Commission of the European Communities

# Information Bulletin of the Steel Industry Safety and Health Commission

No 2

1983

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Prepared by the Directorate-General for Employment, Social Affairs and Education, in collaboration with the Directorate-General for Information Market and Innovation.

**Notice**

# Accidents

## 1. Partial amputation of the left hand of an operator when working on a slitter

At about 6.50 p.m., the main operative responsible for slitting line B was informed by a binder of a surface defect in the slit strip which had just been fed into the recoiler.

After stopping the line, he found the defect on the inner surface of the third strip from the operative's side. From experience, he assumed that there was a fault in the lower knife block at the slitting stand.

He asked the second operative to take over control of the line and to actuate the slitter with stops and starts manually whilst he moved his left hand, protected by a glove, upstream of the slitter, over the knives and neoprene spacers in order to find the cause of the marking.

During this operation his hand was drawn into the slitter.

On hearing the victim's cries, the second operative left the manual controls and pressed the emergency stop button. The main operative's hand was partially amputated.

It should be noted that when actuated manually, the slitter is rotated by impulses, the length of which depends on the time during which actuation is maintained. It may vary from 1/4 to 1 complete revolution of the knives, representing a slitting length of about 1 m.

Planned action:

— Written instructions to be obeyed by the workforce at all times. This calls for special supervision on the part of the foremen and supervisors.

— Study of the various means of limiting the speed of rotation of the slitter knives and other similar equipment at in-running nips of strip finishing installations.

— Study of the idea proposed by the rolling and finishing service: elimination of the pinch rolls upstream of the slitting stand and installation of the vertical guides as closely as possible to the latter, preventing any intervention by the operative upstream of the stand.

### Safety instructions

Work and checks to be carried out on machinery with in-running nips, such as the slitting stand, pinch rolls, etc.

All visual checks on moving machinery must be carried out *downstream.*

All accessories obstructing the operative's vision during checks must be withdrawn once the machine has been stopped (trimming scrap chutes on slitting stands, for example).

To have a clear view of the lower parts of machinery (lower pinch rolls, lower knife blocks, etc.) *the strip must be removed from the machine being checked.*

As a reminder:

— *It is strictly forbidden* to carry out checks on machinery in motion;

— Procedures for shutting down and locking out machinery must be *strictly adhered to.*

## 2. Fatal burns caused by hydrofluoric acid

On the pickling line in a steelworks the supply elbow of the hydrofluoric acid line was removed in preparation for repair work. The flow of acid through the pipe was cut off by a three-way valve. For safety reasons, after the supply elbow had been removed the line was blanked off at eye level with a blind flange. The length of pipe between the three-way valve and the blind flange was some 20 metres. This was the situation for 22 days until the repair was completed as planned, after which the supply elbow was to be re-installed by a foreman and two fitters.

On the day of the accident the foreman checked that the three-way valve was still in the same position, and then left with one of the fitters to fetch pipe clamps and screws. Meanwhile the second fitter was instructed to bring the necessary acid-proof protective clothing. Instead of doing this the fitter began to loosen the nearest bolts securing the blind flange. This allowed a small amount of hydrofluoric acid to spurt from the flange for a short period onto the man's head, throat and neck. Obviously pressure had built up in the line during the down-time period, so that the acid was forced out when the blind flange was loosened, although the reason for the pressure build-up has never been explained. Workmates who were not involved in this operation gave the fitter first aid, removing his clothing and rinsing the affected areas with copious amounts of water. The man was then taken to a nearby hospital, which had the special medications required and the company medical officer gave detailed instructions for treatment. In spite of the small amount involved and the correct first aid treatment and immediate intensive care by the doctors, the patient died in shock some five hours later. In order to prevent a repetition of this accident, when repairs are carried out to similar lines which have been taken out of use, an additional sealed stopcock and a manometer will be fitted.

This will enable the pressure in the line to be checked and relieved under control before the blind flange is removed. In addition the attention of all employees was again drawn to the instructions and information with which they were already familiar regarding working on acid lines and in particular the handling of hydrofluoric acid, namely:

(i) the correct protective clothing must always be worn;

(ii) the protective clothing must be acid-proof and not merely acid-resistant;

(iii) protective goggles are inadequate for handling hydrofluoric acid;

(iv) under no circumstances must contaminated articles of clothing be removed with bare hands.

If there are no showers in areas where hydrofluoric acid is handled, extinguishers suitable for use on men must be provided.

**Comment**

Hydrofluoric acid is an aqueous solution of hydrogen fluoride and is used for the surface treatment of special steels.

One of its distinguishing properties in use is the very high degree of penetration which it achieves. In contact with the skin it does not merely cause surface burns but it very quickly destroys all the subcutaneous tissue, sometimes down to the bone. Even the smallest burns are very painful.

Because of the high penetration rate of hydrofluoric acid acute resorptive poisoning can occur, even after intensive rinsing of the skin. Fluorine bonds with calcium and iron ions, inhibiting vital enzymes and causing dangerous metabolic damage. It can also cause convulsions (tetany), ventricular fibrillation and cardiac arrest. According to the literature the fatal dose by resorption appears to be as low as 2.5 grams, i.e. 3-4 ml of the solution commonly used in the steel industry for pickling. The boiling point of hydrogen fluoride is 19.9° C, and inhalation of large quantities of the fumes can also be fatal.

As a result of this accident two methods of treatment for hydrofluoric acid burns have been recommended by the German medical profession and further information is available from the Secretariat of the General Commission on Health and Safety (DG V), Luxembourg in the following languages: English, French, German and Italian.

A group of medical officers from the German steel industry is studying the problem and would be pleased to exchange information on this subject with colleagues in other countries. The address is:

Referat Arbeitsmedizin,
Wirtschaftsvereinigung der
Eisen- und Stahlindustrie
Breitestrasse 69
*D-4000 Düsseldorf 1*

## 3. Multiple accident in an arc furnace shop

Shortly after tapping a 100-tonne UHP electric arc furnace, cooling water leakage was detected on a section of the roof. The duty foreman inspected the damage and gave instructions to reduce the water supply to the leaking section of the roof and then proceed with tapping of the furnace. There was no reason why this should not have been done, as the small quantity of water emanating from the leak evaporated immediately on contact with the molten charge. Tapping was completed without incident and the water supply to the leaking section of the roof and the roofcore was cut off and the electrodes were removed. Forty minutes later repairs were started, which first of all entailed removing the roofcore with the EOT crane. When the roofcore had been lifted approximately 40 cm a small explosion ensued, followed immediately by a larger one, injuring seven furnacemen and maintenance staff, three of whom were hospitalized.

The accident was caused by residual water running out of the leaking section of the roof into the furnace where there were still molten residues. A furnaceman stated that, when the explosion occurred, the slag blanket had cooled to the extent that it was black. The explosion was probably triggered by a piece of slag falling from the roof or wall of the furnace and breaking through the slag blanket. It is considered likely that water had penetrated the slag underneath the solidified slag blanket.

To avoid accidents of this sort, all work on the furnace is now prohibited as long as it may contain water. Work on the roof should, as far as possible, only be carried out when it has been swung out. In designing water-cooled roofs, particular attention is to be paid to improving water-tight sealing and reducing susceptibility to leaks.

## 4. Crushed between buffers

In the slag processing plant of a steelworks three cars with full slag pots were being positioned for discharging. This entailed shunting a scrap car loaded with skull back up the track.

One of the slag processing staff, whose job was to assist in connecting the slag pots to a crane, stepped onto the track between the head of the slag pot train and the scrap wagon, not noticing that the scrap wagon, which had been shunted up the track, was now slowly rolling backwards. He was caught between the buffers as the car hit him and sustained fatal injuries. Although the crane driver had recognized the danger, he could not warn him in time.

