dramatically raised disfunction risk. The interindividual reliability variance is most probably not a continuum but a dictrotomized distribution in a normal and an abnormal risk level. In dangerous systems we have to accept routines of discrimination in terms of physical and mental fitness for the responsibility, of training control, of periodic checks and of job circulation as an expected procedure. These routines are with proven effects mandatory in civil aviation and should be developed and applied generally where society wellfare is concerned.

The third reliability dimension is the intraindividual degradation of normal capacity with the logical degradation of reliability. The cause is mainly effects of non-tolerable workload both acute and with latent long-time effects. In the concept of workload must be involved both work-organization and aspiration. In the instable, dangerous technical system the human control component is exposed to an impact of mental workload everywhere recognized as stress-factors: complexity, monotony, emotional provocations, frequent and high psychophysiological excitaion, a high precision, to be continously controlled, effects of responsibility, the physical risk, irregular working hours, aging effects, the disqualification risk and much more. A fatal fact in the present sitaution is that we have very little, if any, knowledge of which grade of Provocation in these factors is Tolerable against the claim of Reliability we have on the individual.

It is necessary to define "workload" in the wider concept and to measure the effects on the individual reliability in cross-scientific research as a base for central limitations of working hours, especially in irregular schemes, of work-load intensity, of pension age and definitions of rest as a work duty.

Methods

In Sweden an emphasis has been laid on empirical, statistical models for exploration and control of accident risks. The central accident EDB-register is under revision; unfortenately not to any degree that can make it to an effective safety tool. In special branches, especially in civil aviation, statistical analysis based on function-reports from the pilots has supplied vital information. A material is included in project part II referred under "Plan" above.

It is obvious that even with sufficient statistical materials for empirical models of function and risk, measuring under experimental conditions are necessary to effect the practical decision-makers. The project will use a psychophysiological battery both in reality and simulated function for the specification of energy mobilisation, consumption and rehabilitation. The measurements will define a specification both of workload and of the individual concerned to supply a numerical model as a base for central system modifications as in step 3 referred under "Plan".

The battery and method can (as already routine in Scandinavian Civil Aviation) then be used as a control instrument both in new systems and in work routines in the Society's necessary interest in the reliability of dangerous systems and production.

The project report part 1 och 2 (ref "Plan") are in print.

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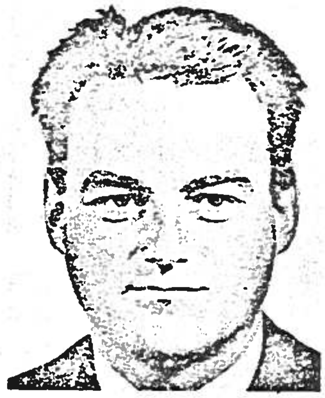

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THE HUMAN SYSTEM COMPONENT AS ACCIDENT CAUSE FACTOR

Accidents and Disfunctions

Accidents in and around technical systems are in an absolute majority caused by the so called Human Factor.

The Accident is functionally a coincidental manifestation of a significant Accident Potential. This potential is built up by several cause factors in a chain reaction. And among these factors we almost inevitebly find one or several "human".

The Human Factor can be defined as a deviation from a laid out and expected functional program; a program disfunction.

Human and technical disfunctions are very often caused by a break down of calculated, tolerable stress limits: by Provocations.

A major disfunction risk in human and technical system components is also the effect of milder but prolonged provocations in the concept of fatigue, or generally: functional Degradation.

The Human component has as its specific disfunction risk the manifold and complexity of internal function programs. Even in simple transmitter function, from command signal to respons, this complexity and manifold of possible functional loops builds up an everywhere demonstrated high risk for responses that from the System point of view are irrational.

The main Accident Risk, the Human Factor, and its background of provocations, functional degradations and response irrationality can in all aspects be isolated by human Behaviour Research using the human component as the measuring object, the measuring device and the data store for analysis.

Human Factor Control Areas

In a new system specification and development we should use systemized registrations of human behaviour and reliability in earlier similar systems and, as a condition, supply material for that need in systems now in operation. We need Empirical analysis for System Development.

In the system development we supply several technical alternatives in which we objectively measure the "goodness" in full experimental control where the human Component measured behaviour is our main factor for alternative choices. We need Experimental control of subsystem and component choices. The human component adaptation to the system, that is training, must be checked by critical tests. Training methods and training effectivity necessary for system reliability can only be developed by measuring individual behaviour in operation.

Operational provocations, never predictable at the construction desk, and main Risk Structure problem, can mainly be detected and analysed in the systemized, empirical experience of the individual human component, the worker. We need an intense flow of experience information from the human component.

Accident Risk structures can never be trusted to be stable; variations are caused by demands of increased productivity, technical "rationalization", change of operator characteristics and so on. Control of provocations and risk structuration by such systemized empirical analysis should never be restricted to the introduction of a new system but should be maintained as work routine in the whole life of the system.

Functional degradation in the human system component as a fast or slow development, normally caused by an abnormal provocation volume, can only be detected and rehabilitated by psychophysiological registration of the individual mobilization, comsumption and rehabilitation.

In the job specification, in experimental tests of operation and in the provocation control we have material for a Specification of the individual human component: needed capacity in the system and needed stress tolerance, what we together can label Reliability. As in all other human characteristics Reliability will have a wide interindividual variance. For system reliability, that is directly Accident Prevention, every component, also human, in the system naturally must pass a lowest acceptable reliability level.

Research "attitude and convention" problems

The accident risk in the industry has as a main problem the human factor. It can be controlled only by research on individual characteristics and behaviour. We need a development of methods for accident prevention - risk structure control. From more than twenty years with such method development I am personally convinced that some conventions and attitudes to safety research necessarily must be discussed as a first condition for a safety improvement.

We must activate the research. As the conventional excuse for not doing so (i.e. in the road traffic) we refer to the fact that no system can be foolproof, we "accept" a certain accident frequency and we find willing money to pay for or even profit on the accident costs.

We must change our attitude to individual failures. We use as a matter of fact conventionally an utmost primitive "responsibility" philosophy. In an accident we have often a precise information of technical and operational functions but we have also one generally unspecified uncontrolled function: the human. If a main accident cause factor not is found in the technical or operational functions it is logically then proved to be the human and on that "proof" the individual is made responsible. A main experience from the twenty years of accident analysis I referred to above, is the almost consequent tendency in "safety experts" to push their own responsibility for inferior technical adaptation, for uncontrolled operational provocations, for uneffective training and lacking safety indoctrination over to an "error" in the individual operator/worker. The acceptance of the"error" philisophy is the opposite of safety development. Directly it obscures the risk structuration and indirectly it stops automatically a possible cooperation between a man having information and the next man capable to use that information to stop the next incident.

We must in safety responsibility change our conventional attitude to the personal integrity. If the democratic rights to make may own mistakes in a certain activity means that I cause accidents for my work-neighbour, is it not an only way to prevent the accidents by a restriction of these rights? I am a factor in this man´s work environment. I am directly very often his main accident risk. My job disadaptation/effectivity and the resulting cooperation problem is a provocation on his own reliability. My mere presence in his environment very often is hos own job adaptation problem. He can today get the physical factors affecting risk and work-hygiene isolated. Myself, as eventually (probably) the main problem in both aspects, will stay either until we have an accident or until I openly demonstrate my low reliability as being for instance a drug accident. Is it rational in the safety development to need to hope for an accident or for a personal tragedy? Is it not possible that my own job disadaptation and risk responsibility actually caused the drug addition? Is it not higly probable that the same factors causing the addition for a long time have lowered my reliability? Is it not a natural right before a new job to have an individual accident risk diagnosis? To have provocations related to the individual tolerance? We should as an accident prevention activity investigate the possibilities to develop methods for individual reliability diagnosis. We must in and around dangerous work positions economically and socially secure an individual flexibility.

Our last problem of convention is again related to the "acceptance of a risk level". If especially the "human factor" must be accepted and these accident can not be prevented a main safety improvement can be reached by preventing damages in the accident. So with the "level" acceptance we detach our main interest and research funds to the prevention not of the accidents bu the accident damages. Both the conception of a "level" and the need to "accept" are main conventional mistakes. We have no other "level" than the resulting loss frequency: the accident risk is structured. By structure analysis - accident prevention research - we can define, isolate or surpass vital risk volumes. As a suggestion the proportion of "damage prevention research" against "accident prevention - safety research" today is 9 to 1. If we disqualify the "acceptance of accidents" should not this proportion from purely logical and practical reasons be reversed or anyhow balanced?

Development of control methods

The following suggestions refer to a work position in a technical system where accident risks in and around the system must be recognized as a problem, but a wider application can of course be discussed.

→ Blanc

Retour un

(complet !)

1. Every operator leaves as a part of his daily job routine a systemized record of system function, own function, own condition, operational hazards and suggestions. The material is entirely used for provocation control and for system development.

2. We have in operation a standardized method for localization and gradings of provocations by a functional and psychophysiological registration on the operators naturally accepted.

3. We have possibilities in operation or in simulated operation to an experimental control of accident risks. This opportunity is used for:

a) accident risk structuration analysis

b) development of emergency procedures

c) (emergency) training, training development and training control.

4. We have developed "clinical" methods for individual reliability diagnosis and apply these methods both for selection to dangerous work at least on an advisory basis and for rehabilitation diagnosis.

5. We develop in and around these systems the concept of Flexibility: working hours, pension age, circulation and so on as a fully natural standard.

Prospects

In military aviation the high accident risks have developed the five points above more or less completely. In civil aviation the safety responsibility consequently has adapted the methods. Even in general aviation, using high risk systems for fun, we have in Scandinavia the full program on the way. In shipping a safety development program along these lines is on the way and has been met very positively especially by the unions. We have in other industry than transportation work positions with high risks.

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SAFETY IN THE EXPLOSIVES INDUSTRY -
-EMPLOYEE ATTITUDES TO THE SAFETY ORGANIZATION

1 Introduction

The present paper will give an account of the results from a study of personnel attitudes to and knowledge of different safety and environmental problems within the explosives industry.

For a description of the main project and the background of the present study, the paper by Urban Kjellén is referred to, where the theoretical basis for the study is also outlined.

2 Some notes about the theoretical frame of reference

The theoretical basis for the attitude survey and the knowledge test is the model of the central processes in risk-taking and the corresponding external variables, which are presented by Urban Kjellén (see Kjelléns paper fig 2). From this model it appears that identification of risks is dependent on knowledge about the risks, and that the interpretation of risks depends on the attitudes to risks. Knowledge, in turn, is influenced by information and experience, while the attitudes are influenced by motivation and various remunerative and control systems.

The effect of different safety measures is dependent on whether the worker is willing to accept the measures, e.g. the increased effort entailed by wearing personal safety equipment or making the detours that are enjoined by the safety instructions (Kronlund & Jensen 1974). Such an acceptance is dependent on the extent to which other individual needs are in conflict with the needs for safety, such as need for contact and social interaction, need for a reasonable income and need for self-determination and personal control over the working situation.

We assume that the factors underlying the safety motivation are the same as those underlying the motivation to work in general (Surry 1968, Andriessen 1974). This indicates that the lay-out of the safety system also has to take into consideration the psycho-social factors of the job, i.e. the individual must not be regarded as a disturbance in the system, the influence of which ought to be eliminated. Instead the construction of the system must consider that man is an active being, demanding influence over his work situation and working conditions. The safety measures in the work environment should not be in conflict with these demands.

It is probable that the individual´s behaviour in the acute situation when an accident occurs is a consequence of an unconscious risk-taking rather than a consciously calculated risk. The behaviour is based on incidental circumstances in the work environment and the working situation, or on the occasional incapacity of the individual. This, however, does not exclude the assumption that the human being is capable of estimating the risks in the environment, and that there is a generality in how people perceive these risks. Our theoretical basis is that the individuals´ experiences and valuations of their own environment, and of the risks associated with their own jobs, shoul be regarded as reflections of the true circumstances; e.g. the workers are competent to estimate the risks of their own work environment.

One of the aims of this study has thus been to investigate how the personnel perceive the risks in their work, and the feed-back of their experiences from production to the parts of the organization working with planning and construction. Only when such a feed-back is properly functioning, by which the experience of the production crew is considered in planning and construction, will it be possible to obtain safe work in a longer perspective.

The study also aims to find out how the employees view their possibilities to actively influence the safety system. Their actual possibilities to influence the safety of their own jobs are to a large extent dependent on how well the formal safety organization of the company is functioning. The roles of different categories of personnel are of a certain interest in this respect, and especially the functions of supervisors and safety stewards (skyddsombuden) (the workers´ safety representatives), in the safety work. Both these groups are important links in the safety communication chain: The supervisors since they are formally responsible for the local job safety, and the safety stewards, since they are the workers´ representatives in the safety organization. Both groups also have a difficult intermediate position, and especially the safety stewards risk finding themselves in loyalty conflicts.

The employees´ involvement in safety matters is dependent on their knowledge about safety-at-work and the risks in their work. It is also a question of satisfactorily functioning information and communication. Thus, we wish to study personnel attitudes to the formal safety education in the companies, their knowledge about the safety organization, about risks at work and their valuation of the safety information.

To sum up, this part of the project aims to bring about an evaluation of the safety system of the explosives industry, reflected in the employees' judgement of the risks in their jobs, their attitudes to the safety organization and their knowledge about subjects concerned with safety at work.

3 Methods

By deduction from the theoretical frame of reference, and with the aid of interviews with representatives for management, supervision, safety stewards and workers at the different companies within the industry an attitude questionnaire was designed for the workers.

The questionnaire covered the following areas:

- background data about age, sex, nationality and length of employment of the subjects
- accident and subjective state of health
- personal safety equipment
- job satisfaction, physical and mental strain
- attitudes to the safety organization
- perception of different job factors in relation to risks (environment, organization, wage system, education)
- attitudes to the system for safety information and communication (the role of co-workers, safety stewards, supervision and management)

Special questionnaires have been constructed for the supervisors and the safety representatives, in order to penetrate the specific problems of these groups. These special questionnaires have, besides the areas mentioned above, also contained questions concerning possibilities to influence the safety work, and the particular role-conflicts that may arise for these groups in relation to other personnel groups, especially in the safety work.

Furthermore, a knowledge test has been constructed. The test concerned workers and safety stewards, and consisted of ten questions about the safety organization and risks at work. The questions were generally formulated and did not concern the conditions at specific work places.

This questionnaire consisted of four types of questions:

- general questions about the safety organization, locally and for the industry
- general questions about the sensitivity of explosives and the risks for ignition
- special questions for the personnel working with, respectively, nitroglycerine, blasting agents and pyrotechnics
- general questions about the properties of explosives and measures against fire and explosions

The workers´ questionnaires were also translated into Finnish. The field-study was carried out during the period April - June 1974. Normally the subjects were connected during working time in groups of 10 - 25 persons, and they filled in the questionnaires anonymously. A total of 549 workers, 33 safety stewards and 51 supervisors from nine factories within the explosives industry were subjects for the study.

4 Results

In the following a brief report will be given on some of the results from the study. In this account we will in particular illustrate the differences between the answers of workers, safety stewards and supervisors concerning different questions.

4.1 Questions concerning education and knowledge

Table 1 Do you think that you have sufficient knowledge about the risks that an explosive might ignite?

	Workers	Safety stewards (skyddsombud)	Supervisors
	N	N	N
Alternatives	546	33	51
	%	%	%
Yes, absolutely	18	21	59
Yes, to a certain extent	42	67	35
No, hardly	21	6	4
No, absolutely not	19	6	2

Concerning the experience of having sufficient knowledge of the risks of the work, there are large differences between the different personnel groups.

Only a few percent of the supervisors and safety stewards think that their knowledge is insufficient, while 40% of the workers state that their knowledge is unsatisfactory. It is apparent from the answers to other questions within this area that only 10% of the workers have had any further education about explosives, apart from the introduction. Furthermore, only 1/3 of the workers state that they have had any introductory education about safety at work in general.

Where the practical safety training is concerned there is also much left to be done. Only 40% of the workers state that they during their employment have taken part in fire-protection exercises, evacuation practices, demonstration of emergency showers etc. This ought to be considered in relation to the specific kind of substances which they are handling.

