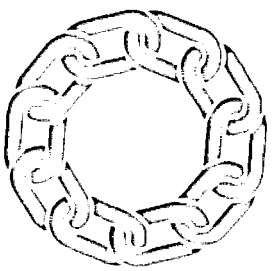
Commission of the European Communities

Information Bulletin of the Steel Industry Safety and Health Commission



1 — 1982

Editorial

The Commission of the European Communities is pleased to launch this first issue of the Steel Industry Safety and Health Commission Information Bulletin, which it hopes will meet with a favourable reception from all sectors of the industry.

Since it was set up in 1965, the Steel Industry Safety and Health Commission, whose task is to organize exchanges of experience in the field of occupational safety and health, has attempted, through the medium of meetings of experts from all the Member States of the Community, to collect information on the problems it has elected to deal with, to give these experts the opportunity for exchanges of experience and to draw up recommendations which may be regarded as constituting codes of good practice. A list of these recommendations can be found in this issue.

The publication of this bulletin is a necessary step towards ensuring the dissemination of studies, of the results of research projects and of work carried out by the SISHC or with financial assistance from the ECSC.

This bulletin is in particular intended to promote exchanges of views on health, safety and working conditions by including accounts of accidents which have occurred in the Community iron and steel industry, by disseminating the conclusions reached in studies or arrived at through work in steel firms themselves and lastly by establishing a dialogue between steelmakers from Member States with exchanges of the solutions they have found to shared problems.

This bulletin will only succeed in being a real medium for mutual exchange and in truly existing if large numbers of its readers contribute to it, provide information and show their interest by answering the questions put in readers' letters.

The Commission of the European Communities, its Directorate-General for Employment, Social Affairs and Education and the Steel Industry Safety and Health Commission take pleasure in sending you this first issue of the Steel Industry Safety and Health Commission's Information Bulletin.

Should you wish to receive forthcoming issues, please read carefully the 'Very important' notice on the bulletin's insert and take the necessary steps to ensure that the reply card is correctly returned.

Accidents

Gas

Four workers were asphyxiated when entering a steel converter tilting pressure accumulator. Owing to a connection error, nitrogen was used in the ventilation system instead of compressed air.

As part of the statutory inspection of pressure vessels, an undertaking was engaged to paint the inside of a metal reservoir normally filled in service with water (to provide pressure for tilting steel converters) and compressed air at 60 bars. The foreman went into the vessel without abiding by the provisions laid down during the preparatory meeting held the day before, whereby there was to be a briefing by the supervisor before work began to ensure the application of the following measures:

— monitoring of atmosphere;

— the painters to enter the vessel one at a time, wearing a lifeline and a safety harness to allow them to be lifted out if necessary, under the surveillance of two persons;

— compressed-air respirators to be worn;

— compressed-air ventilation beforehand, and use of an extractor fan;

— 24-volt lighting;

— no smoking to be allowed.

Owing to a connection error, nitrogen was used in the ventilation system instead of compressed air. Since the safety measures laid down had not been implemented, the foreman was asphyxiated as were the three men who went down into the vessel to help him.

Action planned:

— better knowledge of the plant;

— review of all flow systems and marking of connections;

— insistence on the need for undertakings to respect rules decided at preparatory meetings.

Oxygen

A technician was burned during repressurization of an oxygen system.

A 250 mm diameter pipe, operated at a maximum pressure of 40 bars, links the oxygen plant to the works. The network may be cut off with a shut-off ball valve. Downstream of this valve is the pressure reduction and distribution substation comprising three 150 m^3 containers, also at a maximum in-service pressure of 40 bars. This pressure-reduction station serves the melting shops and blast-furnaces via pipes of various diameters at in-service pressures ranging from 9 to 16 bars. The three containers serve to cushion sudden variations in user service demands.

In August, these containers were depressurized, blanking plates were inserted and the plant purged with compressed air, so that an inspection agency could carry out the statutory three-yearly inspection.

Once the inspection was completed, the blanking plates were removed, the pipes were connected and the inspection holes at the top of the three containers were closed once again. An initial check to see that the containers were sealed was carried out with oil-free compressed air, under low pressure. Once these preliminary operations had been completed, a technician was given the task of repressurizing the system with oxygen.

To carry out this operation, the shut-off ball valve was fitted with a 20 mm diameter copper and bronze by-pass fitted with a cock. By opening the cock, the pressure upstream and downstream can be equalized at a reduced flow before the main valve is opened. The by-pass was opened at about 14h15. It was decided that when a pressure of 10 bars was reached in the containers, a full check would be carried out on the seals, especially on the inspection holes at the top of the three containers, using soapy water.

At about 15h55 the pressure gauge showed a pressure of 8 bars at the entry to the containers and the planned check was undertaken. Suddenly a sheet of flame fed by a large outflow of oxygen shot out around the valve, producing considerable quantities of iron-oxide smoke and spattering molten metal. The pipe downstream of the valve, the valve itself and pipe sections in the flame path were burned. The technician, who was close to the valve, was seriously burned and died.

After the accident, it was discovered that the shut-off ball valve was half open.

Blast-furnaces

Five workers were injured by splashes of hot metal when a skimmer dam gave way (by-pass tapping).

After a shut-down for major maintenance work, a blast-furnace was started up on a Saturday, at about 12h30.

On the Sunday, casting was to be carried out about midnight. A temporary skimmer had been drying since 21h45. At about 23h20 the tap-hole was drilled open. The furnace keeper used an oxygen lance to complete the operation.

At about 23h40 the hot metal was flowing slowly through the normal tap-hole. In 20 minutes or so, 60 tonnes were poured into ladles through the hot metal by-pass. There was a temporary device to protect the normal skimmer. The hot metal flow rate increased and the furnace men standing along the main runner on the right threw sand along the sides to reinforce them. The level gradually rose in the runner and the flow rate increased even more. The foreman decided to check the blast-furnace. It was 23h55.