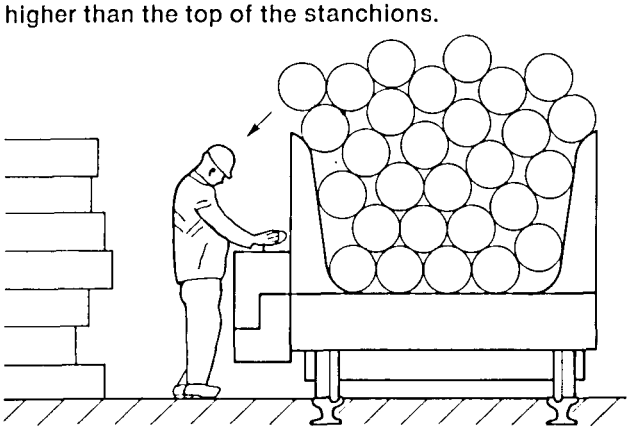
The accident occurred because no steps had been taken to prevent the scrap car being moved accidentally, as works' directives require.

The car could also have been coupled to the slag pot train, but this precaution was not taken.

## 5. Fatal accident caused by overloading a platform wagon

After loading pipes onto a platform wagon with stanchions used for transport within the works, an operator was about to drive the wagon into the adjacent building when one of the uppermost pipes rolled over the stanchions on the side where the control unit was located and hit him. He sustained severe injuries and died shortly afterwards.

This accident, which had such serious consequences, occurred because, contrary to works' directives, the transporter was overloaded and pipes were stacked higher than the top of the stanchions.



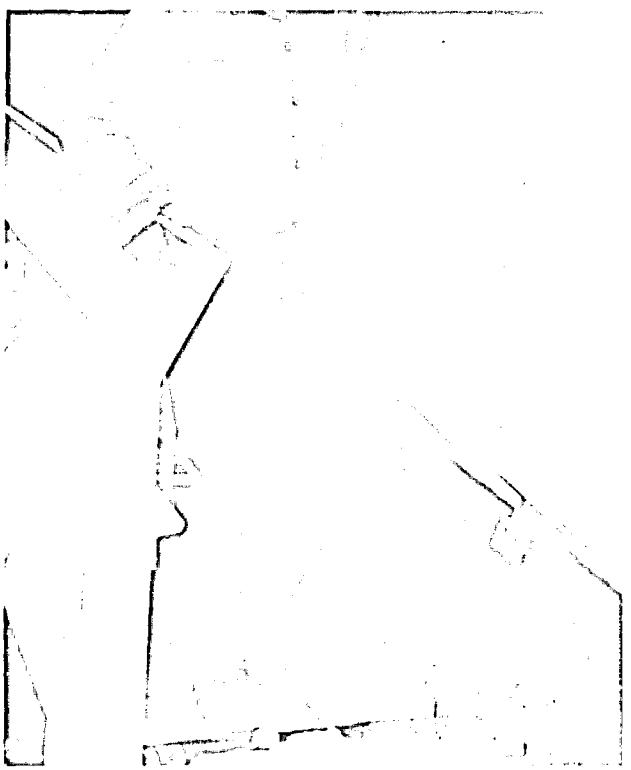
Schematic illustration showing how overloading the platform wagon caused an accident.

## 6. Loader crushed to death

Whilst a train comprising 17 self-tipping wagons with their discharge flaps still open was being shunted, a loader was crushed to death between the wall of a lime silo plant and a discharge flap. The driver and the foreman shunter had agreed to move the train back out of the silo area temporarily, to allow a locomotive to carry out a shunting operation in this area, after which the train was to be shunted back. The loader, whose presence in an area which is neither a working nor a traffic area had gone unnoticed, was caught when the train was shunted back.

This accident prompts us to point out that wagons with open discharge flaps should not, as far as possible, be shunted from one point to another, even in areas which are neither working nor traffic areas. If, however, exceptional circumstances require that the train be shunted while the discharge flaps are still open, the foreman shunter, marshalling staff and the train driver must examine and safeguard the stretch of track concerned.

The company will mount flexible guards to afford protection where space is restricted.



The distance between the protective wall and the open unloading door at the site of the accident was 13 cm.

## 7. Flame emissions from an electric arc furnace

An emission of flame from an electric arc furnace inflicted burn injuries to the hands, face and neck of an employee, who was walking through the furnace bay.

The man had been walking through the bay in order to get to his office in the traffic department. He was wearing a helmet and outdoor garments, not molten metal clothing. The furnace was at the 'pre-blow' stage of its production cycle at the time and oxygen was being admitted by a side port. After approximately 5 minutes of oxygen blowing a prolonged emission of flame of approximately 10 seconds' duration occurred injuring the man. Furnace temperature was 1 565° C. The man's jacket caught fire and he ran, with his arms raised and head lowered to shield himself, from the area. Other employees extinguished the flames and made arrangements for the man to receive medical attention.

A panel of enquiry, investigating the circumstances surrounding this accident, discussed the practicability of controlling the emission of flames from furnaces. The consensus of opinion was that such emissions could not be controlled or even predicted. It was agreed that an active furnace must always be treated with respect and that at any time from half an hour after power on until the furnace is tapped there can be an element of risk.

**Recommendations/Action**

1. Unauthorized persons not to be at floor level in the furnace bay near an active furnace.
2. Suitable warning notices to this effect to be erected in the vicinity.
3. All authorized persons must wear the approved molten metal clothing and associated equipment near an active furnace.

## 8. Crane hits scaffolding

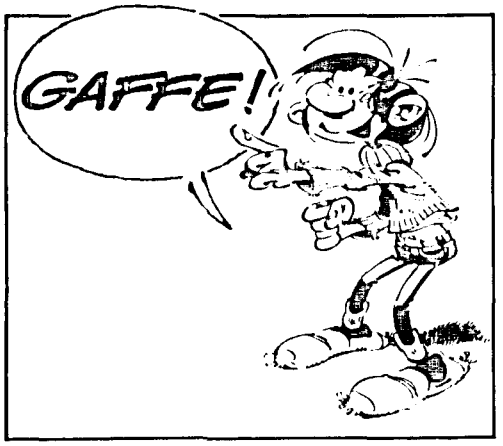
An EOT crane collided with, and damaged, scaffolding erected by contractors in furtherance of maintenance work in a mill. No-one was injured.

The incident occurred in the cold processing bay of a coil plate mill comprising two continuous cut-up lines and a caster shear area serviced by five overhead cranes. Contractors were engaged to work in the plant on cable recovery. Approximately two weeks prior to the incident a contractors' permit to work was issued to the firm involved authorizing access to the plant. The permit to work indicated that sub-contractors would be employed for the purpose of erecting scaffolding. When the permit was signed by plant management it did not describe the scaffolding work to be done. On the day prior to the accident members of the plant's site engineering verbally instructed the subcontractors to build two scaffold towers for the use of the main contractors. The instructions related to the siting of the scaffolding and emphasized the fact that scaffold members should not protrude into the path of EOT cranes. These instructions were given to the scaffolders by their supervisor. A scaffold access tower was erected below the crane girder and alongside a main column to one side of the mill. An access ladder was lashed to the top tube of the tower which protruded nine inches into the bay. One of the EOT cranes moved past the scaffolding several times during its construction and was seen to be well clear of the edge of the column. None the less, a short time later, a different crane was moving down the bay when it collided with the scaffold. As a result the ladder was broken and the scaffold was bent away from the column.