It also seems as though the supervisors often have greater confidence in the workers´ knowledge and ability than the safety stewards and the workers themselves have, which is illustrated in table 2.

Table 2 Do you think that the personnel within your area of responsibility/your department have sufficient knowledge about the ignition and poisoning risks in the work?

	Safety stewards (skyddsombud)	Supervisors
	N	N
Alternatives	33	51
	%	%
Yes, absolutely	15	29
Yes, to a certain extent	30	57
No, hardly	46	12
No, absolutely not	9	2

We have in table 1 above been able to show that 40% of the workers find their knowledge about explosives insufficient. On the corresponding question about the risks for poisoning in the job, 60% of the workers stated that they had too little knowledge. The differences between the answers of the supervisors, on the one hand, and the safety stewards and the workers on the other, are probably due to different frames of reference for the two groups. One ought to notice, however, that the supervisor, according to Swedish law, is immediately responsible for the safety of his department. Thus, there is a great danger in the supervisor overestimating his personnel.

According to the central agreements between the Swedish labor market parties, it is to the supervisor, that the workers should turn in the first place, in matters concerning safety. The answers to one of the questions in the knowledge test indicate that only every fourth worker is aware of this fact:

Table 3 To whom should you in the first place turn in safety matters?

	Workers
	N
Alternatives	534
	%
Your safety steward (skyddsombudet)	71
Your supervisor	28
The safety engineer/safety inspector	1

Another question in the knowledge test concerned the appointment of the local safety steward:

Table 4 Who appoints the safety steward (skyddsombudet) at your work place?

	Workers
	N
Alternatives	534
	%
The works council (företagsnämnden)	5
The safety committee	44
The local union organization	51

According to 40 § in the Industrial Safety Act, the safety steward is appointed by the local union organization having a collective agreement with the employer. Only half of the worker participating in the investigation marked this alternative. A conclusion drawn from this, shown by many results of the study, is that safety information and communication is often insufficient, and does not reach those for whom it is intended.

On an average, the workers gave the right answer for 51% and the safety stewards for 71% of the questions in the knowledge test.

4.2 Questions about state of health

Concerning the occupational health problems, Urban Kjellén has in his paper pointed out the special poisoning risks within the explosives industry, especially when handling toxic substances, such as nitroglycerine and nitroglycol.

Table 5 Do you suffer from any kind of ill-health that you connect with your present work?

Alternatives	Workers	Safety stewards (skyddsombud)	Supervisors
	N 533	N 32	N 50
	%	%	%
Yes	32	22	18
No	68	78	82

About 1/3 of the workers state that they suffer from pain or ill-health in connection with their present job. The safety stewards and supervisors also complain of ill-health but to a lesser degree. The most common pains that are stated are headache, stomach pain, different kinds of allergic reactions, eczema, rash or itching.

A health preserving measure, which at the same time is a way to increase job safety, is to create opportunities for a temporary transfer of a person to another job, if he for some reason has a bad day, is tired, indisposed etc. This implies, of course, that the measure is accepted by the employee, that it is regarded as legitimate to ask for such a transfer, and that the person concerned is not subjected to sanctions or decreased salary.

However, this kind of measure is very seldom applied systematically and the personnel is not aware of the actual opportunities in this respect:

Table 6 Questions to the workers: Do you have the opportunity to be temporarily transferred to another job, if you occasionally feel that it is difficult for you to manage your ordinary job, e.g. from tiredness?

Question to safety stewards (skyddsombuden) and the supervisors: What opportunities does a worker in your area of responsibility/your department have to be temporarily transferred to another job, if he occasionally feels that it is difficult for him to manage his ordinary job, e.g. from tiredness?

Alternatives	Workers	Safety stewards (skyddsombud)	Supervisors
	N 534 %	N 32 %	N 51 %
There are very good opportunities for such a transfer	14	16	30
There are quite good opportunities for such a transfer	25	34	35
There are very restricted, or no opportunities for such a transfer	61	50	35

From the figures in the table it can be concluded that there is a noticeable difference between the workers´ and the supervisors´ answers to this question. 65% of the supervisors have stated that there are at least quite good opportunities for such a transfer. If this actually is a fact, then this information has to very little extent reached the workers, most of whom are of the opinion that such a transference is impossible.

4.3 Attitudes to the safety organization

The attitudes to the various functions of the formal safety organization also differ between the personnel groups:

Table 7 What is your opinion of the safety committee and the work it performs?

Alternatives	Workers	Safety stewards (skyddsombud)	Supervisors
	N 546 %	N 32 %	N 51 %
We have no safety committee	1	-	-
The safety committee is functioning well	40	75	84
The safety committee does not function as it should	34	25	12
I don´t know anything about the safety committee	25	-	4

The supervisors have a noticeably positive attitude to the work of the safety committee. This is also the case for most of the safety stewards. It ought to be pointed out, however, that when the corresponding question of opinions about the total safety work within the company is asked, 36% of the safety stewards state that "the safety work does not function as it should" compared to 8% of the supervisors. We have established before, that the supervisors are locally responsible for the safety, which can partly explain their positive attitudes. The fact that the safety stewards have a more critical attitude to the safety work as a whole than to the work of the safety committee may be a consequence of their themselves being part of the committee. Furthermore, the safety committee is often the only place where the safety steward is able to act and influence the safety work.

every fourth worker states, that he does not know anything about the safety committee. It seems to be difficult for the formal safety organization to reach those who should be benefited by the safety work.

4.4 Job satisfaction

Gardell (1971) has shown in a study of more than 1 000 Swedish industrial workers that 2/3 have a mainly instrumental attitude to their work, i.e. they regard their work mainly as a source of income.

In a study of 700 Swedish sawmill workers, 74% stated that they merely worked for the earnings (Baneryd 1974).

This "instrumental attitude" has been studied by the following question, used both in the above mentioned studies and in our study of explosives workers.

Table 8 Which of the statements below gives the best description of your feelings towards your present job?

Alternatives	Workers N 540 %	Safety stewards (skyddsombud) N 33 %	Supervisors N 49 %
This job is like any other job, you do what you are told, but only the earnings are of any importance	86	61	37
There is something special about this job. Besides the earnings, it also gives me a feeling of personal satisfaction	14	39	63

Those marking the first statement are defined as having a mainly instrumental attitude to their job. It can be seen from the figures that this attitude is very common among the workers of the explosives industry. The results suggest that the attitude is even more widespread than among the sawmill workers, the working conditions of whom are very monotonous and restricted.

The supervisors, on the other hand, seem to be quite satisfied with their jobs in this respect. 68% if the supervisors, however, find their work to be too mentally strenuous, compared to 50% of the workers.

Other questions within this area show that 71% of the workers find their work too monotonous.

Important for the feeling of satisfaction with the job itself, is whether the individual is exposed to continuous pressure from the working process or not, his degree of freedom at work, his degree of personal responsibility and influence on decision, and the overview the individual has of the total context of which his own job is a part. For explosives work in general it can be said that the psychological job content is often considerably restricted by different conditions, viz.:

- assembly line production
- high working pace
- strong repetitivity in combination with demands of superficial attention
- social isolation, as a consequence of the principle that as few individuals as possible should be exposed to danger in case of a sudden ignition of the explosives.

4.5 The role of the safety steward (skyddsombud)

The role of the safety steward in the organization is of particular interest especially in the light of his increased authority according to the amendments of the Industrial Safety Act, with effect from January 1, 1974. Among other things, the safety steward is entitled to stop the work pending a decision by the Industrial Safety Inspectorate, if there is an imminent risk of an employee incurring serious physical injury, and a remedy cannot be obtained immediately after consulting the employer.

Tables 9 a and 9 b below throw light upon the loyalty conflicts that the safety steward can be subjected to:

Table 9 a Do you think that the employer pays any attention to what the safety steward (skyddsombudet) at your work place says?

Alternatives	Workers	Safety stewards (skyddsombud)	Supervisors
	N 546 %	N 33 %	N 51 %
Yes, absolutely	48	58	90
Yes, to a certain extent	11	42	-
No, hardly	4	-	2
No, absolutely not	37	-	8

Table 9 b Do the workers at your work-place pay any attention to what the safety steward (skyddsombudet) says?

Alternatives	Workers	Safety stewards (skyddsombud)	Supervisors
	N 548 %	N 33 %	N 51 %
Yes, absolutely	63	39	90
Yes, to a certain extent	6	61	4
No, hardly	6	-	-
No, absolutely not	25	-	6

If we first look at the answers of the supervisors, we find the statement that the employers as well as the workers really care for what the safety steward says. We can also notice, that in the workers´ group there are more workers stating that the workers themselves pay attention to the safety steward than there are workers thinking that the employers do the same.

Most interesting, however, are the answers from the safety stewards themselves. They think that they have a positive response from the employers as well as the workers. There are, however, more safety stewards choosing the most positive reply to the question about the employers´ interest in their opinions than when the question is about the workers supporting their work. This could be interpreted as showing that the safety stewards are of the opinion that they have better support from the employer than from the workers, in spite of their being the workers´ representatives in the safety organization.

One of the explanations for this might be found in the role that the safety stewards feel that they have in the safety organization, which can be illustrated by table 10 below:

Table 10 Mark which of the statements below, that you think is the mest description of your role as a safety steward (skyddsombud)?

Alternatives	Safety stewards (skyddsombud) N 33 %
I am a member of the safety committee and take part in safety inspections, but otherwise I am not very much engaged in the safety work	30
My main function in the safety work is to see that the workers obey the safety instructions	21
I do as well as I can, but it is hard to get people to listen to what I say	21
I have good opportunities for active safety work, and for influencing dangerous conditions in work	18

From the table it can be seen that most of the safety stewards find their safety functions to be quite passive, and only few think that they have opportunities for more active safety work.

4.6 The situation of the Finnish speaking workers

It has been stated before that the questionnaires were translated into Finnish. A few examples of the special problems of the Finnish speaking workers will be reported here.

In our sample 12% of the workers were Finnish, with limited knowledge of the Swedish language. Information is, of course, a particular problem for this category:

Table 11 What is your general opinion of the safety work within your company?

Alternatives	Swedish speaking workers N 478 %	Finnish speaking workers N 61 %
The safety work is functioning well	44	34
The safety work does not function as it should	38	28
I don´t know anything about the safety work	18	38

From the table it can be seen that there is a noticeably larger number among the Finnish speaking workers stating that they don´t know anything about the safety work.

Another problem is the fact that communication functions in a different way for the Finnish speaking workers:

Table 12 Turns to a fellow-worker if there is something wrong with the equipment or the planning important for the safety work.

Alternatives	Swedish speaking workers N 364 %	Finnish speaking workers N 51 %
Always	11	49
Often	13	18
Sometimes	33	21
Seldom or never	43	12

The formal channels for communication (e.g. via the supervisor) seldom function for the Finnish speaking group. As a rule, they have to make a detour via a worker who knows both the Swedish and the Finnish languages. This increases the risk for disortion of the information, particulary if the fellow worker does not completely understand Swedish either.

5 Discussion and conclusions

The results of the study indicate, that in several cases there are problems as regards information and communication concerning safety. There is also much left to be done about the employees' safety education and practical safety training. In this respect, there is probably no difference between the explosives industry and other Swedish industrial branches.

The work on accident prevention in general may, in principle, be managed in two different ways:

- the safety work is performed by experts, in detail planning and controlling the work
- the employees are involved in the safety work, with opportunities to influence control and planning.

Within the explosives industry the first model is, by tradition, applied, which entails a strong expert control of the safety work. This is due to the violent consequences of an explosion, with risks of e.g. injuring people outside the plant. It is also a consequence of the safety work demanding special knowledge in the technical handling of explosives (c.f.paper by Urban Kjellén).

In order to reduce the number of accidents due to human error, the tasks are frequently broken down into simple operations and are strictly regulated by work schedules. In this way, the individual's influence on the system is minimized.

We have in the theoretical frame of reference made the assumption that the same factors underlie safety motivation as underlie overall motivation to work. Of importance for the motivation to work is the individual's personal control over and influence on his own job, the so called intrinsic job factors (Herzberg 1959, 1966).

The way in which the production within the explosives industry is organized, for production and safety reasons, means that the work, from the psychological point of view, has become very monotonous and restricted.

We have found a widespread instrumental attitude to the work among the workers, indicating low morale and low job satisfaction. Thus, the interpretation may be made, that there is a conflict between the way in which the production and safety systems are organized and the workers ego-needs, such as needs for independence and responsibility.

In order to increase safety motivation, the traditional safety philosophy has to be abandoned, and replaced by an alternative safety approach, where the employees' influence on the safety system is accentuated. Such an approach has been outlined in the paper by Urban Kjellén.

6 References

Andriessen, J.H. (1974): Veiligheid - een kwestie van motivatie. Faculteit Psychologie, Vrije Universiteit, Amsterdam.

Baneryd, K. (1974): Analysis of the psychological job content in sawmill work. Proceedings of IUFRO Joint Meeting, Division 3 and 5. Symposium in Sweden, August 26-30, 1974. Liber Tryck 1975.

Gardell, B. (1971): Produktionsteknik och arbetsglädje. Personal-administrativa rådet, Stockholm.

Herzberg, F. (1966): Work and the nature of man. The World Publishing Company, New York and Cleveland.

Herzberg, F., Mausner, B & Snyderman, B. (1959): The motivation to work. Wiley, New York.

Kronlund, J. & Jensen, I-L. (1974): Löneform och olycksfall. Ekonomiska institutionen vid Linköpings högskola. Forskningsrapport nr 8.

Surry, J. (1968): Industrial accident research. Department of industrial engineering, University of Toronto.

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CHANGES IN SAFETY WORK FROM REPORTING ON NEAR ACCIDENTS - A THEORETICAL FRAME OF REFERENCE

For some years a study group representing the National Swedish Board of Occupational Safety and Health, the Swedish Logging Research Foundation and the Royal College of Forestry have been engaged in a research project which seeks to prevent accidents in forest work.

The members of this group have been chiefly concerned with reporting near accidents or "close calls". Two reasons prompted us to choose this method. First, near accident reporting can make us more knowledgeable about the hazards involved in forest work than if we confine ourselves to manifest accidents. The second reason is that the method we devised for near accident reporting has served to stimulate the internal safety programmes of the companies concerned, this by activating their employees, which has given these persons greater opportunities to influence their work situation.

When trying to define the concept of "accident", one will find a great number of definitions in the research literature. Among these, two extremes can be distinguished: the one assumes that the accident must result in an injury with absence from work, whereas the other only comprises the actual event.

The problem for the researcher trying to define an accident is not to select one or the other of these extremes, but to establish the most suitable definition for the problems which he intends to study. However, this means that the researcher must have a clear grasp of the merits and demerits of the data concerning the problems and the consequences this will have for the result.

The data which can be used are shown in the following diagram:

Death Permanent disability Temporary disability	} Official statistics	} Manifest injuries (Official statistics + Minor accidents)
Minor accidents		
Near accidents Disturbances		} Incidents similar to accidents

The term "Official statistics" comprises cases of death, permanent and temporary disability. Minor accidents require medical care, but not absence from work.

Statistically, the advantage of manifest injuries is that they are easy to define. The first two types are also those which are most expensive for the individual, the company and the community both in their moral and economic aspects.

On the other hand, manifest injuries occur infrequently, which means that measures such as the rate of industrial accidents and the degree of severity become quite hypothetical in all but the largest companies and industries. Another disadvantage is that much of the data is compiled for insurance purposes: in other words, the cause of the injury is described but not the cause of the accident. A further problem when interpreting these data is the varying injury susceptibility of different individuals. The frequency of reporting may also be influenced by whether or not those injured know if it is possible to obtain financial compensation for the injury. A final major problem when restricting investigations to the manifest-accident category is that these will always be ad hoc, that is, it will not be possible to take action before the accident has taken place.

Accident-like events consist of near accidents and disturbances. Near accidents are normally defined as a sudden occurrence which in deviating from the normal course of events might have given rise to an accident. Disturbances may be seen as a wider concept comprising all deviations which may but do not necessarily lead to accidents.