Suddenly the top of the temporary skimmer dam on the slag side split under the pressure of the hot metal and gave way. There was an explosion in the skimmer area, which spattered hot metal around, in particular on the furnace men who were taking action in the vicinity of the sand pile beside the skimmer.

The hot metal flowed rapidly down the slag by-pass runner and reached the 'hot metal trap', causing a series of spattering explosions for two or three minutes.

Molten matter hit five men in various parts of the body. The most seriously injured man had been running away from the danger area when he slipped crossing a runner and fell into it in a sitting position. Despite the fact that a furnace man who happened to be nearby acted quickly in order to extricate him, he was burnt on the posterior by flowing pig iron. The other four men who had been injured to varying degrees managed to escape the danger area and were assisted by fellow workers nearby. The foreman had the tap-hole closed and called for help. (The most seriously injured worker died two and a half months later.)

— The prompt action of the workers on the spot in providing help, and the special fire extinguishers (for use on personnel) and sterile cloth used helped to limit the seriousness of the burns sustained.

— The fireproof clothing worn at all times during work (acquired recently) did not catch fire. Holes were made in it when it was struck by molten matter and the trouser legs were especially damaged in spite of the double layer of cloth.

— The aluminium coating on an aluminized jacket worn by one of the men was volatilized along the lower back, but the material withstood the heat and did not catch fire, even at the shoulders. It was, however, holed in places by drops of molten matter.

Variations in the rate of metal flow from blast-furnaces may occur at any time.

— High flow rates should be contained by sufficiently high and thick runner sides, so that men do not have to intervene in the high-risk area during this part of the operation. A study committee including members of the Safety and Health Commission and the Working Group on Hygiene and Safety at Work - Working Conditions, will be set up to assist in directing research already in progress on appropriate technologies.

— In view of the potenial performance of new and recently-developed clay guns, recommendations will be given that no action should be taken if the flow rate rises very considerably or an incident occurs. If checking the blast-furnace does not prove sufficiently effective, the tap-hole must be closed.

Instructions regarding the operation of temporary skimmers will explain the change in operating procedures.

— Consideration will be given to the purchase of aluminized asbestos leggings which are more comfortable than those previously tested.

Killed by falling billet 3/80

Two billet trimmers were checking and trimming 60 mm square section billets, each approximately 8 metres long. The layout of the trimming section is such that the trimmed, usable billets can be tipped directly from the trimming station into the adjacent collecting pocket—whereas discarded scrap billets have to be removed to the scrap pocket by crane. During this process, the two trimmers carry out the slinging work themselves.

When the two trimmers had deposited a scrap billet in the scrap pocket they pulled the chains hanging from the cross beam over the front of the billet, as usual and threw them on to the billets lying in the scrap pocket. They then gave the crane driver the signal to raise the cross beam and returned to the trimming station to resume work there. When the cross beam was lifted, a chain sling caught the end of a deposited billet and raised it, without this being noticed. When the crane driver had raised the cross beam to the normal height, he drove the trolley to the normal waiting position above the billet trimming station. The billet which had been raised accidentally then slipped out of the chain and fell against the neck of one of the trimmers. The blow was so violent that the man died instantly (Fig. 1).

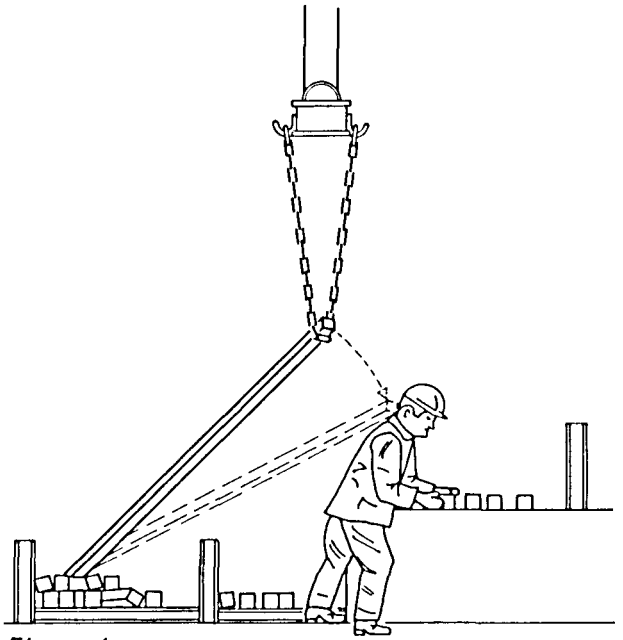


Figure 1.

The accident could have been avoided if the crane driver and billet trimmers had kept their attention on the cross beam and its chain sling until the chains hung freely above the scrap pocket.

Dragged along by a piece of scrap 4/81

In a rolling mill, the crop ends of the rolled bars are cut off by shears and fall into a scrap box under the latter. During a night shift, a sheared crop end was not conveyed by the rollers because it had become jammed. Two men pulled the crop end, weighing about 35 kg, away from the shearing section with hooks and left it lying on the steel plate floor in front of the shears. A third shears operator, who had just completed his break, took a pair of tongs, lifted the hot piece of scrap and swung it into the scrap box containing red hot scrap, which lies at a lower level behind the shears. In the process, he lost his balance and fell between the shears and railing, into the box. He suffered serious injuries from which he later died in hospital.

This serious accident was able to occur because the existing plant was considered adequate, although it incorporated defects. The safety of the railing has since been improved and a chute installed to prevent the crop ends from becoming blocked or otherwise hindered during transport.