The crane which collided with the scaffold tower had an unusual construction in that its access step was built onto the side of the cab. This step cleared the columns by only three inches and an attached hand rail by about nine inches. Because the other crane had travelled through the area without incident the scaffolders formed the erroneous opinion that there was about 24 inches clearance between the cranes and the columns and as a result allowed the lashed ladder to project outside the line of the column by six inches and the top support tube by approximately nine inches. Additionally, investigation showed that the contractors' supervisory staff had not inspected the completed scaffold tower.

**Recommendations/Action**

1. Where crane clearance is of vital safety in work such as this, the permit to work must state clearly that this is a mandatory requirement.
2. In the event of work not being commenced within a reasonable time-scale of the issue of the permit to work or should the nature of the work change or become more clearly defined a new permit to work must be drawn up.
3. Where a permit to work involves the erection of a structure which must not protrude into the path of overhead cranes, that permit to work must state that the erectors of scaffolding must ensure that a supervisor inspects the scaffold within a reasonable time-scale of its completion, and certainly before the end of the day on which it was commenced, irrespective of whether it is complete or not.




*We should like to thank Mr Vidal, the Assistant General Manager at Solmer, for supplying the information which enabled us to publish this article.*

*Thanks are also due to Mr Franquin, who gave permission for reproduction of the illustration.*

**Attention, merci!**

# Safety at Solmer

**Solmer, ever heard of it?**
Solmer is a steelworks operating since 1974 at Fos-sur-Mer on the Mediterranean coast of France.

Solmer is a high-capacity production unit with two blast furnaces (4 000 000 tonnes of iron per year), two converters (3 800 000 tonnes of steel per year with one converter working) and a rolling mill (4 500 000 tonnes per year of steel sheet and strip).

Solmer also has a workforce of almost 6 200 employees on a 600 ha site; 220 engineers and managerial staff, 4 100 workers, technicians and supervisory staff working in jobs in which they may be exposed to risk.

**The safety situation in 1979**
Although an improving trend was apparent at the end of 1978, the figures were still extremely worrying. The frequency rate (the number of accidents giving rise to at least one day's absence from work per million hours worked) was close to 90, one of the highest in the French steel industry.

An attempt was, of course, made to find solutions. In order to identify and eliminate hazards, the supervisory staff carried out a detailed analysis of the causes of all accidents (whether or not they gave rise to absence from work). In order to assist and advise in this task, arrangements were made at the beginning of 1978 for one safety adviser to be constantly available on each shift.

These measures brought about an improvement: the 1979 frequency rate was 76.8. However, this did not satisfy the new manager, Mr Vidal, who decided to take matters in hand personally.

In 1982, the situation has been transformed. The frequency rates have improved gradually, dropping from 41.6 in 1980 to 22.6 in 1981, while the monthly rates from January to June 1982 range about an average of less than 12.

**What happened at Solmer in 1980 to reduce the accident rate?**
The new manager introduced a number of innovations.

In January: A social department was set up.

In March: Work began on training the supervisory staff for their role in the company's social policy.

In April: A slide show with commentary was shown to a large proportion of the workforce. The manager appeared on the screen in the very first slide. He commented on the Solmer statistics and appealed to everyone to give the matter thought and act accordingly.

In July: The accident report procedure was changed in order to bring management into the circuit and involve it in accident prevention.

In September: Assistants were appointed at shop level to aid the supervisory staff in any social problems which arose.

**First safety campaign**
At the very beginning of the year, the safety department, at the request of the manager, was instructed to make preparations for a large-scale operation: a campaign was planned and prepared by an advertising agency and was launched on 20 October 1980.

A green emblem in the form of a heart with the slogan 'Careful please!' and a comic strip character 'Gaston la Gaffe'[1] drawn by a Belgian artist, Franquin, appeared on the buildings and on a large number of display boards throughout the works.

Posters and games, competitions, gadgets (pens, keyholders, etc.) — the whole range of aids used in a normal advertising campaign was brought into play.

A competition was run for the children of the workforce. A 'Gaston la Gaffe' comic book was sent to their homes and they were asked to colour it in and

Note: 'Gaffe' is French slang for 'Watch out!' The cartoon suggests: 'Watch out! Be careful, please!'

[1] Gaffe also means 'Blunder' in French. 'Gaston la Gaffe' would be 'Billy Blunder' in English.

write the dialogue. The children of course asked their parents for advice. Prizes (bicycles, transistor radios, etc.) were awarded for the best entries and were distributed at the Christmas party.

In November: A second slide show was shown to the whole workforce. The manager, Mr Vidal, explained the campaign.

A booklet setting industrial accidents in their general context and relating those occurring in the company to those in the steel industry in general was issued to all employees with a suitable explanation, as was a book of cartoons, 'The things that go wrong at Solmer', with drawings by the cartoonist Franquin.

A competition involving the whole workforce began on 1 December 1980. As part of a game, all the staff were asked for their opinions on safety problems. Many prizes were awarded, the first being a trip for two to the Caribbean.

At the end of the campaign, Mr Vidal said: 'We had taken a step forward but above all what we had learnt was that the general climate of opinion had a very marked effect on accidents. The initial campaign, however, had succeeded in mobilizing opinion for one month only. We had to find a method of holding attention over a longer period.'

This led to the 'Team safety' competition, which ran from May 1981.

**Second campaign: 'Team safety' competition**

This competition is based on the frequency rates for accidents giving rise to at least one day's absence from work. The workforce is divided into a number of groups. As soon as the results for a group are better than the works average, the members are awarded points which can be exchanged for prizes. The rules are as follows.

1. The entire Solmer staff will be divided into different teams, whose composition may change over a period of time.

   Workers who do not wish to take part in the competition must inform their superiors in writing.

2. The teams will be formed within each division by the administrative assistants, who will keep the lists up to date.

3. When a team has completed 35 000 hours of work without any lost-time accident, it will be awarded points for every further complete period of 10 000 hours without lost-time accidents. Statutory and contractual paid holidays are regarded as time worked.

   As from 1 October, maternity leave will also be considered as time worked.

   The period of 35 000 hours mentioned above is a probation period reflecting the ratio

   $$\frac{1\,000\,000}{\text{Solmer frequency rate for the last completed business quarter (rounded down to the next 5 000 hours)}}$$

   Example: Frequency rate for the 1st quarter in 1981: 27.97
   Probation period: 1 000 000/27.97 = 35 752 hours, rounded off to 35 000.

4. The number of points thus distributed to each member of the team will be as follows:
   - 100 points for each of the first three periods of 10 000 hours above the threshold defined above;
   - 200 points for each of the three succeeding periods;
   - 300 points for all periods thereafter.

   The number of points awarded to teams composed entirely of persons employed in the departments listed in the annex, where working conditions are such that the risk is slight, will be 10, 20 and 30 for each of the periods mentioned above.

5. The points acquired by the members of a team will be credited to them as soon as the team has completed 10 000 hours of work without any lost-time accident.

   In the course of this period of 10 000 hours, team members who have been absent for more than 25% of the time for any reason other than statutory or contractual holidays or maternity leave will not be entitled to these points.

6. On joining a new team, an employee will be entitled to the points currently credited to the team he is joining.

7. When a team is involved in a lost-time accident, it retains the points already awarded. The team starts again at the beginning of the competition in accordance with the procedure laid down in Articles 3 and 4 of the present rules.

8. The points obtained may be accumulated as the individuals concerned see fit and can be exchanged for items chosen from the Solmer 'Team safety' catalogue. This catalogue may be modified. Employees may pool their points to obtain a given item.

9. The competition will begin on 1 June 1981 and will run for a period of one year.

   At the end of the competition, teams which are in the process of acquiring points will continue to participate in the competition until they have completed the current period.

   The competition will in any case end for such teams when they have accumulated sufficient points to obtain the catalogue item of highest value.