The primary objection to using data of this type is that the causes of near accidents and disturbances may differ from the causes of manifest accidents. This question has been studied by almost all researchers on near accidents and no differences have been found (1). There are also researchers who maintain that the severity of an accident may be random (2). Incidents from the same causes may recur with high frequency without resulting in injury. If only manifest accidents are taken into account, an incorrect picture of the risks in the working environment will be formed, from which it follows that the wrong measures will be taken.

A further objection to the study of near accidents is that they are difficult to define and this results in a certain amount of drop-out in the studied population. However, this drop-out can be contained if various methods are used to obtain operational definitions of the concept of near accidents (2, 3).

The principal advantage of using incidents similar to accidents is that they so greatly outnumber the actual accidents. An incident will often be better described because the person involved will remain at the workplace and be able to state immediately what has happended. It will also be easier to admit to error when the outcome has not been an accident (1).

A further important advantage in using near accidents is that they provide material for the prevention of accidents before they occur. Reporting on near accidents and disturbances is especially valuable [illegible] machines and techniques.

There are advantages and disadvantages with all kinds of data, which ought to prevail on the individual researcher to invoke the broadest possible definition of the "accident" concept. To quote from a study: "Even if a majority of the reported disfunctions are not direct accident potentials, even if major accidents are described as coincidental, will anyone deny a suggestion that this mass of information should not be of vital value for control and improvement of working conditions and of system reliability?" (4).

However, there is nothing new about studies of near accidents. Investigations based on the critical-incident method got under way during World War II and bore particular reference to the United States Air Force. Vasilas (5) accumulated information about near accidents from flight personnel in order to reduce the number of military accidents. A near accident was defined as an incident which would have led to an accident unless a suitable corrective measure had been taken. In the Swedish Air Force information about flying disfunctions has been collected since 1964 (4). This method has also been used in traffic accident research.

The study of near accidents in the working environment has been performed e g by Heinrich (6) and Tarrants (2). In Sweden the main body of research into near accidents has concentrated on the mining and forestry industries. Forest workers have reported incidents in logging operations had these have provided a basis for the analysis of risks in this type of work (3). In the mining industry a number of selected observers have reported on disturbances which have involved a deviation from the expected course of the work. This expected course has been defined in detail before the study (7).

In most of the above-mentioned reporting systems the reporting of near accidents is considered completed when the researcher or safety engineer finally receives the material. The results are then compiled and used as a basis for technical measures of accident prevention. As a side effect it is often mentioned that the "employees are activated" (2, 7).

Since the same findings emerged in our studies, we decided to go ahead with the task of devising an action-oriented model. In addition to providing a basis for technical measures, this model would lead to increased activation of the individual and at the same time vest him with greater powers to influence his own work situation.

But before I describe this model, it will be appropriate to examine the system of occupational safety we have today and its modus operandi, that is, the manner in which it operates to cut down on the accident rate.

Modus Operandi of the Safety Organization

The safety organization may be said to constitute an example of a representative bureaucracy within the firm or company (8). This means that the rules laid down in such a bureaucracy can be accepted both by employers and employees because these rules serve a common purpose, that is to say, both parties can legitimate the rules for the system because they agree with the values of one´s own group.

The employer endorses the goal, "prevention of accidents", because any accident that occurs impedes production. Hence it is economically profitable to have safety enter into the production goals. Another important motive for the employer, of course, is the purely humanitarian one, but the lengths to which employers are prepared to go on this score are determined, first, from firm to firm with reference to economic criteria; and second, on the basis of norms in the larger society.

The chief interpretation that the workers put on this goal is to avoid getting killed or injured. Many individuals also perceive an accident to be a personal misfortune, since they feel that personal skill has great importance for the avoidance of accidents (1).

According to Weber (9) the representative bureaucracy may also be called an expert-administrered system. That is to say, the work of the safety organization is headed by an expert, the safety engineer, who by virtue of his specialized knowledge is expected to discover and gain control over dangerous circumstances and malpractices. But one does not accept the expert merely because he knows how to implement technical measures to cut down on the number of accidents. There must be a consensus concerning the goals and values of the safety work. The authority of experts will be acknowledged only when it is also used to promote the goals of the workers and when the workers themselves are enabled to take part in shaping and administering the safety programme.

By contrast with most other systems, the method used by the representative bureaucracy to get individuals to obey the different rules is not punishment-centered, that is, one does not assume that the workers are wilfully bent on hurting themselves. Instead, use is made of other methods such as education, training and instruction, which are meant to validate criteria of safet working behaviour.

So a representative bureaucracy builds upon consensus among the industrial relations parties. At this point, obviously, it becomes necessary to ask: Do prerequisites exist for this consensus? We then find, where the structure of the Swedish safety organization is concerned, that the existing preponderance of power in favour of the employer has again asserted itself, as manifested by the status this organization has within the firm. The safety organization is not incorporated in production but functions in a consulting capacity, which greatly narrows the scope for influencing decisions to implement measures already decided. It follows that considerations of safety will be rigidly controlled by the dictates of production.

This in turn accounts for the prevailing attitude among the workers, namely that safety is the employer's concern first and foremost. The local trade unions have attached low priority to safety matters. The work done by the plant safety committees, for example, has been of no more than an advisory character and has slight relevance to the individual worker. Indeed, some workers do not even know the identity of their safety steward.

Obviously, the workers are not sufficiently interested because they have been given few opportunities to influence their work situation. A change for the better in this respect is signified by the Occupational Safety Act of 1974. The purport of this statute is to encourage a system of safety work which confers greater influence on committees and the safety stewards. Hopefully, this should lead in time to improvements in the working environment. And the pre-enactment legislative reports have particularly stressed this point: the local safety work must be organized to get the individual employee involved in shaping the environment in which he works.

However, the text of the law itself does not spell out how this involvement is to be made possible. So we should now like to tie into the model that our study group has been working with.

Action-Oriented Model for Genesis of Accidents

A fundamental idea behind the accident model that has taken shape in the course of our research is that the individual himself is responsible for his acts and hence also for the errors he may commit. In other words, by virtue of his role in the system, the individual may act as a reliability or unreliability factor. At the same time, however, his behavior is controlled by the system, which compels him to function unreliably, that is, take risks. It follows that technical measures alone will not suffice to cut down on the accidents; attention must also be paid to changing those factors in the working environment which control individual behavior, moving them in a direction that will minimize the individual´s risk-taking (10).

If a programme of accident prevention is to get off the ground, it must acknowledge that an accident is not only caused by a number of unfortunate circumstances which cannot be foreseen. Instead, it is the operation of more or less permanent factors in and around the work which conduce to the occurrence of an accident. These circumstances depend in their turn on other factors inside or outside the man-milieu system described.

In principle, the accident model is built up around the risks in the physico-technical working environment, the individual´s behavior in a risk situation, and the controlling systems that may conceivably affect the individual´s behavior (see Figure 1).

The physico-technical working environment encompasses, among other things, the work process itself, machinery, handled products and the physical setting of the workshop. Irrespective of what the individual does, this working environment contains built-in hazards. Just how large this "objective danger" is will depend, first, on the kind of work performed; and second, on the money invested to make the environment safet. Nuclear power plants and space flights are two examples which demonstrate that huge investments can be made to yield a payoff in the form of less hazardous working environments.

When the individual comes into contact with the environment, he may in his role in the production system represent a reliability or unreliability factor and its controlling mechanisms. But the individual is also a victim of the system (11). (Here we assume that the individual does not wilfully generate risks in the system.)

If the individual is going to be able to decide whether a latent risk exists or a hazard has been triggered off in the system, the risk or hazard must be detectable. Further, the individual must recognize the risk or hazard. So some type of warning signal will be required. But that is not always the case, as illustrated by non-response to certain gases or toxic substances. Unless the individual apprehends or recognizes the signals, an accident is bound to occur.

Once the individual has recognized the signal as a sign of danger, he will make an assessment of the specific situation. The risk assessment is affected, first, by the individual´s knowledge and experience of the type and degree of risk; and second, by the alternatives open to him for avoiding the danger. Included in this assessment is a subjective evaluation of his own physical and mental ability to avoid the situation. Sometimes, however, the risk situation unfolds so rapidly that the individual is debarred from taking practical action after he has recognized the signal.

The risk assessment accordingly underpins the individual´s decision as to whether and how he shall act in the situation, that is, the risk-taking itself. Most of the models concerned with risk-taking assume the individual to be a creature of free will in his decision-making, but that doctrine does not hold water in the working environment.

Decision-making is more or less affected by a number of controlling factors. These may be found within the firm in the form of organizational structure, line supervision, method of wage payment or the physico-technical environment. But the members of a work group may also affect the decision-making on the strength of group norms in regard to such things as attitude to personal safety equipment, risk-taking or work pace. Factors in the surrounding society may also control the individual´s decisions. Examples of such factors are laws, regulations, directives, eligibility for compensation of injuries and the state of the labour market.

Summing up: the probability that an upcoming hazard eventuates in an accident or not will depend on the decision the individual takes and how this decision is affected by the controlling instruments.

Our purpose with this model is to point out the importance of adopting an open socio-technical approach to regard the accident process. We want the model to show that the task of preventing accidents must tackle the risks which are built into the physico-technical environment, that the individual must be endowed with better perceptual capabilities for detecting and recognizing risks, that he be provided with better supporting evidence on which to rest his risk assessment, and that the factors which control the individual´s behavior be changed in a direction so as to minimize his coerced risk-taking.

Now how can the reporting of near accidents be made to improve the safety work? Mr. Lennart Gustafsson will tell you about this aspect of our research project.

REFERENCES

1. Chapanis, A.: Research techniques in human engineering. Baltimore, Maryland, 1974.

2. Tarrant, W.E.: An evaluation of the critical incident technique as a method for identifying industrial accident casual factors. Doctor´s Thesis, New York University, New York, 1963.

3. Gustafsson, L., Lagerlöf, E. & Pettersson, B.: Analys av olyckstillbud vid huggning. Institutionen för skogsteknisk, Skogshögskolan, Report No 37, Stockholm, 1970.

4. Lager, C.: Pilot reliability. Royal Institute of Technology, Stockholm, 1974.

5. Vasilas, J.N. et al: Human factors in near accidents. US Air Force School of Aviation and Medicine, Project No 21-1207-001. No 1, 1953.

6. Heinrich, H.W.: Industrial accident prevention. Mc Grawhill Book Company Inc., New York, 1959.

7. Erixon, I. & Nilsson, B-C: Säkerhet i arbetet. Studie av störningar och arbetarskydd i Kirunavaara underjordsgruva. Kiruna, 1972.

8. Gouldner, A.: Patterns of industrial bureacracy. The Free Press, Glencoe, Illinois, 1954.

9. Weber, M.: The theory of social and economic organization. Collier Mc Millan, 1964.

10. Kronlund, J. & Jensen, I-L: Löneform och olycksfall. En teoretisk referensram och undersökningsdesign. Forskningsrapport nr 8, Linköpings universitet. Dept of Economics and Management, 1974.

11. Faverge, J-M: L´Homme Agend d´Infiabilité et de Fiabilité. Ergonomics, Vol 13, No 3. 301-327, 1970.

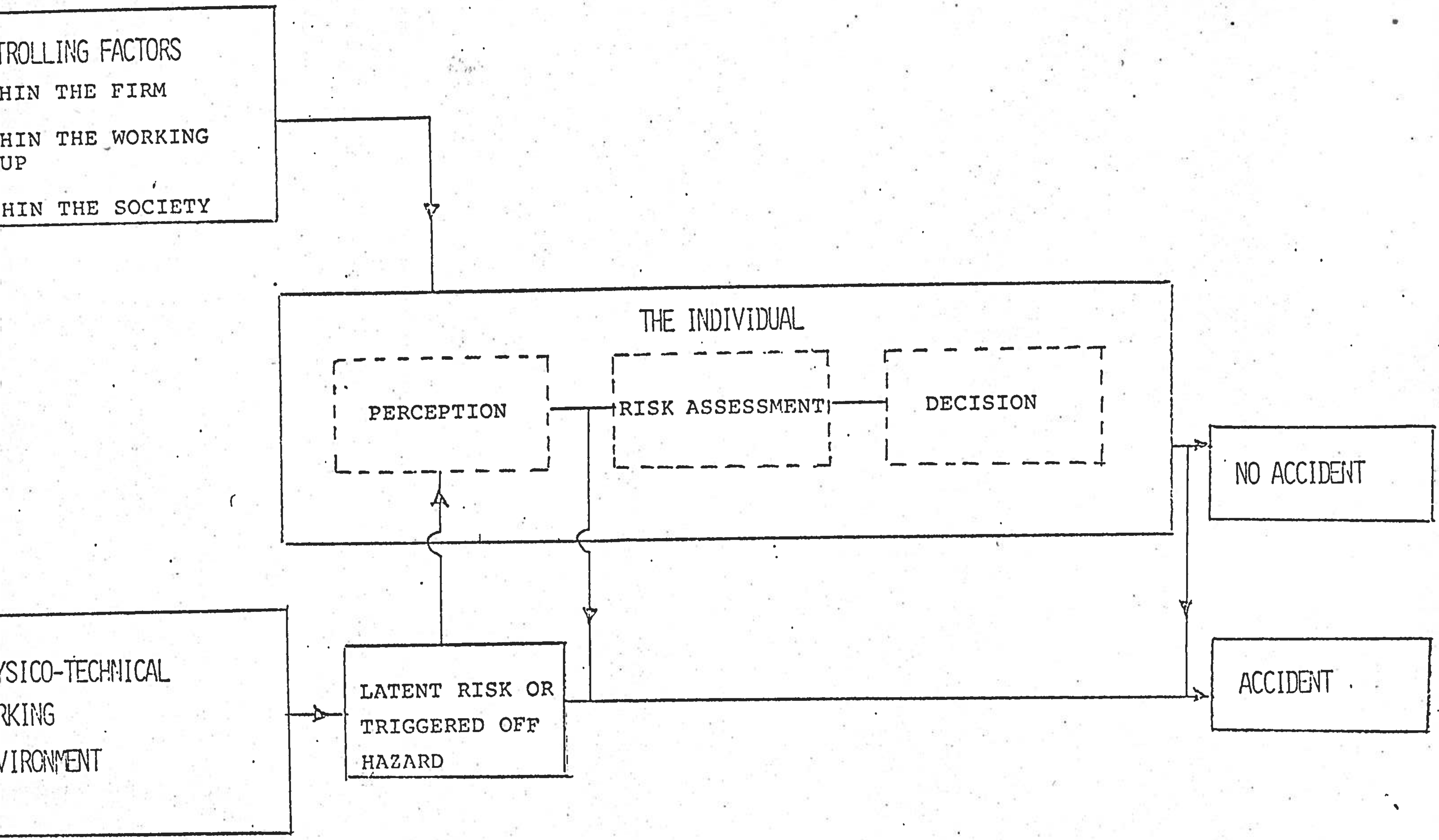

FIGURE 1. ACTION-ORIENTED MODEL FOR THE GENESIS OF ACCIDENTS

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SAFETY IN THE EXPLOSIVES INDUSTRY - DIFFERENT APPROACHES TO SAFETY AT WORK

Introduction and Summary

As a phase in the research on accident prevention in the explosives industry, a three-year interdisciplinary project started on the 1st of July, 1973. The project was initiated by the Swedish Inspectorate of Explosives and is sponsored by the Swedish Work Environment Fund. The research is being carried out by the Swedish Research Institute of National Defence in cooperation with the National Board of Occupational Safety and Health.

The project covers factories in Sweden where explosives are manufactured. The aim of the project is to explore general concepts of risks at work, to investigate the different functions of the safety organization and to develop means for participation in safety problems.

The first year of the project has included a general study of risks at work and of the safety organization in the explosives industry. During this first year a general inventory of the explosives industry was carried out. The inventory was followed by an attitude study of 600 workers and supervisors at nine factories.

The results of the general inventory and the attitude study constitute the background for the next two years research. During this period the project is limited to three factories. Means to activate the employees in safety work and to develop participation in safety problems are applied and evaluated.

In this paper, conditions in the explosives industry and the traditional safety philosophy of the branch is described. With this description as a background motives for an alternative safety approach are discussed and a model for the application of alternative concepts in the safety work of the explosives industry is described.