Struck by tubes from an overturned truck 5/80

A two-wheel tube truck was loaded with three tube racks and pushed through the production shop by four workers. The total weight of the truck was about 5.7 t. When one of its two wheels ran over a cast iron floor plate (600 x 400; 23 mm thick), the latter broke and the truck tipped over. Three workers managed to get to safety; the fourth however, was knocked down by the falling tubes and suffered serious internal injuries.

An examination of the broken floor plate showed that it was simply a case of forced rupture. No previous damage could be found in the structure of the cast iron. The rupture evidently occurred as a result of overloading. This accident illustrates that floor covers should be checked for their carrying capacity, especially if located in traffic or work zones, and can be driven over by vehicles. In the case in question, the method of transporting tubes was also changed.

Accident caused by an incorrect screw fitting on a portable fire extinguisher 4/80

In one of our associated works, a casting operater tried to extinguish burning hydraulic pipes next to the casting tower of a continuous casting installation with PG 6 portable powder extinguishers. When the first extinguisher was empty, the fire continued to burn and he was handed a second extinguisher of the same type. He removed the lead seal and pulled the locking pin, but when the propellant gas flowed into the pressure vessel, the fittings on the container were blown off and wrenched out of his hand. The man suffered a fracture of the radius of the left forearm and facial injuries. During the accident enquiry it was established that the screw-on cap connecting the fittings to the pressure vessel had been held by only one or two threads. It could not be determined whether the cap had been screwed on to the container incorrectly after the extinguisher had been filled or whether it had been manipulated afterwards in the works, because the cap can be removed without damaging the lead seal.

This accident demonstrates the need to ensure that the fittings of portable fire extinguishers in working areas are screwed on to the pressure vessel properly when they are checked. It would be useful if such fire extinguishers could not be unscrewed without breaking the lead seal.

Fatally injured in a collision on a factory road 1/81

A foreman in a sheet metal processing plant was transporting a pile of sheet metal from the materials store to a production shop with a fork lift truck. On the direct route to the store a factory

road had to be crossed (Fig. 2). Since finished products packed in cases had been deposited between the production shop and the road, the foreman could not see into the road. A lorry driver who was driving along the road at the same time could not see if any traffic was coming from the right. When the two drivers arrived at the junction, they recognized the danger and braked sharply. However, they were unable to stop their vehicles quickly enough and the foreman drove into the lorry at the level of the driver's cab with the fork lift truck. He was thrown off the truck and run over by the lorry's double rear wheel. He died of his severe injuries at the scene of the accident.

This accident illustrates the need to ensure that visibility at road/road or road/rail junctions on factory premises is not restricted by deposited cases or stored material. Such areas must be kept clear; if necessary, by the installation of structures to prevent storage. If, for other reasons, it is not possible to keep the view unrestricted, e.g. in narrow thoroughfares between two factory shops, mirrors must be set up to improve visibility or traffic signs installed, e.g. stop signs or warning lights, to draw attention to the danger. Vehicle drivers must drive no faster than walking pace in these areas and must stop their vehicles, if necessary, in order to exclude any danger in driving over the junction.

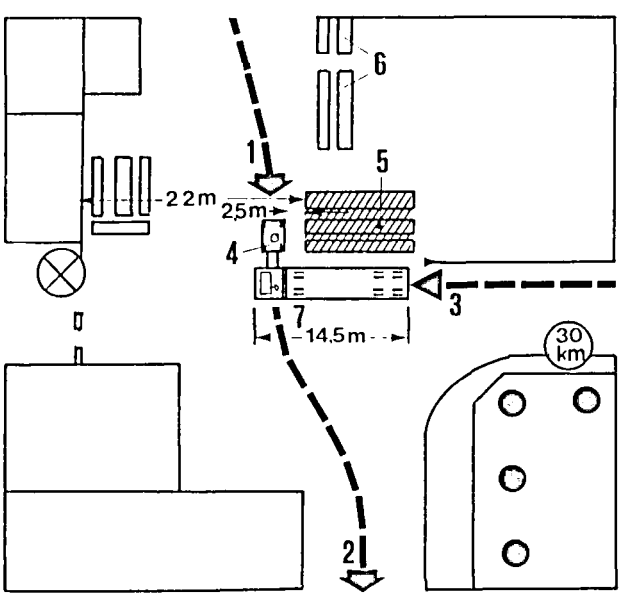


Figure 2. Diagram of the accident situation

Gebäude = building
Bürohaus = administrative building
Abstellplatz = storage area
Fahrtrichtung des Vorderstaplers = direction of travel of fork lift truck
Vorderstapler = fork lift truck
Lastzug = lorry
Fertigprodukte = finished products
Kistenstapel = pile of cases
Fahrtrichtung des Lastzuges = direction of travel of lorry
Angenommene Fahrtrichtung des Vorderstaplers = assumed direction of travel of fork lift truck

Fatally injured while re-railing a wagon 4/81

A shunter noticed that the shuttle car in a group of three wagons (two platform wagons, each carrying two slag bins and the shuttle car) was derailed.

In order to re-rail it with the aid of a casting crane, the coupling between a platform wagon and the shuttle car which was under tension, had to be released. In order to slacken the coupling for the purpose of uncoupling the wagons, a vehicle which may be employed for pushing wagons was used. The vehicle pushed the group of wagons together according to the instructions of a shunter.

During this process, the shunter passed between the wagons and was crushed to death because the buffers missed each other.

In this case, the shunter should have waited at a safe distance for the wagons to be pushed together before releasing the coupling.

Hand amputated by a circular metal saw

In an ingot finishing shop, a test sample was to be sawn off a rolled bar (measuring 150 x 150 mm) by means of a circular saw (blade diameter: 600 mm, peripheral speed: 10 m/min).

After clamping the bar, the operator, who had many years of experience in this work, tried to direct the cooling water pipe, which was close to the saw blade, on to the cutting position. His glove was caught and his hand pulled between the pipe fixture and the saw blade, resulting in the amputation of half of the hand.