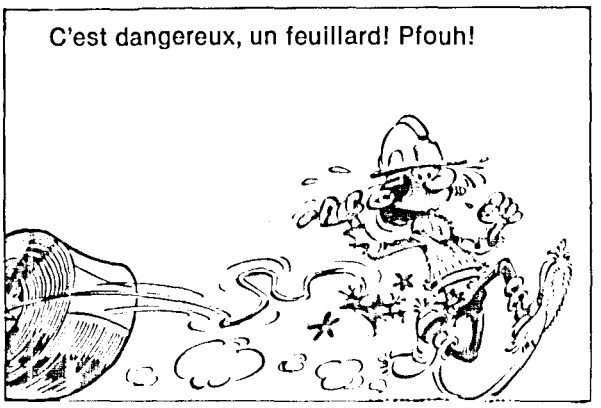
10. The initial points entitlement of each team will be calculated on 1 June 1981 with reference to the last lost-time accident (involving) a member of the team.

11. Any practical difficulties arising during the start-up phase of the competition will be settled by the safety department.

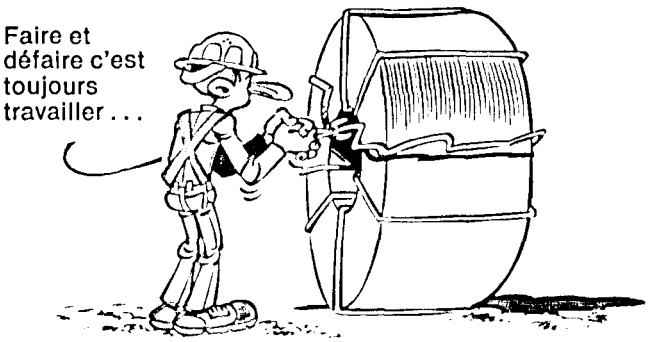
12. These rules may be modified after a trial period of six months in the light of the experience acquired.

**Conclusion**

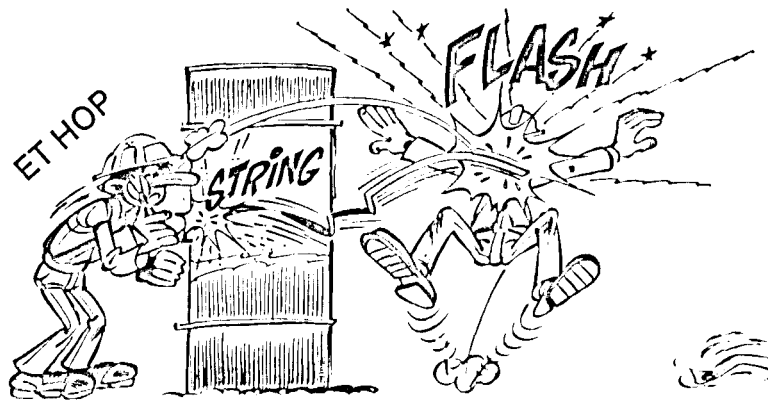
The effect of all this preventive and promotional activity on the industrial accident frequency rate has already been mentioned but at the same time there was a significant fall in the severity rate and a very sharp drop of almost 40% in commuting accidents, which were not covered by the competition.



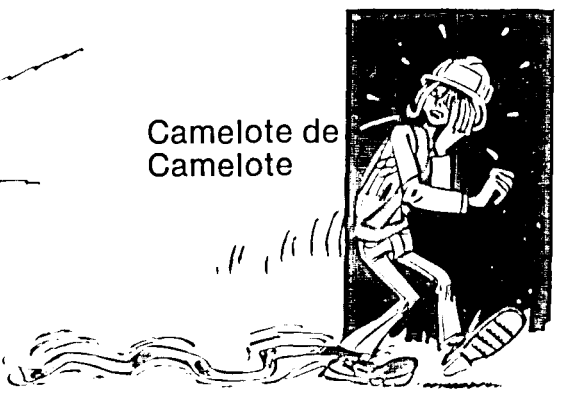

Dangerous things the banding on coils-Ugh!



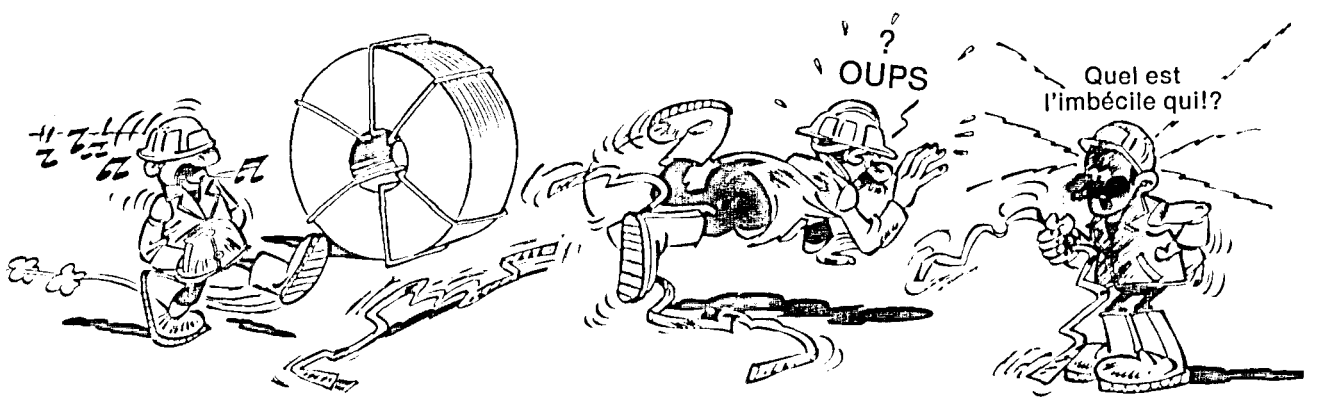

Fastening and unfastening - You never stop working . . .




There we are Zing




Of all the stupid things




OOPS What a silly ass . . .?!


Hey! Have you seen the banding! I left lying around by any chance? I'd like to find it for the sake of my mates' safety!