The Swedish Explosives Industry

The explosives industry in Sweden includes nineteen factories belonging to seven private and two government-owned enterprises. There are 4 000 employees of which approximately 2 200 work in direct contact with explosives.

The explosives industry produces blasting agents and detonators for the mining and construction industries, ammunition and pyrotechnical devices for civil purposes and different types of military material.

The production methods range from manual work to automatic, remote controlled production.

Secondary explosives, such as nitroglycerine-based basting agents, slurries and TNT are mainly manufactured in automatic and semiautomatic process plants. Primary explosives are produced in smaller, non-automatic units.

Typical examples of equipment used in the production of pyrotechnical explosives are powered mills, sieves and mixers. These devices are often remote controlled.

Later phases in production, such as the packaging of blasting agents, the adaptation of high explosives, powder and pyrotechnical explosives in different types of devices and the assembling of these devices to final products are mainly performed manually or by powered tools.

The development of more effective production methods is often retarded by technical conservatism, due to the inherent and not fully explored risks in manufacturing explosives, and by short production series.

Accident Statistics

Explosive substances can be triggered by external forces to explode, purposely or accidentaly. An explosion is often very violent with vast damage to personnel and equipment.

From 1962 to 1973, 52 explosions in the manufacturing of explosives, causing injury to personnel, were reported to the Swedish Inspectorate of Explosives (Sprängämnesinspektionen, 1963-1974). During this period, 71 persons were injured and 31 killed.

In figure 1, the number of accidents during this period is plotted against the number killed in each accident.

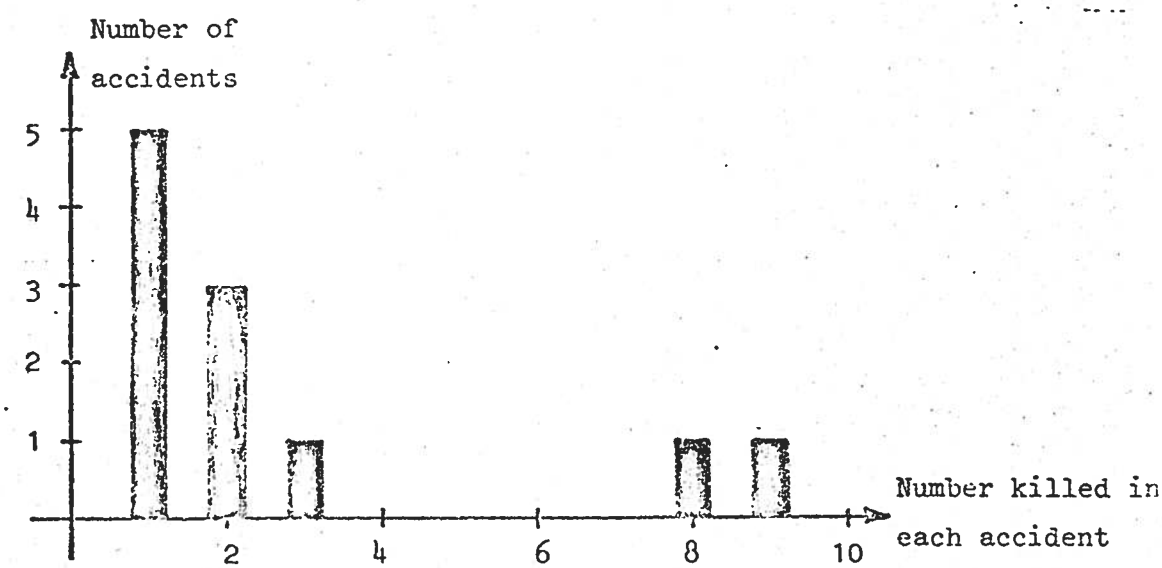

Figure 1. The number of accidents against the number killed in each accident in the Swedish explosives industry from 1962 to 1973.

In two accidents, one in a dynamite plant and one in a pyrotechnical industry, 17 persons were killed, representing 55 % of the total number of fatal cases. These two branches of the explosives industry, the blasting agent industry and the pyrotechnical industry, with approximately 11 % and 8 % of the total number of employees, were responsible for 45 % and 48 % respectively of the total number killed in explosions from 1962 to 1973. It must be pointed out, however, that the statistics has been calculated from a relatively small number of accidents.

The accident risk of different occupational groups is usually derived from the injury rate and the severity rate (Arbetarskyddsfonden, rapport 1973:4). It is not possible to calculate the value of these rates for the explosives workers from data presented by the Swedish Inspectorate of Explosives, as the severity rate of each injury is not shown.

It is possible, however, to calculate the mortality rate of the explosives workers. The mortality rate is defined as the number killed per 100 million hours of work. The mortality rate of the explosives workers for 1962 to 1973, due to explosions, is approximately 60. In calculating these figures, the mean number of explosives workers during this period has been estimated at 2 200 from 1973 figures. The number of hours of work a year per employee has been put at 2 000.

Table 1. The mortality rate of different occupational groups during 1970 (Riksförsäkringsverket, 1973). The number of hours of work per employee and year has been put at 2 000.

Occupational group	Mortality rate
loggers, log-floaters	36
miners, rockblasters	45
deck-and engine crew	52
workers in the chemical and cellulose industries	22
all industries	5

Table 1 shows the corresponding figures for different occupational groups in Sweden and for the Swedish industry for 1970. The mortality rate of explosives workers for 1962 to 1973, due to explosions, is approximately twelve times the mortality rate of the Swedish industry during 1970 and comparable to the mortality rate of occupations that traditionally have been regarded as dangerous.

Employees in the explosives industry are also exposed to toxic substances such as nitroglycerine and nitroglycol, lead and other heavy metal compounds, etc. Deaths from nitroglycol poisoning have been reported (Götell, 1974).

A Traditional Safety Philosophy

very attentive to safety aspects during the planning of the production. The main aim of the safety work is to prevent the occurrence of explosions and, in case of an explosion, to reduce the consequences of this explosion to a minimum.

Based on knowledge of the qualities of explosives and experiences from accidents, a safety philosophy has been developed. Here a few examples of the application of this safety philosophy are presented.

In order to prevent a detonation in one production unit from extending to the whole plant, the production of dynamite is carried out in stages in different buildings, separated by walls. The number of workers in each building is kept at a minimum.

During the production of detonators, sensitive high-explosives are pressed in a cup. The probability of a detonation during the pressing sequence is relatively high. Hence, the quantities of explosive employed in the process are small and the workers are protected by shields from shock pressure and fragments in case of a detonation.

In order to reduce the number of accidents due to human error, the work in the production is frequently broken down into simple operations and regulated by work schedules. Automation of the process is also used to reduce the number of this type of accidents.

Systems Safety Analysis Applied to the Explosives Industry

Recently a new safety technique, systems safety analysis, has been developed and applied to different fields. An introduction to this technique is presented by Recht (1965). This technique has been applied by e g Dyno Industries in Norway in the planning of new explosives plant (Bjordal, 1974). The planning is performed in stages analysing probable events in the production and the consequences of these events to the production unit, the plant and the surrounding community.

In the first stage of the analysis, the location of the plant is considered with regard to the amount of explosives stored inside the plant and the location of surrounding communities, transport roads etc. The safety area around the plant is extended in order to prevent injury to the surrounding population in case of an explosion inside the plant.

Inside the plant area, production sites, warehouses and transport roads are separated. The production site consists of separate units. Each unit is constructed so as to prevent the consequences of an explosion in one unit from extending outside this unit.

In order to estimate and to reduce the probability of an accident inside a unit, a systematic hazard analysis of probable undesired events and the consequences of these events to the unit is carried out.

In hazard analysis a production unit is regarded as a system. The system is broken down into components. The interaction between these components and the behaviour of the total system is described. In the next stage hazards in the system are identified, their causes and the effect of a failure upon the system are recorded. A description of this technique, as applied to a new design to automate the

Systems safety analysis, as applied to the explosives industry, is a development of the traditional safety philosophy of the industry. Is this the ultimate solution to the safety problems of the explosives industry?

Motives for an Alternative Safety Approach

As can be realized from the preceding discussion, experts have a substantial influence on the safety work in the explosives industry. From experience we know, however, that it is difficult to guard against accidents only by planning and technical construction. The following must also be taken into account:

1) In spite of the aim to mechanize and standardize the work in production, the outcome of many tasks are still highly dependent on the skill and judgement of the worker performing the task.

2) Experts, planning the production, are unable to identify and thus to guard against every hazardous situation that might occur in the plant.

Accordingly, the participation of the workers to a greater extent in the safety program has been considered. The motives for this approach are:

1) The activation of the employee in the safety program may give rise to increased safety consciousness of the employee and may hence lead to reduced risk-taking at work.

2) The employees possess direct experience from their work conditions that ought to be utilized in the safety work.

3) The employees have legitimate interests to protect in the planning and realization of changes in production.

A review of the discussion of the relations between knowledge of risks at work, attitudes to risks, and risk-taking is presented in "Olycksfall i arbetsmiljön" (Arbetarskyddsfonden, rapport 1973:4). Research has indicated that workers with a good knowledge of risks at work tend to use safety equipment to greater extent than workers with a poor knowledge and tend to be less exposed to accidents.

To describe the relations between different variables influencing risk-taking, the following model is suggested (figure 2). This model is a

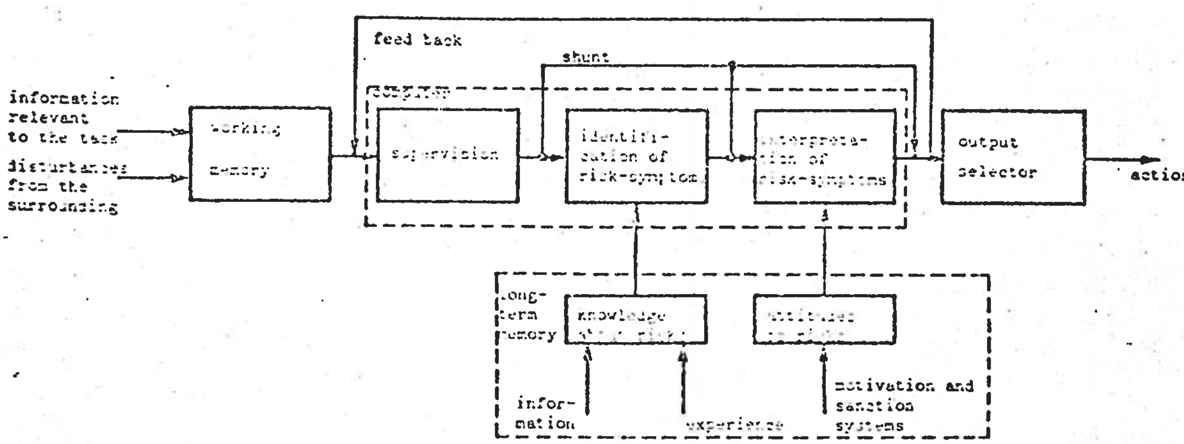

Figure 2. A model of the central processes showing different functions

slightly modified version of stress models, presented by Bergström (1972) and Poulton (1971). In this type of model, the central processes is described in system terms. The reason for this is that man often performs tasks as a part of a system, e g a man-machine system.

The main parts of the model are the input units, the computer, the memory and the output units. The central processes receives information from the sense organs. This information is classified into information relevant to the task and disturbances from the surrounding. The disturbances have a direct or accumulating effect of increasing or reducing the arousal of the central processes.

The working memory holds a representation of information received from the sense organs within a period of a few seconds or information fed back from the computer.

The computer contains three functions, supervision, identification and interpretation. In the box labelled supervision the presence or absence of signals is detected and relevant information is transmitted for identification.

In the box labelled identification, the information from the supervision is compared with models in the long term memory. These modelse are based on knowledge about risks from previous experiences and information received through education, instructions etc. In the following box, this information is interpreted and decisions are made, based on complex strategies, stored in the long-term memory. These strategies consist partly of attitudes to risks, which are influenced by such variables as motivation and sanction systems in the environment.

The shunt in the figure indicates that the identification and interpretation functions might be disengaged during the performance of routine tasks.

The aim of the models is to describe the effect of external variables on the risk taking of an individual and does not intend to explain individual differences.

It is probable that the risk-taking of an individual preceding the action in the acute situation of an accident is often unconscious and dependent on incidental circumstances in the environment or occasional incapacity of the individual. It can be assumed, however, that the individual has a conception of risks in his work environment and that he makes more or less conscious policy decisions as to which risks he is prepared to accept, and that these decisions influence his behaviour in actual situations.

These conclusions indicate the importance of a safety program that influences the employees´ knowledge about and attitudes to risks and at the same time utilizes their experience of risks at work.

Different safety programs with these objectives have been tested and evaluated, e g the reporting of near-accidents in forestry. The reporting of near-accidents is performed during two week campaigns in intervals of from four months to more than a year. As a result of these campaigns, a decrease in accidents, an increased risk-consciousness and increased interest in safety problems among the loggers have been reported, see paper by Lennart Gustavsson.

This technique gives rise to an increased engagement of the employees in the safety program. It is, however, not in conflict with an expert dominated safety program, as long as the employees have no direct influence on the application of the results to their own work-environment.

Studies from industry show the positive correlation between good safety records and a safety program that includes the employees´ participation in the development of their work environment through joint consultation with the managers (Cronin, 1972).

It may be questioned, however, whether a safety program ought to be judged only by its ability to prevent accidents, as the employees are exposed to different risks in their work environment, besides accidents, that threaten their physical and mental health, e g toxic substances and monotonous work.

The Application of Alternative Concepts in the Safety Work of the Explosives Industry

As has been discussed earlier in this paper, much of the safety work in the explosives industry today is performed by experts on explosives. It is probable that safety work will always be dependent on these experts due to the inherent risks in manufacturing explosives. Is it then possible to apply expert knowledge on explosives in safety work in combination with an increased influence of the employees? This is one of the problems in introducing alternative concepts in the safety work of the explosives industry.

Today the safety program in the industry includes such tasks as:

- performing safety measures in the existing work environment,
- integrating safety objectives in the planning of changes in production, and
- integrating safety objectives in the planning of new plants.

The employees have some influence on the existing safety program through their safety representatives. Also the activation of the employees in safety work is encourage by the safety organization in stressing the importance of reporting near-accidents. Joint-consultation groups at different explosives industries are today engaged in the planning of changes in production and in the planning of new plants.

A study of the present safety system within the explosives industry has been performed recently, see paper by Dr Baneryd.

These results also constitute the basis for our plans on further research on safety work in the explosives industry. In this research, means to activate the employees in safety work and to develop the joint-consultation on safety problems will be studied. This project is planned to be completed during 1976 and includes three factories in the explosives industry, representing different sizes and different production areas.

The plan of the research activities includes four steps 1) exploring safety problems, 2) analyzing and developing measures, 3) performing the measures and 4) evaluation. A joint-consultation group with representatives from the workers, the supervisors and the management has been appointed by the safety committee at each factory.

The joint-consultation group has two tasks:

1) to plan in cooperation with the researchers the extent and the performance of research,

2) to participate actively in different parts of the research.

During the exploratory phase hazardous conditions in production and difficulties in safety work will be identified. This phase will be initiated by a critical incident study, similar to the method of reporting near accidents in forestry. In this study the concept of near accidents will be extended to other types of disturbances in the production in order to increase the number of reported events. This technique has earlier been applied to the mining-industry (Erixon & Nilsson, 1973). During this phase, information is also collected through other means such as direct observation of the production.

The results from the exploratory phase will be discussed in the joint-consultation group. From these results the group will develop means to reduce risks at work and to increase the effectivity of the safety organization. The researchers - experts on explosives, psychologists and sociologists - take part in this process as observers, advisers (on technical and psychological problems) and by giving help to the work in the group.

During the next phase, the suggested measures, technical and organizational, will be carried out.

The research at each factory will then be completed with an evaluation of performed measures and collected experiences.

According to this model of realizing changes in the work environment, the traditional roles of the employees, the management and the experts are changed. Employees, as well as experts and management will actively take part in a development process in an exchange of knowledge and experiences. This type of research is being applied to the planning of the production in the mechanical industry (Johansson et al, 1973).