The accident would not have occurred if the operator had not switched on the machine at the preparatory stage, when he was clamping the bar and adjusting the cooling water pipe. The man's gloves increased the risk.

The place where the hand was drawn in was made safe by the installation of a guard. In addition, all employees working in that area received fresh instructions.

Open coil annealing bay

At the beginning of the annealing process, the coils arrive in the bay wound compactly. They are

then unwound and rewound to leave a regular space between the windings. During this operation, the strip passes between two vertical pulling rolls which must be cleaned several times a day by spraying with methylene chloride. The operator performs the cleaning operation with a pneumatic spray gun while standing about one metre from the rolls.

The operator had set the rolls to move slowly in the 'inward' direction in relation to his working position. For reasons which have not been established, he was pulled in between the two rolls. He died on his way to hospital.

In future, the rolls will be sprayed automatically by vertical spray manifolds fed directly under pressure.

LD melting shop — Ingot mould assembly area

The casting bogies on which the bases supporting the ingot moulds are placed are brought alongside an assembly platform. There, the ingot moulds are removed by an overhead travelling crane, the bogies are cleaned and a small plate is placed on each bottom plate at the point of impact of the liquid steel. The latter operations are performed by an operative who is normally in the last section of the working area when the ingot moulds are lowered back into position. He is assisted in his work by a crane driver who removes and replaces the ingot moulds with a clamp.

After checking that the operative on the ground was at the back end of the line of bogies, the crane driver began the task of removing the ingot moulds from the storage area in order to replace them on their bases. Having arrived above the bases, he started the lowering motion. At a given moment he saw an ingot mould turning. He immediately tried, unsuccessfully, to raise the tongs again to retrieve the ingot mould. The mould became detached from the tongs and fell. As it fell, the crane driver saw the operative, who had moved to the adjacent base. The ingot mould fell over towards the victim, striking him on the right hip.

— Operatives working on the ground will be equipped henceforth with a fluorescent yellow helmet and an orange jacket.

— The instructions for the placing of ingot moulds on their bases have been revised.

Steelworks · converter

Following a water leak through a crack in the hood of the converter, the foreman found that the fumes emitted by the converter contained 15% hydrogen.

He therefore decided to empty the converter entirely so that the fume collection installation could be attended to by the maintenance department. In order to do this, the tank supplying the water circulating pumps had to be emptied, and afterwards, the hood containing approximately 10 m^3 of water had to be drained, allowing the water to run into the pit beneath the converter. At the same time, he instructed a bulldozer driver to clean out the pit.

One hour after the converter had been stopped, the bulldozer driver began to clean out the pit under the converter, although it still contained water. In the course of this operation, a violent explosion occurred as a result of contact between water and liquid slag. The driver suffered severe burns and died several days later.

Preventive measures:

— Whenever a technical incident occurs which makes it necessary to drain installations, the pit beneath the converter will have to be cleaned before the fume collection installation is drained.

— Development of a system to drain off water from the upper levels and the hood through an external duct.

— Improvement of the pit's drainage system to allow it to cope with abnormal quantities of inflowing water.

— If a quantity of water remains in the pit in spite of the above precautions, it must be drained by a pump before any other action is taken.

Coloured identification markings for gas cylinders

The subject of safety markings at the place of work has been discussed on numerous occasions by the Steel Industry Safety and Health Commission, which called for discussion of further safety questions. Accordingly, the SISHC drawn attention to the sources of danger for workers who regularly cross a frontier and for migrant workers arising from the different coloured markings used for compressed gas cylinders in the Community countries.

In this document, two sets of examples, will be presented taken at random and not weighted in respect of any particular hazard or country.

Examples - set 1
An Italian migrant worker, who is used to finding ammonia (NH_3) in green cylinders, finds that in the Benelux countries and in the FR of Germany these cylinders contain pure nitrogen (N_2). In the United Kingdom green cylinders contain sulphur dioxide (SO_2) or methyl chloride (CH_3Cl). In addition there is a yellow band round the upper shoulder of the cylinder warning him that the SO_2 is poisonous, or a red band in the same position warning him that CH_3Cl is flammable. In Luxembourg NH_3 is kept in cylinders with blue and white bands, but in Belgium and the United Kingdom it is kept in black cylinders with blue and white lengthwise bands or red and yellow bands round the upper shoulder. In Germany NH_3 cylinders are grey.

Examples - set 2
In France, the United Kingdom, Italy and the Netherlands acetylene (C_2H_2) is kept in brown cylinders. In Luxembourg the cylinders are black and in Germany they are yellow. In the neighbouring countries yellow is used for argon (Ar) in France, for carbon dioxide (CO_2) and carbon monoxide (CO) in Luxembourg, and for neon (Ne) in Belgium. In the United Kingdom yellow is the colour for chlorine (Cl) *inter italia.* In Luxembourg chlorine is kept in cylinders with black and white bands and in Germany in grey cylinders.

If the wrong gas is used because the colour code is misinterpreted, workers could be poisoned or burned, uncontrollable chemical reactions could take place or at best problems of a technical nature could arise.

Letters from readers

As the editorial makes clear, it is intended that this Bulletin should also create a flow of information between all those who deal with safety, health and working conditions in the Community's various steel companies.

The success of the bulletin will largely depend on how frequent such exchanges of information become. It should not just be written *for* but also *by* its readers.

With this in mind, the readers' letters section aims to stimulate cooperation between readers by giving them all a chance to:

(a) put a problem to other readers in order to obtain information or solutions relating to a specific, real problem. To this end, readers should write to:

Secretariat of the SISH Commission
Information Bulletin
Commission of the European Communities
BP 1907
L - 2920 Luxembourg

(b) submit a note or article describing a solution to a problem in the field of safety, health or working conditions.