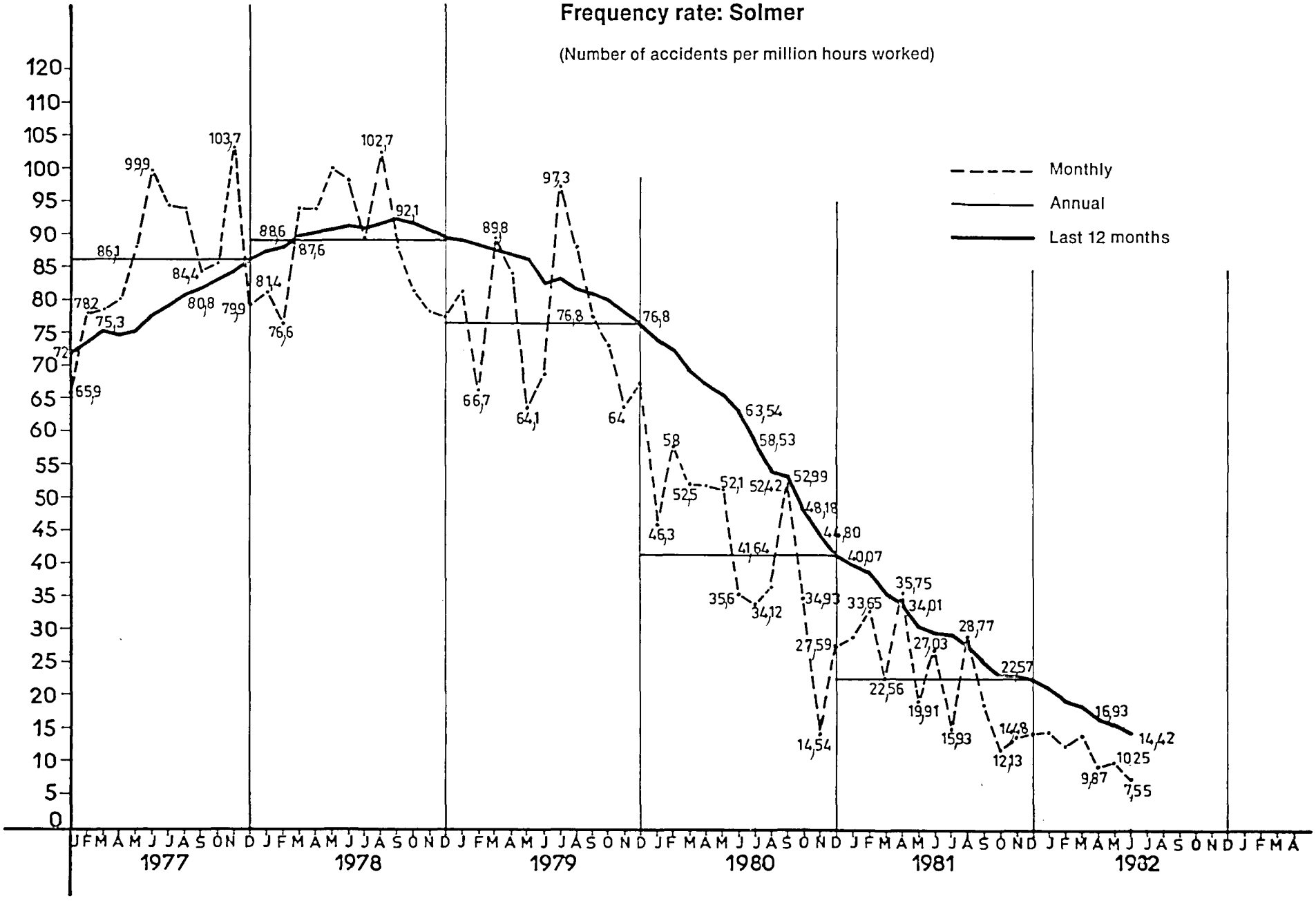
You really learn something working with these lads

That's what comes of being honest

Extract from Gaffe à Solmer, by C. Jacot with the collaboration of Franquin

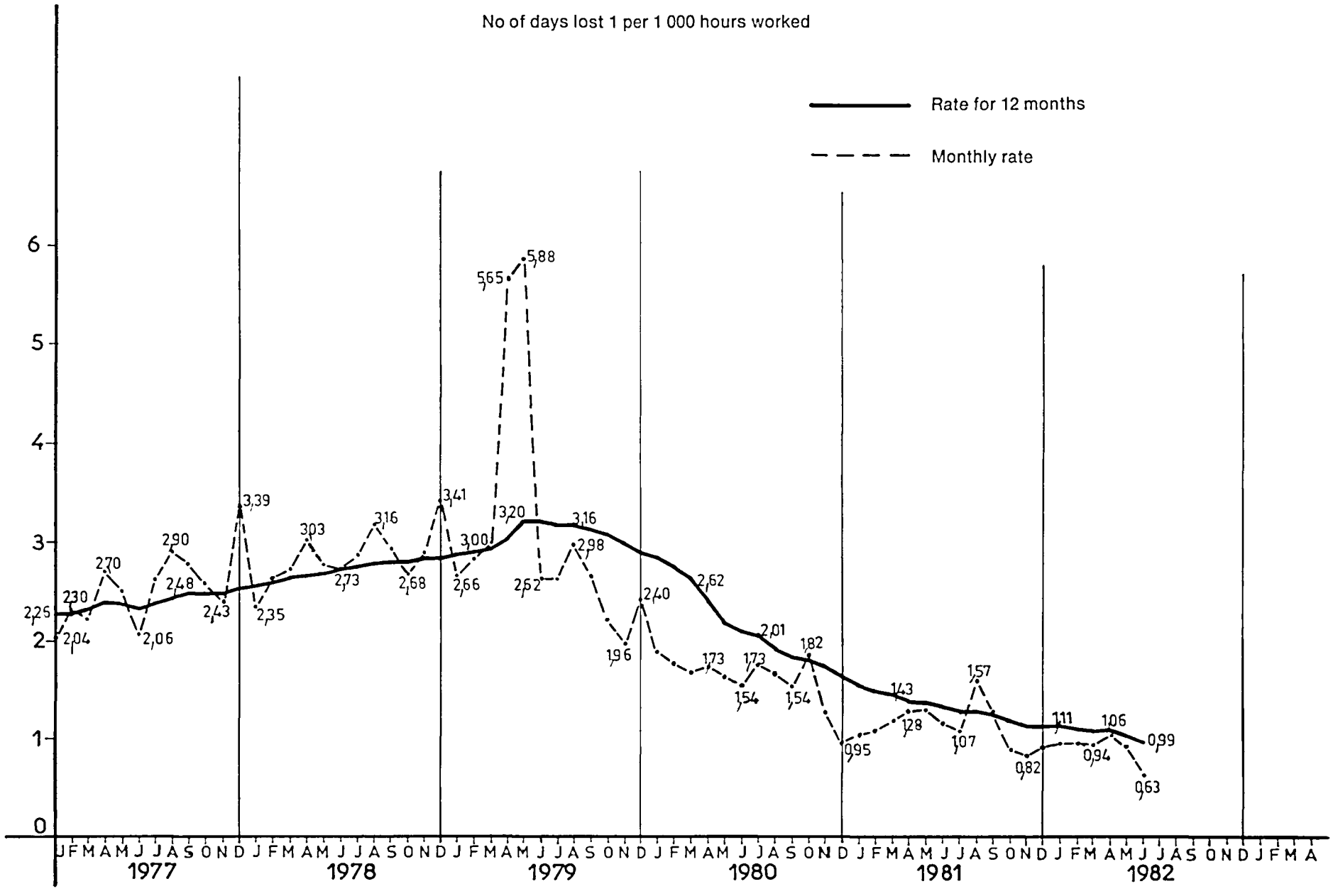
## Frequency rate: Solmer

(Number of accidents per million hours worked)



## Severity rate of temporary incapacity: Solmer

No of days lost 1 per 1 000 hours worked



In Mr Vidal's view:

'It is reasonable to suppose that every industrial accident will henceforth be discussed among the group members. Safety has at last become a subject of concern for the whole workforce. It has been possible to change the attitude of the workforce to safety. As soon as the effectiveness of the current competition begins to decline, a new idea will have to be found to ensure that the workforce continues to talk about safety and to practise self-help in this field.'

At the same time, a number of working parties were set up with a view to the improvement of working conditions, but this is a different experiment, which we shall describe in a later issue.

# Noise in rolling mills

**The following text has been prepared by the working party 'Health in rolling mills' of the Steel Industry Safety and Health Commission and adopted by this Commission on 9 July 1982.**

## 1. General observations

There are many sources of noise in rolling mills and the sound pressure levels attained frequently justify the taking of preventive measures as noise may have various effects on human beings.

An acute auditory trauma provoking immediate lesions may be due to short exposure to exceptionally loud noise.

Occupational loss of hearing is a permanent lack of auditory acuity resulting from repeated exposure to excessive noise levels at the workplace; it can be considered as an occupational illness in respect of which compensation has to be paid according to the statutory requirements of the country concerned.

Several organizations and research workers have attempted to establish acceptable threshold values for these risks and effects. This research has given rise to a number of standards and recommendations which can only be mentioned here.