One of the aims of the development process is to influence the risk-taking of the individual for example by increasing his knowledge about risks and influencing his attitudes to risks and by making his decision in an acute situation more conscious. The aim of the development process is also to influence the decisions that regulate the design of the work-environment.

The design of the work-environment is within certain limits, set by e.g. law and government regulations, a result of a compromise between different interests (economical, safety, job-satisfaction etc). These interests are protected by the different parties of the company such as the management and the employees. The relative influence of the parties on decisions is dependent on their access to information and their power.

The design of the work-environment is rarely optimal with respect to the objectives of the different parties. Alternative designs of the work-environment may be accepted as ´good enough´. The search for better solutions is impeded by lack of information.

The aim of the development process is thus to increase the knowledge of the management, the employees and the experts about environmental factors, technical and organizational, that influence primarily safety at work but also job-satisfaction. The aim of the development process is also to give experts experience as consultants in joint-consultation groups. In this way the parties of the company will be able to find solutions to their problems in common, concerning the work-environment, that better correspond to their different interests.

REFERENCES

Bergström, B, Fakta om människan i normal - respektive flyg-miljö. Printed in Asher G & Törnqvist I, Anpassning förare - flygplan. Report for AB Teleplan, No RTA 420002/U43095, Solna, 1972

Bjordal, E N, Risikoforhold i industrien - sprengstoff - industri. Presented at the course of the NIF on Personal Safety, Sandefjord, Norway, December 3-6, 1974

Cronin, J, Cause and effects? Investigations into aspects of industrial accidents in United Kingdom. ILO Review Vol 103, No 2, February 1971

Erixon, I & Nilsson, B-C, Projektet "Säkerhet i arbetet". Studier av störningar och arbetarskydd i Kiirunavaara underjordsgruva. Gruvforskningen, Serie B, Nr 182, 1973

Götell, P, Nitroglykolexposition hos dynamitarbetare inom sprängämnesindustrin i Sverige. Examensarbete utfört vid Arbetarskyddsstyrelsens kurs för skyddsingenjörer 1973/74. Stockholm 1974

Johansson, S-Å, et al, Försök och forskningsverksamhet kring utveckling av samarbetsformer för planering av produktionen vid AB Åkers Styckebruk, Delrapport 1. Report for the Department of Industrial Management and Economics, Royal Institute of Technology, Stockholm 1973

Mc Glanaham, K W, A hazard analysis on a new design to automate the processing of initiating explosives. Research report for Texas A & M University, College Station, Texas, 1971

Arbetarskyddsfonden, Olycksfall i arbetsmiljön, Rapport 1973:4

Poulton, C, Skilled performance and stress. Printed in Warr P B (ed.) Psychology at work. Penguin, London 1971

Recht, I L, System safety analysis - a modern approach to safety problems. National Safety News, 4 parts, December 1965, February, April, June 1966

Riksförsäkringsverket, Yrkesskador 1970, Stockholm, 1973

Sprängämnesinspektionen, Sprängämnesinspektionens årsberättelse 1962-1973, Stockholm, 1963 - 1974.

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REPORTING OF NEAR-ACCIDENTS -

A method for more active work on industrial safety

Background

Before presenting our research work on the reporting of near-accidents, a brief presentation of industrial safety in Sweden might be useful in order to better explain the procedure of the reporting.

Industrial safety in Sweden is regulated both under law and on the basis of voluntary agreements reached between labour and management. It is up to the management to organize safety work as a whole, to determine the distribution of responsibility, to allocate funds and to provide the basics for a good system of industrial safety.

The employees' own representative is the safety steward (skyddsombud). He is usually designated by the authority to take whatever time he might need, with full pay, to do his job as a safety steward; to see all documents which are relevant to his job; and to stop work which he considers dangerous to the workers, until the Safety Inspector arrives.

The Safety Committee which consists of representatives for employers and employees, is the coordinating unit at the local level. Its main responsibility is to plan and supervise the safety work at the work-place, and this means participating in the planning of new buildings, machines and working methods or the redesigning of old ones. Training and information are also areas where the Safety Committee has important responsibilities.

In forestry work we have at present a fair amount of knowledge of the dangers involved, as well as a relatively well developed system of technical safety. Despite these measures, a large number of accidents occur every year, and during the passed decade these accidents have increased rather than decreased within Swedish forestry.

There are no obvious effects to be noted as yet of the work already done for the safety, and the reasons why are many.

One of the reason is that it has not been possible to obtain information about the risk factors involved in the work. This means that the workers have insufficient knowledge of safety problem, which leads to a lack of interest in safety work.

Another reason why we have failed to lower the accident rate, is that the safety organization does not function, this applies primarily to the organization at the working site. The safety stewards have reeived the training which is necessary for them to be able to function in an effective manner. They lack detailed instruction with regard to their work, and their authority is strictly limited. At the same time, the safety stewards´ compensation is inadequate which has contributed to the fact that very often the right man has not been selected as a safety steward.

A third reason as to why the safety work has failed is the lack of cooperation between the various personnel groups within the companies. The information distributed by the company to their workers is onesided, therefore the workers´ viewpoints have very little chance of reaching the people who make the decisions.

Finally, we can draw your attention to the fact that to date all safety work, not only in forestry, has onesidedly studied the technical aspect of safety and entirely forgotten the social an psychological aspects.

In order to be able to cut down the accident rate, we feel that it is necessary to increase the effectiveness of the present safety organization at all levels within the company.

Reporting of near-accidents

Our research work has proved that the reporting of near-accidents may provide very encouraging results if planned and carried out carefully. Under most reporting systems, when the researcher or safety engineer finally receives the material from for instance the reporting on near-accidents it is considered completed. The results are compiled and used as a basis for technical measures for accident prevention. As a sideeffect it is often mentioned that "the employees are activated".

For this reason we have attempted to develop a method for the reporting of near-accidents as a method of activating safety work and extending cooperation concerning industrial safety measures. The reporting on near-accidents provides the participants with increased knowledge as to work risks and thereby to increased safety consciousness. Attempts are also being made to improve paths of communication and to improve cooperation between employer and employee, which may lead to improved work organization and job design.

The following aspects have to be considered carefully in order to make use of the reporting of near-accidents.

- The person in the near-accident situation should report on it himself. He is the only person able to determine whether or not an incident is a near-accident. Studies using observers have three disadvantages, to wit, low observer reliability (both inter and intra), low validity of the reports, and influence on the person being studied, which in itself may lead to disturbances or near-accidents.

- Detailed information as to what is meant by near-accidents should be provided before the reporting. If possible, attempts should be made to provide operational definitions of near-accidents and discuss these in detail with those called upon to report.

- Reporting should take place anonymously. There will be a low response frequency if this is not done. The reports must never be used as a weapon against individuals and the possible errors they have committed, nor should specific individuals be classed as accident-prone.

- A greater number of near-accidents are reported if ONE interviewer collecs the information, i.e. the workers' safety steward. The person collecting the information should make daily visits to those reporting.

- The period of time for reporting should be limited. The optimal length of this period would appear to be a fortnight. The individual lacks motivation for a longer period, while a shorter period would give too few near-accidents, since there is a certain amount of initial resistance to reporting. The reporting period should be repeated after a period of four to six months.

- The result should be reported back to the reporter as quickly as possible. Before the participant has forgotten the report he should be shown the results in the form of reviews and examples of specific near-accidents.

- The result should be discussed at a workplace meeting where all of the reporters and a management representative are present. Carrying out the reporting of near-accidents in the manner described above provides an opportunity for two-way communication where knowledge and experience are utlized by those who are working every day in the environment in question.

- Necessary measures have to be taken. If the reporting is to have the intended effect then results have to be readily apparent.

Experimental activities within forestry

The following example from the forestry branch illustrates how the reporting of near-accidents should be carried out in practice (see Figure 1). Before reporting begins, all of those involved within the company should be informed, and they must have a positive attitude if the study is to be started. The interviewers are given a two-day course, and the reporters are congregated in groups of about 15 for a joint two-hour information session.

During a fortnight period the safety steward visits the loggers every day. If a near- or manifest accident has taken place the logger is interviewed about the incident with the aid of a predetermined questionnaire. The safety steward then sends the information to the central unit for processing. It is then analyzed and compiled and returned to the safety officer and to a representative of management as well as to the safety steward. A meeting is then held at the workplace, the results are discussed, and measures to be taken proposed. Both the supervisor and some other person authorized to make a decision should, if possible, be present. The measures to be taken may refer either to technology or to organization.

Studies on reporting of near-accidents according to the model above have been carried out within four comparatively large forest companies for a period of two years. Approximately 300 forest workers participated in these studies. The most important experiences from these studies are presented below.

- There has been a follow-up of the accident trend before and after the study activities at the administration taking part in the reporting on near-accidents. This trend has been compared with corresponding trend within one reference control-administration in each of the companies not reporting on near-accidents.

  Fig. 2 shows that the rate of accidents per million hours of work has decreased significantly within the administration studied from introducing of the reporting of near-accidents.

- The manifest accidents have also been classified as to their degree of severity according to which consequences the accidents in the most fatal cases could have led. This classification reveals that the proportion of severe accidents has turned out to be less also within the administrations studied in comparison with the control group of administrations.

- The reporting has given increased insight into accident risks and has provided a technical basis for preventive measures in traditional as well as in recently introduced jobs.

- Those participating in the reporting have received a better insight into the risks at work which has resulted in safer working methods, increased use of personal-safety equipment and an increased interest in safety matters.

- Increased active participation in decisions concerning industrial safety on the part of both employer and employee.

- The safety organization has become better known to the individual at the same time as the organization has been activated and functions better.

Figure 1. Routine for near-accident reporting

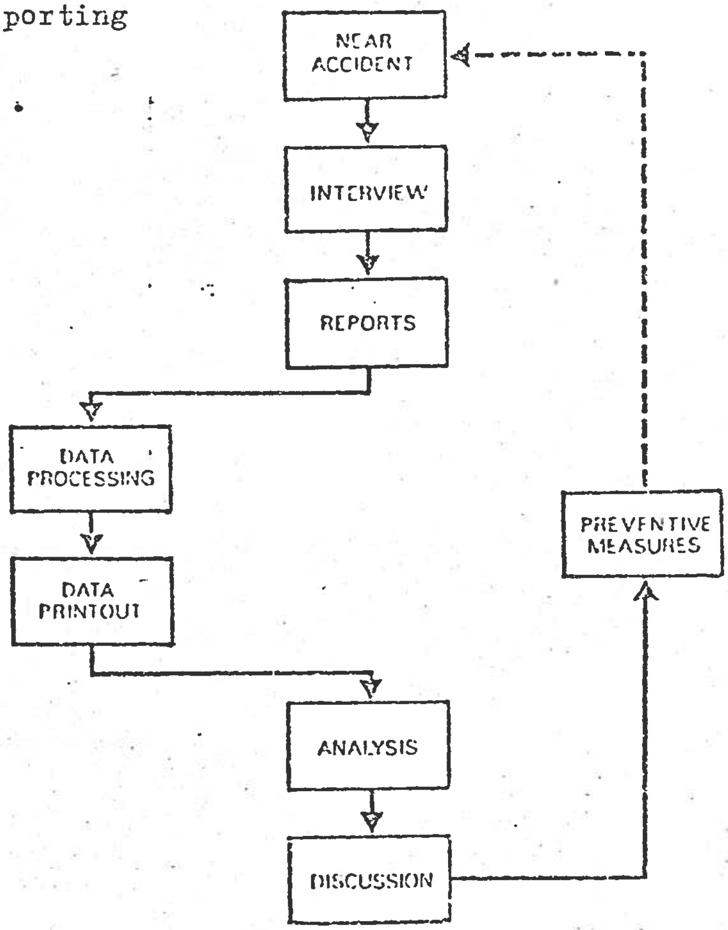
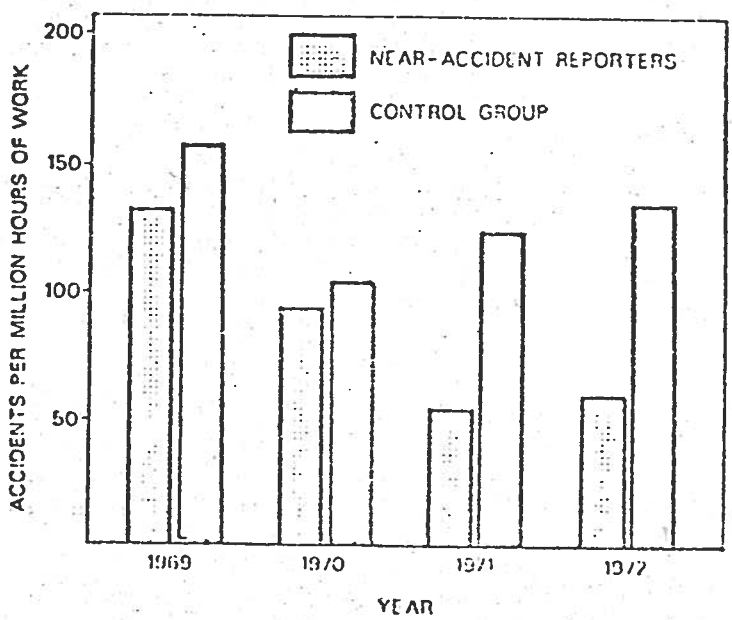


Figure 2. Comparison of injury rates in study and control areas



References:

Gustafsson, L., Lagerlöf, E. and Pettersson, B. 1970

An analysis of Near Accidents in Cutting Work. English summary. Dept of Operational Efficiency, The Royal College of Forestry, Research Notes No. 37.

Gustafsson, L. 1973.

An experiment in routine reporting of near accidents. - From Methods in ergonomic research in forestry, IUFRO Division No. 3. 'Forest operations and techniques', Publication No. 2.

Heinrich, H.W. 1959.

Industrial Accident Prevention - New York.

Tarrant, W.E. 1963.

An evaluation of the critical incident technique as a method for identifying industrial accident casual factors (Doctor's Thesis, New York University).

Vasilas et al. 1953.

Human factors in Near Accidents (US Air Force School of Aviation and Medicine Project No. 21-1207-001. No. 1).

<u>ARBETARSKYDDSSTYRELSEN</u>: - La Direction de la Protection et de l'Hygiène du Travail.
- National Swedish Board of Occupational Safety and Health.

Siège: Wennerbergsgatan IO   100 26 Stockholm
Tel. 08/ 54 02 60

Président: Gunnar DANIELSSON
Dir. Gen. - " -
Dir. Gen. Adj.: O. GUNNARSSON

- créée en 1972, mais existait déjà sous un autre nom depuis 1949.

A.S.S. est chargé de la réglementation et du contrôle des conditions de travail.

INSPECTION GENERALE DE LA SECURITE DU TRAVAIL fait partie de A.S.S. Cette inspection est divisée en 19 districts.

BUDGET: 1974/75 A.S.S 33,6 millions de couronnes suédoises.
Inspection. 33,5 millions de C.S.

Nombre: A.S.S. 360 personnes
Inspection 385 personnes.

ARBETARSKYDDSFONDEN: - Fonds pour l'environnement du travail.
- Swedish work environment fund.

Siège: Wennergren Center Sveavägen 166 8tr. 113 46 Stockholm
Tel. 08/ 15 13 00

Sec. général: Bo OSCARSSON

-créé en 1972.

A.S.F. doit:
- soutenir la recherche et le développement consacrés à diminuer les risques d'accidents professionnels.
- lutter contre les conditions de travail nuisibles à la santé.
- améliorer l'environnement du travail.
- et par là favoriser la sécurité et la santé dans la vie professionnelle.

A.S.F. R. et D. mais aussi EDUCATION et INFORMATION en matière de sécurité et environnement du travail.

BUDGET: 1974-75 80 millions de C.S.
A.S.F. est financé et géré indépendamment de A.S.S.

Nombre: 13 membres nommés pour 3 ans.

Bourses: A.S.F. distribue des bourses pour des séjours dans une institution étrangère hautement qualifiée.

PRIORITE: sur les accidents du travail.