Publication of the text will be free of charge.

Answers from readers may be sent to the same address. The Secretariat will forward them to the reader who posed the problem as soon as possible.

The Editorial Committee will judge whether to publish those answers which have a general interest and will safeguard the anonymity of the author if so requested.

Readers' letters

Cleaning the bags of our filter plant raises a pollution problem, since in the final phase of the cleaning operation we direct a stream of compressed air onto the bags, which releases large clouds of dust to the atmosphere.

Is there any other way of carrying out this operation?

Communication problems in noisy working environments where various types of protective equipment need to be worn

In certain circumstances technical personnel have to work together without being able to see each other. In such cases good communications are essential.

Attempts are being made to develop suitable means of communication for use in situations of this type where protective equipment also needs to be worn (safety helmets, goggles, ear defenders, respirators, etc.).

One example is the overhaul of an end coiler in a hot-strip mill next to a working coiler with a noise level varying from 95 to 110 dB (A).

Have satisfactory solutions been found to this problem?

Checklist for management

It is often said that a company's accident record reflects its methods of operation. Another assertion frequently heard these days is that management is constantly concerned about working conditions.

Consider for a moment what answers would be given to the following questions:

— Could a visitor unexpectedly use any toilet or shower which he found in your sector without causing you embarrassment?

— Do you give, or have you endorsed, orders which you would not carry out yourself?

— Do you have any sedentary workers on your staff? If not, why not?

— Do you consider certain jobs to be more dangerous than others?

— Are you 'afraid' of entering certain sectors?

— Have you considered how you would organize your sector to ensure a more contented staff?

— Do you think production would decrease if this were done?

— Did you request the budgetary means to effect your improvements?

— Have you produced a job definition for each task?

Have you had experience with similar checklists? If so, what were the results?

Letters to the editor

Improved working conditions lead to fewer accidents.

One of the main stress factors at work is noise. Numerous efforts have led to improvements in some areas, notably finishing bays of rolling mills.

The improvements are often a result of simple modifications, which could easily be carried out on similar plant elsewhere.

If you have found a solution, let us know - others may be interested.

The stacks of oxygen converter shops have to be visited at regular intervals for cleaning and inspection purposes. This inspection visit is carried out in a purpose-built cage which must also be capable of negotiating the elbow in the stack. If the inspection cage gets stuck, or if there is a breakdown in the cage drive or any other type of malfunction, it may prove necessary to rescue the workers in the cage.

What solutions have been found to this problem in other steelworks?

The causes of very serious accidents

During the period 1977-80 the Steel Industry Safety and Health Commission carried out a detailed survey into the causes of 670 very serious accidents which had occurred in the Lorraine steel industry between 1970 and 1976 and had caused either death or at least 10% permanent disablement. The survey showed that 12% of the accidents had happened to workmen in a job which they had been doing for less than six months. Of these accident victims, more had been transferred from a different job than were new employees. Eighteen percent of the accidents happened to employees during their first year of doing a particular job, and over 30% happened in the first three years. This evident lack of experience in the job shows clearly the importance of practical training which is geared to the requirements of the job. It is as important for workmen who change jobs in the same works as for newly-recruited workers.

When the accidents happened a number of years ago, it is difficult to determine whether any oral or written instructions were given, but the survey indicated that in 25% of the cases no instructions had been formulated. In 50% of the cases instructions had been given, but were disregar-

ded either by the victim or by a third party in half of these cases. This means that in half of the cases of very serious accidents work had been undertaken without instructions having been given or complied with. It is essential that there should be safety instructions for every job. They should be clear, precise and relevant, and should be incorporated into the instructions for doing the job. However, it is not enough merely to draw up instructions. They must be driven home and shown to be important. The workmen must be motivated to follow them and a check should be kept on this.

The cause of half of these 670 very serious accidents lay in the equipment (plant, machinery or tools), which was either in poor condition (23%), not fitted with a safety device which could have prevented the accident (23%) or fitted with a safety device which was unsuitable or not functioning properly (5%). This clearly shows the part played by equipment in causing very serious accidents. It should be studied in detail in the interests of better accident prevention.

The above are just one or two of the conclusions of this study. A full report is at present being printed and a notice will appear in this bulletin when it is published.

Safety aspects of rail transport in steelworks

A working party of Assider (Associazione della siderurgia italiana) has prepared a document on this subject.

We hereby publish integrally the part of this document which contains the practical recommendations, and thank Assider for its kind permission to do so.

1. Design engineering characteristics and the characteristics of rolling stock in the context of rail transport in steelworks

Rail networks are always subject to variations as regards clearances because of injudicious positioning of materials and vehicles; interference on these networks is common, both between rail vehicles and with road vehicles at junctions. In steelworks this situation is exacerbated by the fact that the confined spaces involved are congested by rail and road traffic operating at the same time and place. In addition, during transfer of ladles, slag pots, equipment and various materials, overhead cranes may interfere with the safe use of the tracks.

In new installations or when design improvements are being incorporated in existing plants, an endeavour should be made to minimize interference and introduce specific codes of practice. With this in mind:

— routes and halts for road vehicles should be established in advance;

— routes for overhead loads (e.g. steel ladles, slag pots etc.) should be established in advance;

— minimum clearances over and above any standard gauge normally used should be observed both on the straight and on bends; double-track lines should have a minimum space of 70 cm between them;

— minimum clearances of 70 cm over and above the standard gauge should be respected on both sides of the track at the entrance point and inside the shops; when this is not possible, specific warning and safety systems should be introduced;

— provision should be made for communication and signalling installations governing access to shops by rail vehicles; this rule should also be extended to existing installations;

— the erection or installation of load-bearing structures, access points to underground premises, reladling pits, fluid-carrying pipes, electricity lines, etc., should be avoided in the vicinity of railway lines carrying molten material; where this is not possible, special protection systems should be used to avoid damage in the event of spillage of molten material from the rail cars;

— slopes should be eliminated at all halts and, whenever technically possible, this should also apply to through tracks; this rule should also be extended to existing installations;

— barriers should be placed opposite the exits from production areas and the access ramps to installations in order to channel personnel in a path parallel to the railway line; the doors of these production areas should open outwards and the stairs should not encroach upon the clearance added to the standard gauge.