The most important are listed hereunder:

— Standard ISO R 1999 — Acoustics — Assessment of occupational exposure to noise with a view to the protection of hearing (also AFNOR NF S 31013);
— Order on Workplaces (Arbeitsstätten-Verordnung Arbstätt V) of 20 March 1975 (FR of Germany);
— Ministry of Public Health Technical Committee on Noise (France);
— CHABA standard (Committee on Hearing Bioacoustics and Biomechanics, USA);
— American Conference of Governmental Industrial Hygienists' proposed Threshold Limit Value for noise (USA);
— Code of practice for reducing the exposure of employed persons to noise (Department of Employment, UK);
— Occupational Safety and Health Standards for general industry (OSHA, Department of Labor, USA);
— Occupational noise exposure (Rules and Regulations) USA — Federal Register, Vol. 46, No 11, Friday, 16 January 1981).

According to these standards, or recommendations, there are variations between 85 dBA and 90 dBA where problems of occupational hearing loss could arise.

Furthermore, some authors believe that even below this threshold noise can have repercussions on the neurovegetative, endocrine and nervous systems and on the major physical functions (respiration, circulation, digestion and metabolism). According to these research workers noise in industry can:

— dull the senses,
— increase reaction time,
— adversely affect the field of vision, particularly as regards the depth of this field,
— cause somnolence,
— give rise to irritability which can adversely affect the quality of team work,
— give the impression of having a dry throat or being thirsty.

It must, however, also be borne in mind that noise interferes with speech communication and may even render it impossible with a consequent risk of incidents and accidents, that it impairs mental concentration, that it gives rise to additional fatigue in workers and, lastly, that the compensation paid out in respect of occupational loss of hearing may constitute a substantial economic burden for the community at large.

It is important to note that sound levels may vary greatly from works to works because of the service conditions of machines operating in the no-load or loaded conditions, the concentration of such machines, the proximity of other departments, the existence of sound-absorbing partitions, the degree of sound dampening of machinery and plant, etc. In fact, each shop is a special case which must be treated as such.

Effective noise control involves the following measures:

1.1. Identification of the sources of noise by measurement of the sound pressure level, any machine or plant generating a level in excess of the tolerance limit being regarded as suspect and all the more so if the figure measured is higher.

1.2. Subsequent determination of the most suitable preventive measure or measures for the protection of the workers from the harmful effects of noise (if necessary on the basis of a frequency analysis of the noise in question).

Possible preventive measures fall into four categories:

1.2.1. Noise reduction at source, e.g.:
- — limiting impact noise:
  - • speed of impact,
  - • absorption of impact,
  - • extent of drop;
- — quieter plant and equipment:
  - • weight,
  - • speed of movement,
  - • use of appropriate materials;
- — silencers on inlets and outlets;
- — elimination of metal-to-metal friction;
- — improvement of servicing and lubrication.

1.2.2. Reduction of the sound pressure level radiating by absorbing the noise as close as possible to its source, e.g.:
- — positioning of the noisier plant and equipment in unoccupied places or in special enclosures;
- — total or partial sealing-off of noisy areas in order to forestall acoustic pollution of neighbouring areas;
- — installation of insulating partitions or panels.

1.2.3. Reduction of the sound pressure level at the workers' ears, e.g.:
- — installation of sound-proofed operator cabins;
- — installation of insulating partitions or panels;
- — keeping the sources of noise away from structural parts of the premises;
- — introduction of a rotation system for work in noisy and less-noisy areas.

1.2.4. Lastly, for want of better solutions, operatives should wear personal protection equipment (helmets, ear plugs, etc.)

The different categories of measures may be combined, e.g. a worker assigned to a control cabin should wear a personal protective device whenever he leaves the operator's cabin.

> Remedial measures are often costly and do not always produce the desired result. Just as for any other nuisance at the place of work, the noise problem must therefore be taken into account at the design and/or ordering stage of machine, premises, work stations and in work organization.

1.3. Estimation of the exposure to noise of workers liable to suffer occupational loss of hearing despite the measures taken. Reference should be made in this connection to standard ISO R 1999, which describes a method of carrying out such an estimate on the basis of the sound level and noise duration (equivalent continuous sound level) and the percentage of persons who may be expected to suffer hearing loss induced solely by occupational exposure to noise. This standard also provides a method of calculating the equivalent continuous sound level when personal ear defenders are worn.

1.4. If a worker is still at risk despite all the preventive measures taken, the only way in which he can be protected is to organize his work in such a manner that the effect of a noisy environment can be mitigated by periods of work or rest in a quiet place so that the equivalent continuous sound level does not exceed the permissible threshold.

Appropriate medical examination and supervision of the hearing of workers exposed to high noise levels should be provided.

## 2. Noise abatement

Numerous research projects and tests have been undertaken to reduce noise, or provision of protection against it, with varying degrees of success. It is essential before changes, which may be costly, are carried out that reference should be made to such findings.

More often than not, most of the noise problems which arise in rolling mills can be solved satisfactorily only by specialists, for although the identification of the measures needed is a fairly straightforward process, the choice of insulating or sound-dampening materials and of the design of the absorption system depends not only on the type of problem and the relevant environment, but also and especially on the characteristics of the source of noise. Each problem must therefore be tackled separately and a solution which proves effective on one item of equipment will not necessarily be equally effective on another item of equipment of the same kind (e.g. a silencer which is suited to one fan may or may not be suited to another which is identical but is used in different conditions).

Furthermore, when the list of improvements is drawn up in order of priority, due account should be taken of the frequency of the tasks carried out by operatives in the vicinity of the noise source. It is far more urgent to deal with the sources of noise near which operatives are frequently required to work than those situated in places where they are not required for any length of time.

Below is a list of the improvements possible on excessively noisy plant and equipment common in rolling mills.

2. 1. *Fans*
- — installations of fans outside the shops (taking due account of neighbouring premises) or in cellars;
- — installation of fans on suitable shock absorbers;
- — regular balancing of the wheel;
- — installation of silencers;
- — installation of a sound-insulating enclosure around the fan;
- — installation of elastic washers on the flanges between fans and pipes.

2. 2. *Pipework*
- — installation of elastic washers and shock absorbing supports to pipework.

2. 3. *Burners*
- — frequent checking of the regulation of the flame.

2. 4. *Rolling stands*
- — choice of low noise elements of drive transmission;
- — use of synthetic materials where possible in transmission drives;
- — frequent maintenance of the elements of transmission;

— good balancing of the spindles;
— on small mills, soundproof enclosures for the reducer gears;
— the introduction of automatic servomechanisms.

2. 5. *Roller tables*
— independent operation of each roller;
— regular overhauling of the mechanisms.

2. 6. *Sprays*
— soundproofing of the spray hoods.

2. 7. *Flame-scarfing*
— soundproofing of the automatic flame-scarfing bays.

2. 8. *Shearing*
— raising to head height of the parapets over the crop end pits.

2. 9. *Hot and cold sawing, cooling beds and straighteners*
— suitable design of teeth for saw blades;
— protective covering for the saw blades;
— preference for walking beam or chain cooling beds which avoid scraping.

2.10. *Coilers*
— use of easily movable sound-absorbing screens;
— banding of coils by automatic machines.

2.11. *Pickling, straightening and shearing lines*
— covering of roller tables with synthetic materials;
— soundproofing for drive mechanisms;
— automatic system for braking the coil being uncoiled;
— positioning of pinch rollers covered with plastics upstream and downstream of the trimmers.

2.12. *Handling of materials*
— use of packing/unpacking systems whereby handling noises can be reduced.