AFSR

Présentation

Grev Turegatan 14
Box 5073
102 42 Stockholm 5
Association franco-suédoise pour la Recherche

COMITE DIRECTEUR

Membres suédois	Depuis
Professeur Sven BROHULT, Président de l'Association franco-suédoise pour la Recherche	1967
Directeur Harry BRYNIELSSON, nommé par l'Académie Royale des Sciences Techniques	1975
Professeur Kåre FRÖIER, nommé par l'Académie Royale de Sylviculture et d'Agriculture	1967
Professeur Tord GANELIUS, nommé par l'Académie Royale des Sciences	1975
Professeur Erik INGELSTAM, nommé par le Conseil National pour la Recherche Scientifique	1967
Directeur Gösta LAGERMALM, nommé par la Direction Nationale pour le Développement Technique	1967
Gouverneur Bengt PETRI, nommé par le Conseil National pour la Recherche Médicale	1967
Professeur Bror REXED, Directeur Général de la Direction Nationale pour la Santé Publique et la Prévoyance Sociale	1967

Membres français

Professeur Hubert CURIEN, Délégué Général à la Recherche Scientifique et Technique, Vice Président de l'Association franco-suédoise pour la Recherche	1969
M. Albert BROUSSE, Délégué Général de l'Association Nationale pour la Recherche Technique	1973
Professeur Constant BURG, Directeur Général de l'Institut National de la Santé et de la Recherche Médicale	1969
M. Claude DUGAS, Directeur Scientifique de la Compagnie Thomson-CSF	1967
M. Raymond FEVRIER, Inspecteur Général de l'Agronomie, Institut National de la Recherche Agronomique	1973
M. Bernard GREGORY, Directeur Général du Centre National de la Recherche Scientifique	1973
M. Jean LALOY, Directeur Général des Relations Culturelles, Scientifiques et Techniques du Ministère des Affaires Etrangères	1974
M. Henri PIATIER, Directeur Général Adjoint à l'Ecole Polytechnique de Paris	1967

L'Association franco-suédoise pour la Recherche, AFSR, qui a été créée en 1967, a pour mission de stimuler et faciliter la coopération entre la France et la Suède en recherche et technologie.

L'Association a pour actions principales de:

— Promouvoir et organiser des colloques bilatéraux franco-suédois

— Organiser des conférences sur la recherche et la technologie dans les deux pays

— Informer et recruter des candidats suédois pour des bourses scientifiques et techniques françaises

— Informer et recruter des candidats français pour des bourses scientifiques et techniques suédoises

— Stimuler les échanges de chercheurs entre les laboratoires scientifiques suédois et français

— Préparer les programmes de visites en France et en Suède pour des personnalités scientifiques et techniques

— Organiser des coopérations bilatérales entre laboratoires de recherche et développement

— Présenter sous forme de rapports les réalisations techniques et industrielles dans les deux pays

— Répondre aux demandes d'information sur la science et la technique françaises et suédoises

— Informer des cours de français en Suède et en France pour des techniciens, chercheurs et médecins suédois.

Le Comité Directeur de l'AFSR donne les lignes directrices pour l'activité du secrétariat.

Le secrétariat exécute les programmes d'échanges.

Le financement de base est assuré au moyen de subventions des gouvernements français et suédois. L'Association reçoit aussi des cotisations de membres individuels ainsi que de membres associés.

Les industries suivantes sont membres associés de l'AFSR (janvier 1976).

Français

AIR LIQUIDE

ARMINES (Association pour la Recherche et le Développement des Méthodes et Processus Industriels)

BERTIN & CIE

CGE (Compagnie Générale d'Electricité)

CTP (Centre Technique de l'Industrie des Papiers, Cartons et Celluloses)

COMEX (Compagnie Maritime d'Expertise)

IFP (Institut Français du Pétrole)

ORSAN (Les Produits Organiques du Santerre)

RHONE POULENC

SAGEM (Société d'Applications Générales d'Electricité et de Mécanique)

TECHNIQUES MENARD

THOMSON-HOUSTON-HOTCHKISS-BRANDT

Suédois

ALFA-LAVAL

ASEA

AB ASTRA

BEROL KEMI AB

TELEFON AB L M ERICSSON

FORSHEDA GUMMIFABRIK

FRIGOSCANDIA AB

AB IGGESUNDS BRUK

AB KABI

LKB-PRODUKTER AB

SAAB-SCANIA

SALENREDERIERNA AB

SCA (Svenska Cellulosa AB)

SKANDINAVISKA ENSKILDA BANKEN

SU (Svenska Utvecklings-aktiebolaget)

UDDEHOLM AB

AB VOLVO

Siège de l'Association franco-suédoise pour la Recherche à Stockholm

Adresse: Grev Turegatan 14, Box 5073, S-102 42 STOCKHOLM 5
Tél: 08-11 42 75 Télex: 17172 IVA S
Chef du secrétariat: M. Gérard RIVIÈRE

Correspondant à Göteborg

M. Girard DE LEYE, Association franco-suédoise pour la Recherche,
Götgatan 15, IV, S-411 05 GÖTEBORG
Tél. 031-11 00 58 Télex 21186 JALGOT

Correspondant à Paris

Mlle Marie WANNHEDEN, Association franco-suédoise pour la Recherche
c/o Ambassade de Suède
17, rue Barbet de Jouy, 75007 PARIS
Tél 555 92 15 Télex: 204675 SVENSK PARIS

A.S.S. Organigramme

La Conseil d'Aministration

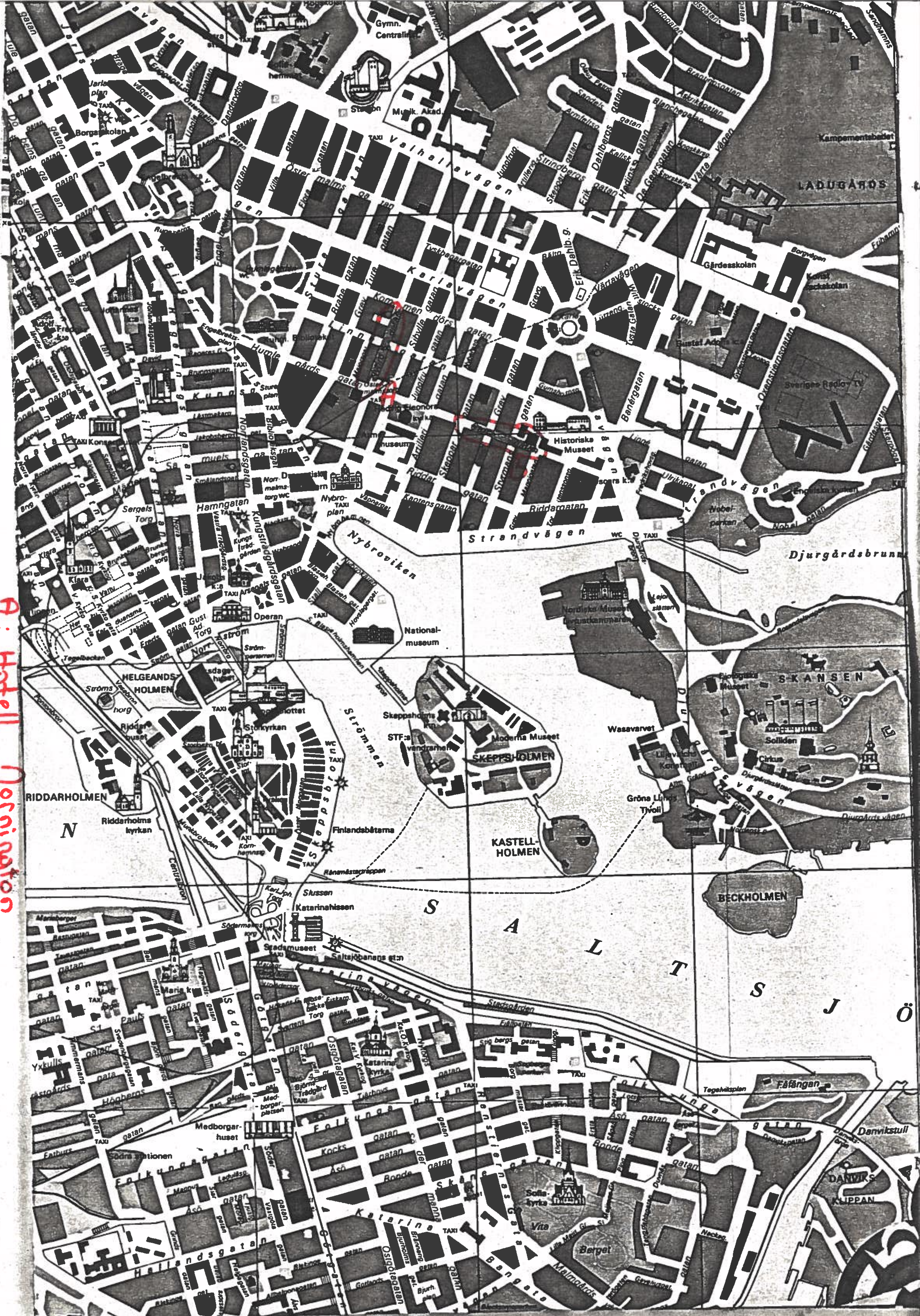
Directeur général

Comité "horaire de travail"

Inspection
- bureau général
- bureau des machines
- bureau du bâtiment
- bureau de la Chimie
- unité des questions médicales et sociales.
- Inspection générale de la Sécurité du travail

Médecine du travail
- physiologie du travail
- psycologie du travail
- chimie
- médecine
- téchnologie
- Bureau de Médecine du travail à l'IMEA

Administration
- bureau "temps de travail"
- unité de planification
- bureau "to[illegible]
- chancellerie
- Section formation
- Section diffusion



A: Hotell Mornington
B: Industri Huset

AMBASSADE DE FRANCE
EN SUEDE
Services Scientifiques et Techniques

Note N° 85/SST
du 25 septembre 1975

Les activités de Recherche et Développement consacrées en Suède à l'amélioration des conditions de travail.

1. Aspects structuraux.

Les activités de Recherche et Développement consacrées à l'amélioration des conditions de travail ont fait l'objet de structures particulières à compter du 1er janvier 1972.

A cette date, fut mis en place au sein du Ministère du Travail, le "Fonds pour l'Environnement de Travail" (Arbetarskydds fonden - A.S.F. - Swedish Work Environment Fund). Ce fonds est alimenté par une taxe instituée simultanément à laquelle sont assujettis les employeurs. Elle s'élève à 0,075% du montant des salaires perçus, tant dans le secteur privé que dans les secteurs public et communal. Au produit de cette taxe s'ajoute une subvention de l'Etat. Le fonds A.S.F. a disposé en 1974 d'environ 70 millions de couronnes.

Il a reçu pour mission de soutenir par des allocations les activités de recherche et developpement consacrées à diminuer les risques d'accidents professionnels, lutter contre les conditions de travail nuisibles à la santé, améliorer l'environnement du travail, et par là favoriser la sécurité et la santé dans la vie professionnelle.

A.S.F. a également pour but le développement de l'éducation et de l'information dans ces domaines. Il est en outre chargé de suivre le déroulement des activités qu'il subventionne.

Le Comité de Direction du Fonds est composé de 13 membres, nommés pour trois ans par le Gouvernement sur proposition des organisations et administrations représentées (dont 4 membres pour les différentes fédérations syndicales de salariés et 2 pour la confédération du patronat).

Il faut noter que ce fonds A.S.F. est financé et géré

.../...

indépendamment de la Direction de la Protection et de l'Hygiène du Travail (Arbetarskyddsstyrelsen - National Swedish Board of Occupational Safety and Health) qui est chargée de la réglementation et du contrôle des conditions de travail. Mis en place dès 1949, cet organisme dispose à la fois d'un important réseau d'inspecteurs (Inspection générale de la sécurité du Travail), de moyens d'enquête dans les entreprises et de services spécialisés par branches qui consacrent une part de leurs activités à des travaux de recherche et développement subventionnés par le Fonds.

Un conseil paritaire pour les questions d'administration des personnels et de concertation au sein des entreprises (Utvecklingsrådet), mis en place en commun en 1966 par les fédérations syndicales de salariés et par la confédération patronale, a créé en 1969 un groupe pour des activités de recherche. Sa contribution à la Recherche et Développement, pour ce qui est de l'environnement du travail, est peu importante au regard des activités de A.S.F.

Il est à remarquer enfin que les subventions accordées par ce fonds viennent s'ajouter à des crédits de base alloués par les diverses institutions de financement de la recherche.

2. Orientation générale des activités du Fonds A.S.F. en Recherche et Développement.

Le rapport d'activité de A.S.F. pour 1974 met en évidence les orientations prioritaires que le fonds s'est fixé actuellement.

Parmi les projets soumis par les chercheurs et les techniciens, la plus grande importance est accordée à ceux qui ont pour objet direct une amélioration pratique au niveau même des postes de travail. Cependant, l'expérience montre que la connaissance des conditions d'applications de nouvelles dispositions pratiques sont souvent insuffisantes et qu'il est nécessaire de déve-

.../...

lopper aussi les recherches visant à améliorer la connaissance des facteurs conditionnant l'environnement du travail, qu'il s'agisse de ses composantes matérielles, psychologiques ou sociales.

A côté des projets de recherche ou développement proprement dits, A.S.F. consacre beaucoup d'efforts à l'amélioration des conditions d'éducation et d'information en matière de sécurité et environnement du travail. Ces efforts s'exercent en direction des délégués des personnels chargés de ces questions, des contremaîtres et chefs de travaux. Ils visent aussi à la formation d'un personnel enseignant spécialisé dans les questions d'environnement du travail.

Concernant les actions destinées à l'augmentation des connaissances relatives aux conditions et à l'environnement du travail, le manque de chercheurs suffisamment qualifiés est un facteur limitant les capacités d'interventions. A.S.F. a pour cette raison offert depuis 1974 un certain nombre de bourses destinées à permettre à de jeunes chercheurs ou techniciens de compléter leur formation par un séjour d'au plus un an dans une institution étrangère hautement qualifiée. Les domaines retenus à ce titre sont l'épidémiologie, l'ergonomie industrielle, l'étude des risques sanitaires d'origine chimique, celle des accidents professionnels.

Les accidents du travail représentent la première priorité, l'effort de recherche et développement sur ce thème étant encore estimé trop modeste. Un comité a été constitué pour étudier et préparer la mise en place d'un groupe de recherche axé spécialement sur ce point. Les propositions de ce comité devraient être publiées avant la fin de l'année 1975.

Insuffisance des connaissances ou des compétences ne doivent en aucun cas conduire à retarder des actions concrètes de développement qui dans de nombreux cas peuvent être menées sans

.../...

disposer de tous les éléments de connaissance du problème. Il en est ainsi par exemple de l'élimination des substances dont on soupçonne qu'elles ont une action néfaste à la santé des personnes qui en subissent l'influence durant leur travail. Il est à noter que ce principe, souligné par A.S.F., est en accord avec les nouvelles dispositions de la loi du travail qui autorisent un délégué du personnel à ordonner l'interruption d'une opération de travail lorsqu'il pense qu'elle est est dangereuse, sans qu'il soit sanctionné s'il s'avère ensuite qu'il se trompait.

Des groupes spécialisés ont été mis en place depuis 19.. associant chercheurs et techniciens pour coordonner les projets de R et D du Fonds, assurer leur aboutissement à des applications pratiques, dans les domaines de la soudure, des traitements des surfaces des matériaux, et de la forge.

En collaboration avec la Direction du Marché du Travail un projet est consacré à établir le recensement des problèmes d'environnement du travail posés dans les différentes branches d'activités. Cette "carte" des points noirs par branches est notamment établie en vue de promouvoir des modifications des méthodes de travail ainsi que des procédés de production.