1.1 Access to rail vehicles. With the exception of ingot cars and the like, these vehicles should be fitted with an approved-type access ladder

consisting of steps and not rungs, with a handrail on either side; these ladders should be recessed into the vehicle so that the operator is always within the overall dimensions of the vehicle. The first step should be at a standard height in relation to the rail surface for all types of vehicles used inside a given works. There should be a minimum of two ladders and, if there are only two, these should be placed diagonally at either end of the vehicle. In the case of vehicles used to carry molten material (e. g. slag cars), there should be four ladders corresponding to the above specification. The pair of ladders at either end should be interlinked by a gangway appropriately shielded against splashing of molten material. Buffer wagons in particular must be equipped with ladders and gangways on the driver's side only.

1.2 Use of special cars. In order to carry liquid and/or special materials (e. g. molten metal), these cars must be suitably proportioned so as to be able to cope with the particularly heavy duty common in the steel sector; they should be of solid and simple design in order to facilitate use and maintenance.

Their carrying facility should be of a design which, in the context of low-speed haulage, should eliminate the possibility of splashes and spillage. Any cars fitted with mechanical or automatic tipping facilities should be equipped with failsafe systems to prevent accidental tipping.

1.3 Use of cars with automatic couplings. Automatic couplings and their installation on the ends of cars should cater for technical requirements originating in the mechanical and dynamic stresses encountered during coupling/uncoupling and push-pull shunting operations and should be fitted with appropriate protection systems on the upper part in order to prevent jamming or coupling/uncoupling problems due to splashes of molten material.

The release control should be positioned so that the shunter never has to enter the space between the car ends. In addition, it should be equipped with a suitable safety device in order to prevent injury to the shunter in the event of a sudden jerk in the primary linkage.

It is to be hoped that the use of automatic couplings will gradually be extended to all types of cars and locomotives operating in steelworks, particularly for carrying hot materials.

1.4 Use of non-braking cars. In terms of weight and braking power the size of locomotives should be such that, in conjunction with low-speed operation and abiding by the general rules governing rail traffic, the train can be halted over a reasonably short distance. If technical reasons make it impossible to eliminate slight slopes in the steel production area, suitable devices should be fitted to non-braking vehicles in order to be able to immobilize them on the tracks.

1.5 Buffer wagons. Locomotives used to carry molten material must be equipped with buffer wagons to shield them against heat for the purposes of hauling hot loads (e.g. ingot cars). Locomotives are usually equipped with one buffer wagon at each end for this purpose.

By increasing the distance between the locomotive and the ingot cars, the buffer wagon acts as a heat shield for the locomotive and may, in conjunction with the locomotive, enhance the braking action on the train if it is equipped with a braking system.

2. Operational characteristics

The operational characteristics of rail traffic in steelworks involve, in additon to the hazards arising from rail traffic as such, hazards due to the transport of molten material.

This necessitates greater driver discipline, because of the inherently higher risk involved in any manoeuvring error or any failure to abide by the rules. The foregoing considerations therefore amply justify the endeavour made by steel companies to draw up rules, modelled on those adopted by the FS, [1] for internal rail operations; these rules are supplemented by recommendations to be followed in the steel production areas. The need therefore arises for a 'code of practice' and the following is proposed:

A *code of practice* in this context should mean a set of written in-plant recommendations drawn up beforehand jointly by employer and employees with a view to:

— bringing internal rail transport movements into line with the other activities in steelworks while observing in full requirements concerning operative safety and the safeguard of plant and equipment;

— supplementing the rules and recommendations laid down by the company on rail transport.

A code of practice requires:

1. Clear establishment of which bodies and which workers within the company are responsible for the implementation of the various provisions embodied in this code;

[1] FS = Italian State railways.

2. Identification of the plant, equipment and processes directly and/or indirectly to be covered by this code and the hazards involved;
3. Identification of the general internal rail transport regulations and arrangements to be stressed in the code with a view to accident prevention;
4. Agreement between the various bodies responsible for the practical implementation of the code and the operatives concerned;
5. Ensuring that the content is based on the preventive measures deduced from an analysis of the hazards;
6. A description of the practical stages, setting out clearly the behavioural and procedural pattern to be strictly adhered to in the interests of accident prevention;
7. Instruction of all workers covered by the code of practice.

The various codes of practice and the works regulations governing rail transport should be supplemented by a hierarchical breakdown of responsibility as regards the allocation of individual duties within the company.

As a steelwork can comprise the following:
(a) - scrapyard,
(b) - furnace charging bay,
(c) - casting pits,
(d) - ingot mould preparation,
(e) - stripping bay,
(f) - preparation of feeder heads,
(g) - reladling pit,
(h) - continuous casting facilities.

These codes of practice, catering for the requirements mentioned earlier, (and essential as far as safety is concerned) must therefore take due account of the objective situations of individual installations and of specific aspects peculiar to certain sectors, e. g.:

A - *Scrapyard*

A-1. The material (scrap, sprue, croppings, etc.) must never project beyond the sides of the car.

A-2. The load must be properly balanced.

A-3. The material to be loaded must be deposited in the car and not dropped into it from a height.

A-4. The route followed by overhead loads must not be an obstacle to or lie above trains which are manoeuvring.

A-5. The routes followed by overhead loads must coincide as little as possible with the path of the tracks in order to minimize the presence of scrap between the rails.