## 3. General preventive measures

3.1. *Measurement of equivalent continuous sound level*

Many operatives in rolling mills are given tasks which expose them to noise levels which vary considerably in time, either because the rolling or finishing operations are discontinuous, or because the workers are required to move from place to place within the shop, e.g. from the control station to the production shop and vice versa.

This is a fundamental consideration in that it warrants measurement of the equivalent continuous sound level in the majority of work stations (see 1.3. above) because of the different tasks to be carried out there.

When this measurement exceeds the tolerance limit it is necessary to consider preventive measures such as the ones outlined in 1.2. and possibly 1.4., should be implemented.

3.2. *Personal ear defenders*

The use of personal protective equipment is thus essential in many cases, for wearing this equipment will limit the risk during those periods of exposure to excessively high noise levels.

The choice of an ear defender is of considerable importance for it must at the same time:

— attenuate the noise in the inner ear;
— allow for verbal communication;
— cause no undue discomfort to the worker.

There are several types of defender on the market and their capacity for reducing noise and their standard of comfort vary considerably.

Generally speaking, all rolling mill operatives (apart from those permanently in soundproof cabins) should be equipped with ear defenders.[1] However, it is equally essential to convince workers of the need to wear them and to see that this instruction is followed. The risk of occupational hearing loss is insidious and lack of auditory acuity becomes apparent only after a number of years. This number varies, but the higher the noise levels to which a worker is exposed, the sooner his hearing is affected.

In addition, ear defenders other than the disposable type should be hygienically cleaned and maintained at regular intervals.

3.3. *Soundproof cabins*

Soundproof cabins are essential in view of the high levels of noise originating in some of the various rolling and finishing operations, and their use should be more widespread so that as many of the control stations as possible are shielded acoustically.

Soundproof cabin design parameters must include not only the characteristics of ambient noise (the choice of sound-dampening materials is very important) but also other factors such as:

— protection against dangerous splashes and excessive radiant heat and light;
— air conditioning;
— accessibility;
— visibility outwards;
— interior lighting (variable reflection-free lighting).

For those workers in areas of levels of noise in excess of the tolerable limit, and who cannot perform their work within soundproof cabins, a noise-free facility should be provided for use at rest periods or whenever the work task permits.

[1] See document 'Adoption and regular use of individual means of protection'.

# Gasholders

**The following text has been prepared by the working party 'Safety · Gas lines' of the Steel Industry Safety and Health Commission and adopted by this Commission.**

## 1. General remarks

A large number of sometimes very serious accidents may be attributed to gasholders, which has caused the public authorities of some countries to draw up pertinent regulations and manufacturers to lay down directives.

The same attitude has led the Steel Industry Safety and Health Commission to draft the following recommendations on gasholders in iron and steel undertakings, as a result of experience acquired in this industry.

## 2. Types of gasholders

Gasholders may be subdivided into two main categories: waterless gasholders and water-sealed gasholders.

Depending on the type, waterless gasholders are made gas-tight either with a grease seal (circular gasholders), or with an oil seal (polygonal gasholders) or else with a canvas seal (circular gasholders).

All water-sealed gasholders are circular, but may be subdivided according to their guidance system (column guided or spiral guided) and the number of lifts.

## 3. Recommendations on the construction of gasholders

3.1. *Location*
Gasholders must be located at a sufficient distance from houses, workshops belonging to the undertaking or neighbouring undertakings and public thoroughfares (road and rail). They should also be located at a sufficient distance from sources of heat (e.g. flares) or cooling towers (on account of the additional risk of ice formation in their proximity). Lastly, there should be a reasonable distance between neighbouring gasholders, whether they contain different gases or the same gas.

Gasholders must be installed in restricted areas to which access is prohibited to all non-authorized persons. This prohibition should be indicated by appropriate signs, or as is the case in some works, by a wire fence. The latter should have at least two exits, placed as discernibly as possible depending on local conditions and prevailing winds.

Access roads must allow fire tenders and rescue workers to reach the gasholders.

3.2. *Extreme positions of gasholders' lifts or pistons — danger of excessive high or low pressure*
In order to prevent gasholders' lifts or pistons reaching their extreme upper or lower positions, two separate automatic systems should progressively close off the valves allowing gas to leave the gasholder (for the lower position) and the supply valves to the gasholder (for the upper position) so that the valves concerned are completely closed before these extreme points are reached. The same effect should be obtained when there is only a single main for supplying and distributing the gas. These systems should also set off visual and audible alarms at the control station and will thus present the highest possible level of safety.

Furthermore, to prevent excessive pressures in gasholders, emergency gas vents, which automatically come into operation when the piston or the lift reaches its highest point, should be provided and kept in operational order at all times.

3.3. *Shut-off devices*
The devices to close off the supply pipe to the gasholder and the distribution pipe must be designed to provide the maximum sealing possible and be quick to operate. They must be remote controlled, with facilities for manual operation if necessary. To allow for maintenance on the gasholder in gas-free conditions, it is advisable to use a goggle valve to provide effective isolation, such a valve always being preferable to two consecutive valves with intermediate venting.

3.4. *Permanent recording systems*
A dual permanent recording and indicating system to indicate the position of the lift or piston should be fitted to each gasholder to allow readings of the piston speed or lift movements and the volume of gas in the holder. Gas pressure should also be measured at the same time.

3.5. *Signalling and operating information*
The separate automatic systems regulating the valves to and from the gasholder to give warning of the approach of the venting condition or of the extreme positions of the piston should be connected, as mentioned in 3.2., to an alarm at the control station. The signal, which should be visual and audible, must warn the service staff to carry out operations that the situation requires so as to avoid at all times the extreme positions being reached or, above all, the gas vents being activated.

Furthermore, in some regions and according to local conditions, information on the speed and direction of wind should be obtained, especially before certain maintenance work and checks are undertaken.

A recording device is being developed to measure the tilt of pistons or lifts with sufficient accuracy.

3.6. *Electrical installations*
All electrical installations providing lighting or power installed inside gasholders, on domes or supporting structures or inside the restricted area should be of flameproof design. Portable or hand-held equipment and their power supply lines used in the same places should also be flameproof and of the prescribed low voltage.

The armouring or metal sheaths of all cables entering the holder or lantern should be effectively bonded to the surrounding steelwork at the point of entry. This also applies to any earthed conductor.

3.7. *Protection from lightning strikes*
The fixed and movable parts of the gasholder structure should be earthed.

Gas vent stacks should not project above the top of the holder, in order to minimize the possibility of a stack acting as a lightning conductor. They should be securely bonded to structures to eliminate the danger of sparks.

Radio aerials or other non-essential projections must not be erected on gasholders.

Metal suspension cables and equalizer leads on gasholders must not pass too high above the roofs where they may be in danger of being struck by lightning.

Telephone and power lines must not be supported by or attached to gasholders.

3.8. *Access to the various parts of gasholders*
Every gasholder should have two access points to the various platforms and inspection areas, to allow for speedy evacuation at all times. These access points should be set opposite each other and prevailing winds should be taken into account when deciding on locations. They should consist of stairs and not vertical ladders. Attention is drawn to the fact that these stairs must be designed to allow for persons on stretchers to be easily carried. In tall gas holders, stairs should preferably be replaced by a lift. The possibility of installing a cradle for inspecting the outer surface should be examined at the design stage.

A chamber which can be pressurized and supplied with clean air may be installed on the roofs of gasholders to provide on-the-spot emergency treatment for gassed workers.

3.9. *Protection against freezing*
All gasholders and especially the water-sealed type must be protected against the effects of freezing. Steam for example may be used to provide sufficient heat for water seals. During cold weather there must be special monitoring of water temperature.