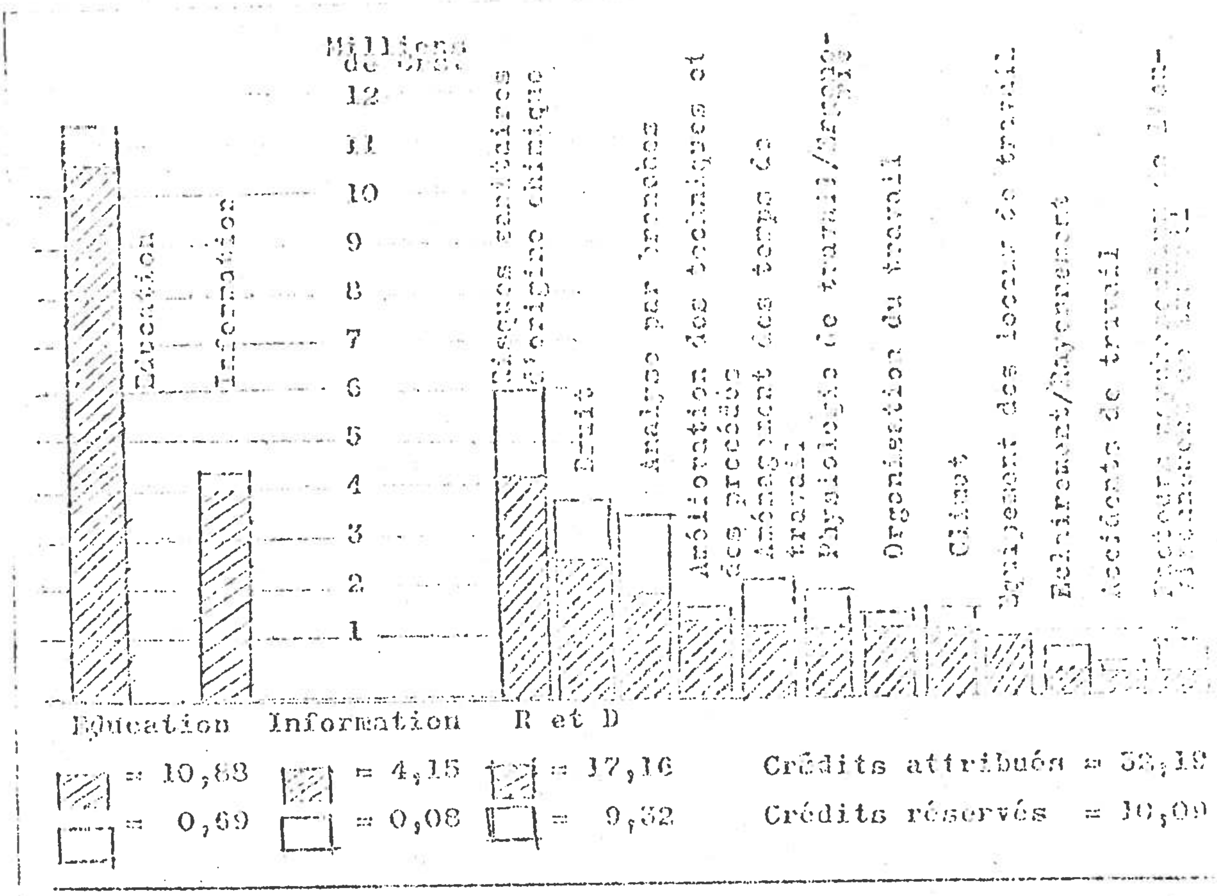
Ces efforts sont notamment développés vers les petites et moyennes entreprises qui n'ont pas les moyens d'investir elles mêmes en matière de recherche de meilleures conditions de travail, comme ont pu le faire des firmes plus puissantes. C'est le cas de nombreuses grandes entreprises suédoises qui ont opéré ces dernières années d'importantes innovations, comme Volvo AB avec sa nouvelle usine de Kalmar, Holmens Bruk AB avec une nouvelle machine à papier, A.S.E.A. avec un système d'analyse minutieuse de l'influence des conditions de travail, Mataki AB avec l'élimination de la poussière dans les opérations de concassage des roches. Il est donc important de tenir compte de l'activité des grandes entreprises pour avoir une vue d'ensemble des travaux de R et D suédois

.../...

Ces derniers présentent l'intérêt d'être directement orientés vers l'application et confrontés d'emblée avec les contraintes d'ordre économique.

Enfin une commission est chargée depuis 1973 par le gouvernement de rapporter sur les équipements des locaux de travail susceptibles de contribuer à l'instauration du milieu de travail optimal, en tenant compte de l'influence qu'il exerce sur les coûts et sur la production. Le rapport de cette commission (utredning) devrait être publié en 1975.

3. Projets de R et D pour l'amélioration des conditions de travail.



Moyens consacrés par A.S.F. en 1974 à la Recherche et au Développement pour l'amélioration des conditions de travail (répartition par secteurs d'activités), ainsi qu'à l'Education et l'Information.
Crédits attribués, Crédits réservés en Millions de couronnes suédoises (les crédits réservés correspondent à des opérations s'étendant sur plusieurs années).

Durant l'année 1974, 150 projets nouveaux ont été subventionés par le fonds A.S.F., parmi lesquels 88 ont trait à des activités de recherche et développement, 45 à l'éducation et 17 à l'information. De plus, 51 projets déjà en cours ont continué d'être subventionnés (47 en recherche et développement, 3 en éducation et 1 en information). Sur la subvention globale accordée de 32 millions de couronnes suédoises, 17,2 MKr vont à la recherche et au développement, dont 10,5 MKr aux 45 projets nouveaux qui se répartissent comme suit :

- selon les disciplines :

médecine	22 projets	pour	1,9	MKr
sciences physiques et naturelles-technique	30 "	"	3,4	"
sciences sociales psychologie	14 "	"	1,5	"
pluridisciplinaires	22 "	"	3,7	"

- selon l'importance des projets :

< 50	milliers	de couronnes	22 projets
50-100	"	"	29 "
100-500	"	"	33 "
> 500	"	"	1 "

Le détail de la répartition sectorielle est indiqué par la figure précédente.

Les contrats ont trait aux sujets principaux suivants

- opérations de soudure : risques chimiques, protection étude épidémiologique des travailleurs affectés à ces opérations, (hôpital Sahlgrenska et chantiers navals Götaverken à Göteborg - division de médecine du travail à la Direction de l'environnement du travail, Arbetarskyddsstyrelsen),
- conditions de travail dans les forges (Association de mécaniciens),
- traitements industriels des surfaces,

.../..

- horaires de travail : effets sociaux de l'étalement et de l'aménagement des horaires - relations entre horaires de travail, rythmes biologiques et conditions de repos (Institut de Psychologie de l'Université de Stockholm), études de groupes pratiquant le changement des postes de travail (Laboratoire de recherches cliniques sur la fatigue à Stockholm), aspects psycho-sociologiques de l'étalement des temps de travail (Institut psychotechnique de Göteborg),

- études spécialisées par branches industrielles : conditions de travail des personnels de nettoiement, des personnels de l'hotellerie et de la restauration, des personnels maritimes, dans l'industrie automobile, les industries chimiques des matières plastiques, des colorants du caoutchouc, des verres,

- éclairement et rayonnement : en particulier dans les industries graphiques,

- bruits et vibrations : notamment étude systématique des sources d'"infrasons" (de basse fréquence, non perceptibles par l'oreille) dans les postes de travail (Université d'Umeå),

- risques sanitaires d'origine chimique : notamment du point de vue toxicologique, étude des techniques d'élimination,

- aménagements pratiques des installations, appareillage et locaux de travail.

Parmi les laboratoires effectuant ces travaux, il faut mentionner particulièrement ceux de la Direction de l'Environnement du travail (Arbetarskyddsstyrelsen) dont les différentes divisions effectuent des travaux de recherche (médecine du travail, toxicologie opérationnelle, physiologie du travail, hygiène industrielle). L'Institut Karolinska de Stockholm comporte d'éminents laboratoires actifs dans ce domaine (Physiologie accoustique, Laboratoire de recherches cliniques sur la fatigue). A signaler aussi de bons laboratoires universitaires : le service d'ergonomie à l'Institut supérieur technique de Luleå, l'Institut de

.../...

psychotechnique de l'Université de Stockholm, l'Institut d'anatomie de l'Université de Göteborg, l'Institut biomédical d'Uppsala, service de toxicologie industrielle de l'Université d'Uppsala. Dans le domaine plus appliqué est à mentionner l'Institut de Recherches des Industries métalliques à Göteborg.

Le fonds A.S.F. publie chaque année d'importants rapports de ses commissions de travail. Cinq thèmes ont fait l'obje de rapports en 1973 :

- Education et information relatives à l'environnement d travail,
- Les accidents du travail,
- La pollution chimique dans l'environnement du travail,
- études spécialisées par branches industrielles,
- étalement des horaires de travail.

Quatre de ces rapports qui orientent l'action de A.S. à l'heure actuelle, viennent de faire l'objet d'une traduction condensée en langue anglaise "Research for a better work environment" dont un exemplaire est joint à la présente note (réf. Liber Förlag LF/ALLF 532 75 003 Liber Tryck mars 1975).

Le dernier rapport publié est celui de la commission d'étude de l'aménagement matériel des lieux de travail (avril 19

Chaque année enfin est édité par A.S.F. un catalogue des projets de recherche et développement subventionnés.

4. Perspectives de coopération avec les institutions françaises.

L'A.S.F. a récemment décidé d'octroyer des crédits destinés à faciliter la coopération avec les institutions étrangères par le biais d'échanges de chercheurs et l'établissement de programmes communs.

Echanges de chercheurs

Sur l'année budgétaire 1975/76 vont être distribuées des bourses destinées à de jeunes chercheurs voulant se perfectionner par des stages à l'étranger. Ces bourses doivent faire pro-

.../...

chainement l'objet d'annonces dans la presse suédoise. L'épidémiologie est un des domaines sur lesquels la Suède souhaite mettr l'accent à cet égard.

D'autre part, des crédits ont été également réservés pour permettre la venue en Suède de spécialistes étrangers pour y faire des séjours de travail de longue durée.

Programmes de coopération

Après discussion avec Monsieur Bo OSKARSSON, secrétair général d'A.S.F., il s'avère que le Fonds est très désireux de mener des études en collaboration avec des institutions françaises avec lesquelles il est déjà en contact, la Délégation Générale à la Recherche scientifique et technique (D.G.R.S.T.) et l'Agence Nationale pour l'Amélioration des Conditions de Travail(A.N.A.C.T

Parmi les points susceptibles de susciter un intérêt commun figurent les études spécialisées par branches, par exemple celles concernant l'imprimerie et les industries graphiques.

L'épidémiologie peut aussi être le thème de fructueuse coopérations, sur des points très cruciaux aujourd'hui comme celui des cancers abdominaux en relation avec les conditions de travail, ou celui de l'amiante qui vient de provoquer en Suède beaucoup d'émoi et l'établissement de sévères restrictions à l'emploi industriel de ce matériau.

Calendrier projeté

Il apparaît d'ores et déjà possible de concrétiser ces possibilités selon le schéma suivant. Suite à la réunion du Comi directeur d'A.S.F. le 24 septembre au cours de laquelle M. OSKARSSON présentera la coopération susceptible d'être établie avec les institutions françaises, ce dernier se propose de rencontrer en France des représentants de la D.G.R.S.T. et de l'A.N.A.C.T., entre autres MM. MIQUEL et DELAMOTTE. Cette réunion aurait pour objet de dégager les thèmes sur lesquels les institutions françaises et suédoises ont des préoccupations communes.

.../...

Sur la base de ces discussions, un colloque pourrait réunir à Stockholm les spécialistes des deux pays sur les thèmes retenus, au début de l'année 1976 pour arrêter des programmes de travail communs. Ce colloque viendrait naturellement comme suite à celui réuni au mois de mai dernier à Paris sous les auspices de l'Institut suédois. Ce deuxième colloque 1976 pourrait utilement être organisé par l'Association franco-suédoise pour la Recherche (A.F.S.R.)./.

Gunnar BORG

INSTITUTE OF APPLIED PSYCHOLOGY

RÅSUNDAVÄGEN 101 · S-171 37 SOLNA · SWEDEN · PHONE 08/27 26 10

September 10, 1976

Docteur Alain Wisner
Conservatoire National des Arts et Métiers
Départment des Sciences de l`Homme au Travail
Physiologie du Travail - Ergonomie
41, Rue Gay-Lussac
75005 PARIS
France

Dear Alain:

It was nice to meet and discuss various problems of mutual interest. Hope you had a good time in Stockholm and in Luleå.

Enclosed please find our Annual Reports. If there are some articles or reports of interest I will be glad to send them to you. I will also put you on our mailing list.

I look forward to meet you again.

Sincerely,

Gunnar

Gunnar Borg

Encls.

GB/ij

6	
7	Very, very light
8	
9	Very light
10	
11	Fairly light
12	
13	Somewhat hard
14	
15	Hard
16	
17	Very hard
18	
19	Very, very hard
20	

MINISTÈRE DE L'ÉDUCATION NATIONALE

ÉCOLE PRATIQUE
DES HAUTES ÉTUDES

LABORATOIRE DE
PSYCHOLOGIE DU TRAVAIL

Équipe de Recherche Associée au C.N.R.S.

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UNE METHODE D'ANALYSE DES ACCIDENTS :

EXPERIENCE D'ENSEIGNEMENT ET D'EVALUATION

Xavier CUNY

Colloque sur les accidents
du travail.
STOCKHOLM - Septembre 1976

UNE METHODE D'ANALYSE DES ACCIDENTS :

EXPERIENCE D'ENSEIGNEMENT ET D'EVALUATION

A - LA METHODE :

Les programmes de recherche réalisés de 1961 à 1970 sous l'égide de la Communauté Européenne Charbon Acier eurent pour conséquence essentielle de renouveler la conception générale de l'accident. Il apparut que celui-ci était le plus souvent déclenché sous l'action non d'une "cause" unique mais d'un réseau complexe de facteurs, eux-mêmes en rapport avec l'état globalement ou partiellement déficient du système socio-technique où ils se manifestaient. On a pu dire, et la formule a été depuis fréquemment reprise, que l'accident pouvait être considéré comme un révélateur ou symptôme, parmi d'autres, de dysfonctionnement d'un système. La méthode dont il sera question dans cet exposé est élaborée précisément sur la base des thèmes contenus dans cette conception de l'accident.

Sur le plan opérationnel le principe de la méthode consiste en une procédure récursive permettant d'aller de l'évènement accident vers les dysfonctionnements situés à différents moments de la genèse de celui-ci. On pose que la bonne prévention demande un traitement de fond, nécessairement dirigé vers les dysfonctionnements, dont il s'agit donc de pratiquer l'identification systématique préalable.

Il existe sans doute plus d'une manière de remonter dans la genèse d'un accident. Ici intervient en effet un premier choix, caractéristique de la méthode : les faits à travers lesquels s'effectuera ce retour seront limités à ce qu'il a été convenu d'appeler les "variations", notion déjà présentée dans l'exposé précédent en même temps qu'une estimation des avantages et des inconvénients de ce choix. De même on a vu que les relations entre variations étaient déterminées à partir de questions du type : "quelle variation antécédente a été nécessaire pour que telle variation conséquente se produise" ? Les relations recherchées sont avant tout d'ordre logique.

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La pratique de la méthode est préconisée en quatre étapes :

1 - Premier recueil de faits et sélection des variations.

2 - Classement des variations dans les quatre composantes générales retenues : Individu, Tâche, Matériel, Milieu.

3 - Recherche des relations entre variations classées, construction d'un arbre logique décrivant la genèse de l'accident à travers ces variations, éventuellement poursuite du recueil des faits au vu des lacunes apparues en établissant l'arbre.

4 - Analyse pluridisciplinaire de l'arbre finalement obtenu, interprétation de l'accident en termes de dysfonctionnements rapportés à différents systèmes, décisions en faveur de la prévention et pour une exploitation plus complète des données.

B - PREMIERE EXPERIMENTATION :

Nous avons participé avec le Centre de Recherche de l'I.N.R.S. à une expérimentation de cette méthode dans les mines de fer de Lorraine, de Novembre 1971 à Juin 1972. Des animateurs de sécurité de ces mines (porions) ont été formés à la pratique décrite ci-dessus et ont analysé 169 accidents, avec arrêt, survenus durant cette période. L'exploitation des données s'est effectuée à la section de Psychologie Industrielle de l'I.N.R.S..