B - *Furnace charging bay*

B-1. Slag pot cars

— There must be a maximum loading level in order to prevent spillage resulting from braking or manoeuvring.

— There must be no slag overhanging the sides or above the level of the top of the slag pot.

C - *Casting pits*

C-1. During railway manoeuvres, overhead cranes should not operate on the length of track over which the train is being made up or over which it sets off.

C-2. When the 'teeming train' [1] sets off there should be no steel skulls projecting beyond the overall dimensions of the car and the track should first be cleared of materials of any kind.

C-3. In the event of accidental spillage of molten material on to the track, the pit operative must personally coordinate the train manoeuvres with the engine driver.

C-4. In the event of accidental spillage of steel on the ground near a track on which a manoeuvre is taking place, the pit operative must immediately notify the engine driver concerned.

D - *Preparation of ingot moulds*

D-1. When the train is made up, the loads must be balanced. Any plates placed as a protection between the bottom plate and the ingot mould must not project beyond the overall dimensions of the bottom plate.

D-2. Overhead cranes must not operate where the trains are manoeuvring.

E - *Stripping bay*

E-1. Ingots, bottom plates and ingot moulds must not be dropped onto bogeys during stripping operations.

E-2. Overhead cranes must never operate on a stretch of track where shunting operations are taking place.

E-3. When the stripping operations have been completed and before the train sets off, the stability and the balance of the load must first be checked.

[1] The expression 'teeming train' refers to a train loaded with ingot moulds into which steel has been poured.

3. Qualifications of workers and work organization

In relation to other activities in the works, the procedural and behavioural aspects of rail transport hold deep implications as regards safety and it is therefore essential to:

— train the personnel who, in addition to the specific knowledge relating to rail transport must have a working knowledge of the materials transported, the relevant technical characteristics and the hazards arising from the state and the temperature of these materials;

— provide appropriate information to the operatives as regards the specific technical features of railway and equipment;

— ensure that operatives participate in drawing up railway rules and codes of practice, which must be supplemented by hierarchical breakdown of responsibilities as regards individual tasks and duties.

Bibliography

1. Publications on the activities of the Steel Industry Safety and Health Commission

Since it was first set up in 1964, the Steel Industry Safety and Health Commission has approved the publication of numerous recommendations drawn up by its working parties and some studies carried out by experts.

These documents are available and may be requested in writing from the Secretariat of the SISHC, Directorate-General for Employment, Social Affairs and Education, Commission of the European Communities, BP 1907, Luxembourg.

The documents are listed below with details of the languages in which they were published according to the following code:

DE - German
EN - English
FR - French
IT - Italian
NL - Dutch

If the language code of a document is underlined, this means that the version is out of print, but the text is available as a photocopy at a price of BFR 10 per page (documents with an EUR number have one photocopied page for two pages of text).

Documents for which no sale price is quoted will be sent free while stocks last.

Prevention

— Adoption and regular use of individual means of protection. 11 pp., 1971 - (DE, EN, FR, IT, NL)
— Principles of accident prevention. 7 pp., 1973 (2nd ed.) - (DE, EN, FR, IT, NL)
— The accident prevention policy of the British Steel Corporation, 25 pp., 1973 - (DE, FR, IT, NL)
— Check questionnaire of the accident prevention organization within the enterprise. 13 pp., 1974 - (DE, EN, FR, IT, NL)
— EUR 5922 - Accident prevention programme. 16 pp., 1977 - (DE, EN, FR, IT, NL)
Price: FB 150 - DKR 25.50 - DM 9.70 - FF 20 - LIT 3 600 - HFL 10 - UKL 2.40 - USD 4
— EUR 5927 - Trends in industrial safety at 'Cockerill-Liège' 1956-1974 - Analysis and conclusions, 60 pp., 1977 - (DE, EN, FR, IT, NL)
Price: FB 260 - DKR 44 - DM 16.80 - FF 35 - LIT 6 200 - HFL 17.70 - UKL 4.10 - USD 7.20
— EUR 5926 - Comprehensive accident control for prevention of accidents causing injury. 70 pp., 1977 - (DE, EN, FR, IT, NL)
Price: FB 300 - DKR 51 - DM 19.40 - FF 40.50 - LIT 7 150 - HFL 20.40 - UKL 4.80 - USD 8.30

Training

— Principles of training in industrial safety. 10 pp., 1969 - (DE, FR, IT, NL)
— EUR 6091 - Training of industrial safety advisers. 9 pp., 1978 - (DE, EN, FR, IT, NL)
Price: FB 100 - DKR 17 - DM 6.40 - FF 14 - LIT 2 700 - HFL 7 - UKL 1.70 - USD 3.50
— EUR 6205 - Integration into an industrial environment of unskilled production workers. 27 pp., 1978 - (DE, EN, FR, IT, NL)
Price: FB 120 - DKR 21 - DM 7.60 - FF 17.50 - LIT 3 400 - HFL 8 - UKL 2 - USD 4

Overhead travelling cranes

— Access to the the cabin of an overhead travelling crane. 32 pp., 1968 - (DE, EN, FR, IT, NL)
— Selection and training of crane-drivers. 34 pp., 1968 - (DE, FR, IT, NL)

Maintenance and repair work on gas lines and apparatus

— Construction requirements. 44 pp., 1968 - (DE, FR, IT, NL)
— Personal protection; monitoring and detection of gases. 18 pp., 1970 - (DE, FR, IT, NL)
— Insulating and degasing lines. 10 pp., 1973 - (DE, FR, IT, NL)
— EUR 6048 - Water seals and drain seal pots. 17 pp., 1978 - (DE, EN, FR, IT, NL)
Price: FB 150 - DKR 26.20 - DM 9.50 - FF 21 - LIT 4 000 - HFL 10.40 - UKL 2.50 - USD 5