In connection with the water in water-sealed gasholders, it should be noted that its level of acidity must be monitored. The danger of corrosion may be diminished by adding a corrosion inhibitor to the water.

3.10. *Fire precautions*
All naked flames must be strictly prohibited in the restricted area around gasholders (see 3.1.); smoking in particular should be forbidden. Written instructions and notices posted in sufficient number should be provided to remind all persons of these regulations.

A system for introducing inert gas below the piston in sufficient quantity into each gasholder through two diametrically opposite inlets should be installed and be permanently operational.

Sufficient quantities of water for fire fighting or cooling purposes must be available.

## 4. Operating and maintenance procedures

4.1. *Inspections, checks and maintenance*
A complete procedure must be set down for all maintenance checks and inspections, to be carried out, both frequently (weekly for example) and periodically (overhaul), including inspection to check the normal wear and tear and corrosion of gasholders (e. g. yearly or two-yearly).

Detailed reports should be made of all maintenance work and plant inspections, indicating their purpose and the equipment inspected by means of checklists which should be filled in by the responsible person as the inspection proceeds.

4.2. A register should be kept for every gasholder and all maintenance work, repairs and modifications, as well as the results of all checks and inspections, should be entered into it. Each entry should be dated and signed by the person carrying out or responsible for the work done.

4.3. No welding or cutting must be done in the restricted zone around gasholders (see 3.1.) unless a procedure for granting a 'fire permit' has been laid down. This should include all job instructions, precautions to be taken and the name(s) of the person(s) in charge.

4.4. Maintenance staff should not be authorized access to gasholder roofs unless there are at least two persons and they have a permit to carry out work issued by the person in charge of the gas holder, and after the required measures have been taken.

4.5. Work of a non-urgent nature must not be undertaken on or in a gasholder when thunder or storm conditions — or the danger of one of these — exist.

4.6. When work is being carried out underneath bells or pistons, they should be secured to prevent them falling onto personnel.

4.7. The resistance of the earthing conductors must be monitored at least annually; where stricter regulations do not exist, the resistance must not exceed 10 ohms. These measurements should be entered in the register (see 4.2.).

4.8. When gasholders are taken out of service, they should be isolated and purged in accordance with the recommendations in the document 'Maintenance and repair work to gas lines and equipment — isolation and degassing of gas lines and equipment' ('Travaux d'entretien et de réparations des conduites et appareils à gaz — isolation et dégazage des conduites et appareils') which was published as part of the conclusions of the Steel Industry Safety and Health Commission.

4.9. Adequate breathing apparatus should be provided, checked regularly and carried by the personnel whenever work is done on gasholders.

# Readers' letters

The aim of this feature is to enable readers to exchange information. It is open to anyone seeking information on a particular practical problem, and also to anyone who can supply this information. Other contributions describing a particularly successful experiment or project with novel features will also be accepted.

Readers are asked to address their correspondence to the Secretariat of the Steel Industry Safety and Health Commission, Information Bulletin, DG V, Commission of the European Communities, BP 1907, L-2920 Luxembourg.

The Bulletin's editorial committee will decide whether it is appropriate and practicable to publish replies to questions and other contributions submitted. In any event replies will be sent direct to the questioner concerned.

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*Letter of a reader*

*Problem with operating a blast furnace clay gun*

For each plugging operation, the gun is filled with 12 to 15 packets of taphole clay, each of which weighs approximately 20 kg and measures 19 x 14.5 x 38 cm.

The total amount cannot be inserted in a single operation and about six stages are necessary. After each filling operation, the material has to be compacted by the piston. The packets of taphole clay are inserted through the round or square opening in the clay gun. The opening has a cover which must be closed (blocked) for the plugging operation. The opening, however, is not closed with the cover for the compacting process. The considerable effort required to close the opening for this process (weight of the cover, stiffness of the hinges, ergonomically unsuitable posture of the worker) would make this work intolerable. Since the taphole gun is operated hydraulically, it would be very difficult and has so far not been usual, to close the unprotected opening securely by locking or other means.

The filling operation is generally carried out by two persons, one of which does the manual work on the machine while the second, at the machine's control panel about 9 m away, operates the clay gun according to the first person's instructions.

Any misinterpretation in the communication between these two persons may cause a serious accident and we have recorded the case of a worker who had his hand crushed in the machine, as a consequence of which the hand had to be amputated.

In order to improve safety in the operation of this type of equipment, reports would be welcomed from other readers on means of securing the opening during compacting without obstructing the machine's operating area.

# Bibliography

Just published

**— EUR 7782 — Oxygen — Oxygen in the iron and steel industry**

1982 — III, 26 pp.

(DE, EN, FR, IT, NL)

Price (excluding VAT) in Luxembourg:
ECU 3.33 BFR 150 IRL 2.30 UKL 1.90 USD 3.50

This document deals specifically with the use of oxygen in steelworks and contains many recommendations aimed at increasing occupational safety. It covers the design and installation of multi-purpose, manually operated and controlled stations (for welding, flame-cutting, hot scarfing, burning, tapping, etc.), supplied by an oxygen distribution system in most workshops and steel plants, enrichment of air blast furnaces or reheating furnaces (soaking pits, cowpers, continuous reheating furnaces, etc.), oxygen conversion processes (LD, LD-AC, OLP, OBM, Q-BOP, LWS, etc.), pure oxygen torches and oxygen lances.

**— EUR 7783 — The causes of serious accidents which occurred in Lorraine — 1970-76**

1982 — III, 50 pp.

(DE, EN, FR, IT, NL)

Price (excluding VAT) in Luxembourg:
ECU 3.33 BFR 150 IRL 2.30 UKL 1.90 USD 3.50

This document presents the conclusions of an in-depth study of the causes of 670 very serious accidents resulting in death or permanent disability of more than 10% which occurred at four Lorraine iron and steel companies — with a total workforce of over 50 000 in 1977 — between 1970 and 1976. The study was based on a special questionnaire completed for each accident.

These reports have been published by the Office for Official Publications of the European Communities.

**A recent publication from the Community Ergonomics Action Bureau of Information and Coordination**

**A glossary of terms commonly used in ergonomics in six languages**

The interdisciplinary, perhaps, hybrid, nature of ergonomics makes a glossary of terms commonly used in its literature a prerequisite for informed reading, even by the specialist in the field. This is all the more so when the reading involves translation from another language. Its terms are drawn from a variety of disciplines: from communications engineering through psychology and physiology to production engineering, touching many others on the way. In an ergonomics text one might find such unlikely bedfellows as 'closed loop system', 'dysacusis' and 'work design'. To accommodate a translation of such a range of terms several glossaries and dictionaries would have to be searched.

The new publication from the Community Ergonomics Action Bureau of Information and Coordination, 'A glossary of terms commonly used in ergonomics', brings together more than 1 100 scientific/technical terms drawn from the various disciplines for use in ergonomics to give their definitions in English, French and German and further language equivalences in Italian, Dutch and Danish.

Copies of the glossary are being distributed by the Bureau throughout the ECSC industries. Further copies can be had free of charge, by the coal and steel industries *only*, on application to

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For others wishing copies, the commercial version costing HFL 115 is available from

Bohn, Scheltema & Holkema
PO Box 23
7400 GA Deventer
Nederland

This periodical is published in English, French, German and Italian, and can be obtained free of charge by simply applying to the Commission of the European Communities, Directorate-General XIII, Division for Scientific and Technical Communication, POB 1907, L-2920 Luxembourg.

There is a Dutch version of the study 'Noise in rolling mills' which appears in this booklet. It can be obtained by applying to the Secretariat of the Steel Industry Safety and Health Commission, Directorate-General for Employment, Social Affairs and Education, CEC, POB 1907, L-2920 Luxembourg.

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