De cette expérience en situation réelle les enseignements suivants sont à souligner :

- la méthode est apparue praticable dans l'industrie par des agents de maîtrise en ce qui concerne les étapes 1 et 2 ;
- Les analyses montrent de façon précise qu'en majorité les accidents présentent une genèse complexe ;
- elles mettent en évidence des facteurs de risque ainsi que des relations entre facteurs que l'exploitation traditionnelle en usage dans les mines n'avait pas identifiés ; exemple la chaîne suivante : panne ——→ opération omise ——→ récupération ——→ mouvements incontrôlés ——→ blessure.
- elles suggèrent très directement un ensemble de mesures de prévention appropriées au secteur et bien diversifiées en actions sur les individus et les tâches, sur le matériel et le milieu de travail, sur l'organisation du travail.

Les résultats complets de l'expérimentation figurent dans le rapport n° 140 de l'I.N.R.S. Cependant malgré ce bilan positif les directeurs des mines concernés n'ont pas souhaité continuer l'application de la méthode après ce premier essai. Ils invoquèrent à l'appui de leur décision deux types de motifs :

a) le bouleversement et l'importance du travail supplémentaire qu'engendrerait dans les services de sécurité le remplacement du mode d'exploitation traditionnel des accidents par le nouveau ;

b) les difficultés rencontrées dans le maniement ordinaire de la méthode : il était reproché à celle-ci une certaine lourdeur, des exigences d'abstraction et des ambiguïtés terminologiques ; la déclaration individuelle suivante résume assez bien l'argumentation des responsables : "les résultats obtenus sont peutêtre de meilleure qualité mais l'analyse d'accident devient un travail laborieux et l'effort exigé est demesuré par rapport à ces résultats".

La méthode ayant fait la preuve de son efficacité sur le plan des objectifs qui lui avaient été définis (recherche des facteurs d'accident), il importait d'essayer de vérifier le degré de pertinence de ces objections (une méthode efficace n'est pas nécessairement souhaitée elle peut être redoutée et provoquer des attitudes d'hostilité dans un premier temps). Il importait en outre après évaluation des difficultés réelles de tenter de faire la part des aspects traitables par une formation adaptée des utilisateurs, et des aspects appelant une une modification dans la présentation actuelle de la méthode. Pour cette double raison une nouvelle expérimentation a été conçue avec la section de Psychologie de l'I.N.R.S.

C - <u>STAGE EXPERIMENTAL</u> :

Cette seconde expérimentation a pris la forme d'un stage destiné à des agents de sécurité en fonction dans une entreprise. Quinze agents venant de secteurs industriels différents ont participé au stage organisé en deux sessions au centre de l'I.N.R.S. à Nancy. La première session, d'une durée de trois jours, visait à enseigner le maniement de la méthode. Les exposés ont été suivis d'exercices d'analyse de cas et d'épreuves de contrôle corrigées en groupe. De retour

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dans ~~les entreprises~~ leurs entreprises les agents se sont, pendant quatre mois, ~~efforcé~~ efforcé d'appliquer la méthode aux accidents qui pouvaient survenir. Après quoi ils se sont réunis à Nancy pour une session d'évaluation qui a duré deux jours. Des épreuves de contrôle ont été administrées pour apprécier l'acquis après la période d'essai en usine. Les analyses faites durant cette même période ont été examinées et les agents ont été invités à exprimer leurs opinions sur la méthode, sur son maniement et sur son application dans une ~~application dans une~~ entreprise. Pour le recueil des données tous les exercices écrits ont été récupérés et toutes les discussions enregistrées.

Le stage ainsi conçu a été jugé propre à apporter des réponses aux questions suscitées par l'aspect quelque peu contradictoire des résultats de l'expérience "mines de fer" : Les sessions de formation, étroitement contrôlées, devaient permettre de déceler toute difficulté inhérente à la présentation ou à la conception de la méthode, ressentie par des représentants des vrais destinataires, et de faire en outre éventuellement la part des difficultés réductibles par la formation et des difficultés résiduelles. Les essais d'application en entreprise et leur évaluation au cours de la deuxième session devaient fournir des informations plus précises sur les conditions qui, dans les organisations industrielles, peuvent favoriser ou au contraire interdire l'introduction de la méthode et notamment sur les attitudes de l'encadrement et des directions face aux propositions d'innovation en matière d'analyse d'accidents.

Nous examinerons maintenant la validité de ces prévisions à travers les données recueillies aux différents moments du stage.

Avant toute présentation de la méthode, les participants assistaient à la projection d'un film d'accident et étaient invités à analyser le cas de la façon qui leur était habituelle. Les résultats de ces analyses étaient comparés à ceux de l'analyse effectuée au préalable avec la méthode proposée. On a constaté que :

- Dix participants sur quinze ont su mettre en évidence le mécanisme de l'accident présenté.

- L'ensemble des participants n'a identifié que 44 % des facteurs dégagés avec la méthode ; certains des facteurs omis étaient absolument nécessaires à la production de l'accident.

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- Les facteurs les plus mentionnés étaient proches de l'accident.
- La structure de la genèse reconstituée par les participants était plus simple (de type séquentiel) que la structure obtenue avec la méthode.

Après une première présentation, sur le mode des exposés habituels destinés à faire connaître la méthode, les participants ont subi deux épreuves, l'une de classement des variations (quarante libellés de variations sont à répartir dans les quatre catégories "Individu", "Tâche", "Matériel", "Milieu"), l'autre de constructions d'arbres logiques (représenter par un diagramme les relations logiques existant entre un groupe donné de variations). Les mêmes épreuves ont été administrées (avec des questions différentes) à la fin de la première session, c'est à dire après de nombreux exercices et explications. Les résultats globaux sont donnés par le tableau suivant :

	Nombre total d'erreurs	
Epreuves	Après le premier exposé	A la fin de la session
Classement de variations	170	95
Construction de diagrammes	67	66

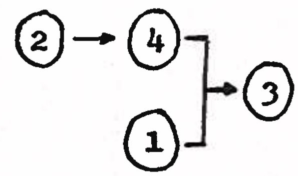
Pour le classement de variations un progrès a été réalisé mais le nombre d'erreursreste élevé (15 % des réponses). Pour la construction de diagrammes le progrès est nul. On peut donc considérer que l'effet de la formation est assez faible à la fin de la première session.

L'analyse qualitative des résultats fait apparaître une difficulté particulière à l'épreuve de classement : la différenciation entre les catégories "Individu" et "Tâche".

La définition de ces catégories dans la présentation de la méthode a manqué de clarté et les agents habitués à travailler antérieurement avec la dichotomie "causes humaines", "causes matérielles" n'ont pas réussi à utiliser le nouveau découpage proposé.

Les participants ont également eu du mal à acquérir une pratique satisfaisante de l'établissement des arbres logiques. La difficulté tient ~~xix~~ ici aux aspects formels du travail demandé (appliquer des règles logiques comme celle de l'implication) : les erreurs correspondent le plus souvent à un abandon momentané de la règle formelle au profit d'une règle plus "concrète", comme l'illustre l'exemple-type suivant :

- groupe de variations proposé : sol mouillé, panne du véhicule, glissade, déplacement à pied ;
- réponse de la majorité des participants : (2) → (4) → (1) → (3)
- réponse du corrigé :



La séquence des participants est recevable du point de vue d'une chronologie possible des variations. Mais du point de vue de la règle de mise en relation logique des faits, définie dans la méthode, la flèche reliant (4) et (1) n'est pas correcte et la solution du corrigé est la seule possible.

Le fait que les participants ayant réussi à faire peu d'erreurs possèdent à la fois un niveau d'instruction élevé et un statut dans l'entreprise fort accrédite l'idée de l'influence d'un facteur culturel. Il ressort bien de cette expérience que la difficulté de construire un arbre logique pour décrire un accident se laisse mal réduire par la formation spécifique adoptée. Or l'arbre logique est certainement un des points forts de la méthode et il est sans doute malaisé de modifier cette partie sans porter atteinte à l'efficacité de l'outil.

Les résultats de la formation doivent être évalués en outre à l'aide des données de la deuxième session (quatre mois après l'enseignement proprement dit et après exercices sur le terrain). Notons d'abord que les participants ayant eu l'occasion de traiter quelques cas dans leur entreprise ont obtenu de meilleurs résultats aux épreuves qu'à la fin de la première session. Au contraire tous les participants qui, pour différentes raisons, n'ont pu appliquer la méthode entre les deux sessions ont réalisé de moins bonnes performances à la seconde session. Un entraînement post-formation sur des situations apréhendées concrètement aurait donc un effet positif. Au cours de la seconde sdssion les participants ont eu, comme au début du stage à analyser en détail et individuellement un cas d'accident. Mais cette fois ils devaient utiliser la méthode apprise. Par rapport à l'analyse "modèle", l'ensemble des participants a identifié 87 % des variations en jeu, ce qui représente un progrès substantiel comparé aux 44 % de la première analyse. En outre, l'examen individuel des analyses montre que le progrès est sensible pour chacun des participants. Même dans la construction du diagramme logique, qui était demandée dans cette épreuve, tous les participants sauf un ont mieux réussi qu'aux exercices de la première session, ce qui semble confirmer l'intérêt d'un entraînement pratique d'une certaine durée.

APPLICATION DANS LES ENTREPRISES :

A l'occasion de la deuxième session les participants ont livré leurs apinions sur l'introduction de la méthode dans les entreprises, s'accordant à reconnaître que celle-ci rencontrerait plus d'obstacles que de conditions favorables, notamment :

- la méthode est vue comme imposant un surcroît de travail aux personnes désirant l'essayer ;
- elle vient concurrencer des systèmes de traitement des accidents déjà en place et dont l'abandon rapide est difficile à envisager ;
- le recueil d'informations détaillées sur les antécédents d'un accident se heurte encore actuellement à une forte opposition de la hiérarchie ;
- les faibles moyens accordés aux services de sécurité sont insuffisants au regard des exigences d'application intensive de la méthode ;
- les problèmes identifiés en poussant l'analyse avec la méthode risquent de provoquer contre celle-ci l'hostilité du C.H.S. aussi bien que de la Direction.

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D - CONCLUSION :

Le stage expérimental organisé au Centre de Nancy a permis de confirmer l'existence de difficultés inhérentes à la méthode, perçues lors de la première expérimentation sur le terrain. En outre, la nature de ces difficultés a pu être identifiée.

Certaines de ces difficultés (utilisation de nouvelles catégories de facteurs, maniement de règles logiques) ne se laissent pas complètement réduire par une formation spécifique. Il faudrait alors envisager soit une préparation des agents sur la base d'un contenu plus large (cours de Sécurité), soit une coopération agents-ingénieurs dans la conduite des analyses.

Dans tous les cas, un minimum de formation est nécessaire pour l'utilisation de la méthode qui a ses exigences, au même titre que la plupart des outils ou machines dont le débutant doit apprendre à se servir.

Des suggestions ont en outre été faites pour que la présentation de la méthode, dans les livrets ou dans les exposés, soit aménagée sans atténuer l'efficacité de l'analyse.

D'autres suggestions visent l'information, voire le recyclage en matière de sécurité, des responsables cadres et directeurs d'entreprises. Car l'obstacle le plus important à l'adoption durable d'une méthode de ce genre est en définitive moins dans la difficulté pour les agents d'arriver à en appliquer tous les points à la lettre (seuls les principes essentiels sont à respecter), que dans les résistances actuelles des hiérarchies à l'égard de ce type d'étude des accidents.

French-Swedish Symposium on
Occupational Accidents Research

P R O G R A M

Monday, September 6th

- Arrival

Tuesday, September 7th

9.00 a.m. - Visit to the National Board of Occupational Health and Safety (Arbetarskyddsstyrelsen). Prof Nils Lundgren, Dr Elisabeth Lagerlöf (Leave hotel by car at about 8.30)

12.00 - LUNCHEON

13.30 - Visit to the Royal Technical University of Stockholm, Institute for Aviation Technology and Institute for Industrial Ergonomy. Prof Carl Lager, Prof Ulf Åberg

19.00 - Reception and dinner at Wenner-Gren Center, 23rd floor, Sveavägen 166, Stockholm

Wednesday, September 8th

8.15 a.m. - Visit to Oxelösunds Järnverk, Oxelösund (One of the biggest iron-works factories in Sweden, about 120 kilometers south of Stockholm). M.M. Brännström. Bus leaves from your hotel 8.15 a.m. Return to Stockholm about 16.30 p.m.

10.00 Arrival

Coffee - General introduction to the company

10.30 The company from the point of view of the employees

Statistics concerning the employees
Among others: The number of employees
Distribution women-men
Foreign employees
Absenteeism
Accident statistics etc

11.00 Company health service:

- Organization
- Work organization
- Co-operation
- Education etc

11.30 Special activities within the accident area

Questions - discussion

12.00 Luncheon at the company lunch-room

13.15 Visit to the ironworks

14.30 Coffee - Questions and ansvers - Ready for departure

15.00 Departure for Stockholm

Thursday, September 9th

9.00 a.m. - Seminar

The seminar will take place at Industrihuset, Storgatan 19, Stockholm

9.00-12.00 - Session. Presentation of and discussion on different projects in France and Sweden. Each of the presentations should take about 10-15 minutes whereafter a discussion of about 10 minutes will take place.

→ BO OSCARSSON

- Research and development regarding work safety in Sweden by Elisabeth Lagerlöf, Sweden

- Some tendencies regarding work safety by Alain Wisner, France

10.15

- Practical experiences of difficulties in accident prevention by Håkan Täljestedt, Sweden STRIKE

- The industrial medical officer and accident prevention by Jean-Jacques Jarry, France

- Reconstruction of the origin of accidents: advantages, difficulties and limitations by Jacques LePlat, France

- An accident analysis method: teaching and evaluation experiment by Xavier Cuny, France

- Occupational accident prevention. Research and description of potentional factors of accidents by E Quinot, France

- Development of a method of occupational accident research and practical safety work
  by Leif Svanström, Sweden

- Dangerous work. Experimental methods for control of workload and man/machine adaptation
  by Carl Lager, Sweden

12.00 LUNCHEON

13.00-17.00 Session continues

- Power relations, behavioral control system and safety in industry
  by Jan Kronlund, Sweden

- Safety in Forestry. Remunerative system and risk-taking
  by Carin Sundström-Frisk, Sweden

- Accidents and work load in agriculture
  by Norbert See, France

- Identification, risk consciousness and work organization. Three concepts in job safety
  by Elisabeth Lagerlöf, Sweden

- Safety at work and road safety: a draft of comparative analysis illustrating the case of professional drivers
  by Yvon Chich, France

- Accident prevention in explosives industry
  by Urban Kjellén, Sweden

- Communications within working groups
  by Francis Jankovsky, France

- Combined study of safety and noise on small stamping power presses
  by Monsieur Jaunet, France

- A multidisciplinary study of the consequenses of night-work on industrial mental stress. Consequences regarding safety
  by P Cazamian, France

- Logging research from basis - applied research and development for forestry
  by Bo Pettersson, Sweden

- Future plans for accident research at the National Board of Occupational Safety and Health
  by Nils Lundgren, Sweden

16.30 French Embassy

17.00 DINNER

~~18.30~~ 20.00 Evening session (prel.)

Friday, September 10th

9.00 a.m. - General methodological aspects on occupational accidents research (organization research, statistical empirical methods, experimental technical research development)
The discussion will take place at Industrihuset, Storgatan 19, Stockholm

12.00 - LUNCHEON

13.30 - Concluding discussion. Further French-Swedish co-operation in occupational accidents research.

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Location: Hotel MORNINGTON
Nybrogatan 52
Stockholm

70 x 60.000 4200 000

16.000.000

NILS PETERSSON

young
elder
LULEA
JANKOWSKY
ROMSTRA
mental load
AHERG
epidemiology
social

- visits
- seminars → Bengt KNAVE
- visits → Bertil GARDELL
- common research [Bengt KNAVE]
- journal visit   handicapped

- visit of union specialists of work condition
- visit of management specialists of work condition

- exchange of researchers in stays of short and long periods
- visit researchers to meetings
- joint meeting   work environment
- ~~cooperat~~ joint research programme
- joint documentation
- antenna of communication..