Oxygen

— Oxygen pipe connections. 67 pp., 1969 - (DE, FR, IT, NL)
— Shut-off and control devices. 115 pp., 1970 - (DE, FR, IT, NL)
— The design, construction, location and operation of fittings in oxygen installations. 33 pp., 1971 - (DE, FR, IT, NL)
— Filters, intermediate storage vessels, measurement equipment of importance for safety, lubrification, degreasing of oxygen lines and equipment. 64 pp., 1973 - (DE, FR, IT, NL)
— Flexible pipes. 13 pp., 1974 - (DE, FR, IT, NL)
— EUR 5923 - Precautions to be taken in the preparation of plant and equipment. 10 pp., 1977 - (DE, EN, FR, IT, NL)
Price: FB 140 - DKR 23.80 - DM 9 - FF 16 - LIT 3 350 - HFL 9.50 - UKL 2.20 - USD 4
— EUR 6047 - Oxygen enriched atmospheres. 13 pp., 1978 - (DE, EN, FR, IT, NL)
Price: FB 120 - DKR 21 - DM 7.60 - FF 17 - LIT 3 200 - HFL 8.30 - UKL 2 - USD 4

Miscellaneous

— EUR 5896 - Blast furnace tapping. 77 pp., 1977 - (DE, EN, FR, IT, NL)

Price: FB 300 - DKR 51 - DM 19.50 - FF 41 - LIT 7 200 - HFL 20.40 - UKL 4.80 - USD 8.30

— EUR 5928 - First aid and rescue. 64 pp., 1978 - (DE, EN, FR, IT, NL)
Price: FB 300 - DKR 55 - DM 19.30 - FF 43.50 - LIT 8 100 - HFL 21 - UKL 5 - USD 9.50

— EUR 6200 - Hydrogen in the iron and steel industry. 146 pp., 1979 - (DE, EN, FR, IT, NL)
Price: FB 400 - DKR 72 - DM 25 - FF 58.50 - LIT 11 200 - HFL 27.50 - UKL 6.10 - USD 13.70

ECSC research in the iron and steel industry

Just published
EUR 5977 — Technical control of pollution in the iron and steel industry
Research progress report: 1 January 1980

1981 — VIII, 166 pp.

DE, EN, FR, IT, NL

Price (excluding VAT) in Luxembourg:
ECU 9.73 BFR 400 IRL 6.75 UKL 5.50
USD 10

This report is the fourth to be published since the ECSC extended its acitvities to research into pollution in the steel industry.

The interest which this work has aroused in the industrial world and in the most varied circles has not ceased to increase along with the need to improve the environment of people in general and that of industrial centres in particular. Like many others, the iron and steel industry has been faced with the essential task of controlling the pollution which it causes.

The European Commission has thus quite naturally been involved in these efforts and has made its contribution in accordance with the Treaty, particularly in the research sector.

In this report, the Commission of the European Communities aims to provide the reader with a general overview of results now to hand from recent research and give them an indication of the state of progress. More detailed commentaries will be found in the regular series of 'Euro-Abstracts'.

Reports follow on a total of 68 research projects, divided up into different thematic groups and arranged within these in alphabetical order. Most of them still come under the 3 programme, but they do also include - in particular in connection with the residue and waste problem projects from the 4 programme.

The chapters of this publication cover:

— control of atmospheric pollution (35 projects);

— control of water pollution (13 projects);

— noise abatement (6 projects) (mainly on electric arc furnaces);

— utilization and disposal of residues and waste (14 projects).

The publication is a follow-up to the summary of previous research work given in:

EUR 5977 — Technical control of pollution in the iron and steel industry
Research progress report: 30 June 1977
1978 - 90 pp.

DE, EN, FR, IT, NL

BFR 205; DKR 36.20; DM 13.20; FF 30; LIT 5 550; HFL 14; UKL 3.40; USD 6.50

The 38 projects described in some 80 pages of summary reports were all aided financially by the Commission of the European Communities in accordance with Article 55, 2c of the ECSC Treaty.

The projects were aimed at improving the working conditions of steelworkers and protecting residential areas in the neighbourhood of steel works from undesirable emissions and immissions by determining the type and amount of contamination and by investigating and developing methods for the collection and precipitation of contaminating substances, their elimination from the ecological point of view and the removal of the sources of such contamination.

EUR 7197 — EGKS-Rundtischgespräch „Kokerei- und Koksforschung"
EUR 7197 — ECSC round table meeting 'Coke oven and coke research'
EUR 7197 — CECA table ronde «Recherches sur cokeries et coke»

1981 — IX, 361 pp.

DE/EN/FR/IT

Price (excluding VAT) in Luxembourg:
ECU 18 BFR 750 DM 46 IRL 12.50
UKL 9.80 USD 21.50

This publication contains the papers presented at the symposium which took place at Luxembourg on 6 and 7 October 1980, on the latest research projects sponsored by the European Coal and Steel Community on the protection of the working environment in coking plants, and the production and use of coke.

Very important

This issue of the Information Bulletin is being sent to company and works managements, to medical and safety departments, to the chairmen of safety committees and company or works bodies (Betriebsrat, Consiglio di fabbrica, Comité ou Conseil d'entreprise) formed as a result of legislation and called upon to deal with the whole range of social problems arising within the Community iron and steel industry.

Future issues will be sent free not to the aforementioned persons but only to companies or works which have so requested, so that bulk deliveries may be made. Interested parties in the same company or works are therefore asked to consult one together before filling out the reply card on the facing page and to indicate on it the number of copies (within reason, i. e. in order to meet a real need) which the company or works would like to receive and the department (not the person) in the company or works whose task it is to disseminate and circulate the Information Bulletin to the interested parties.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