CONTROL OF ACCIDENTAL LOSS

By A. BURGERS
National Occupational Safety Association

Abstract

Downgrading incidents are defined as injury, damage, fire etc. Investigations into accidents reveal cost levels involved. Management's responsibility in this are listed. The cause and effect of downgrading incidents are investigated and steps given to set up a Loss Control Programme. Areas of gain are set out.

Introduction

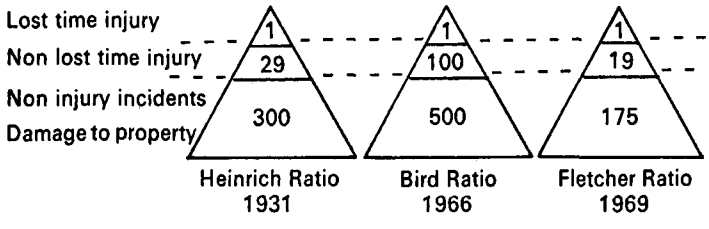
The purpose of this presentation is to encourage the promotion of an essential management function — to improve efficiency and productivity, to reduce loss due to downgrading incidents and to increase profitability.

Downgrading incidents

Jack Fletcher[1] defined downgrading incidents as "any deviation in accepted performance levels resulting in injury, occupational sickness, property damage, fire or explosion, breaches of security, pollution or product liability".

"Freedom from such incidents or loss in any organisation" he said "is directly proportionate to the desire of the top executive and his management team to excel and their impatience with mediocrity".

According to Peter Drucker, "the measurement used determines what one pays attention to". Fortunately attention has to be paid to injury accidents in accordance with the laws of the land and records have to be kept. A measurement of injury-accidents indicates the seriousness of the downgrading incident problem which can be assessed roughly by comparison with accepted standards based on investigations conducted by Heinrich[2], Bird[3] and Fletcher[1].



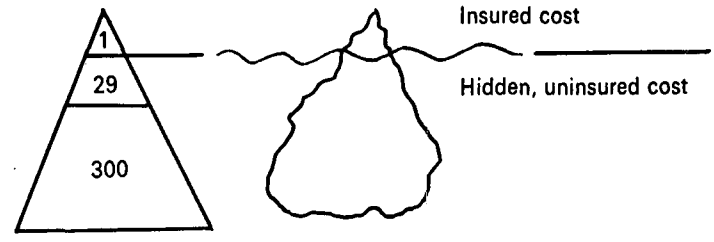
Bird's Lukens investigation in 1959 of 90 000 accidents showed that damage-only accidents occurred 5 times more frequently than injury-accidents at a rate of $325 545 per million manhours worked.

Professor Rollin H. Simonds[4] compiled the following uninsured cost figures in 1954 in the USA when the hourly pay was $1,76:

First aid cases	$5,70
Doctors' cases	$21,70
Lost time injuries	$100,00
No injury accidents	$290,00

Whatever the actual cost figures may be we can accept that they may vary from industry to industry, factory to factory. We can, however, safely say that by investigation and by taking remedial measures to correct the occurrence of injury accidents we are attending to the top of the iceberg, ignoring the far greater hidden area.

Iceberg analogy



The action taken in injury prevention will automatically reduce those non-injury accidents with causes similar to injury accidents. By removing the tip of the iceberg it will automatically rise thereby exposing areas hitherto hidden.

The greater loss area may never be sufficiently exposed by scratching at the top. Any business venture is a speculative risk the outcome of which may be either gain or loss depending largely on the extent of deviation from planned performance.

Loss causation requires thorough active investigation in every area of occurrence in order to institute effective control measures.

When Bird introduced damage control at the Lukens Steel Mills, all accidental property damage incidents were investigated and control measures introduced. The disabling injury frequency rate at that time was only 2,0 per million man hours but the damage rate was $325 545 per million man hours worked. An excellent all injury prevention programme must surely already have reduced a large percentage of damage only accidents but those still occurring motivated further action in this field of property damage accidents. The damage rate was in five years reduced to $137 832 per million manhours worked.

Management's responsibilities

Management has three main responsibilities:

(1) Its responsibilities to shareholders which require not only maximum profits but safeguarding of investment. Control of loss is paramount.

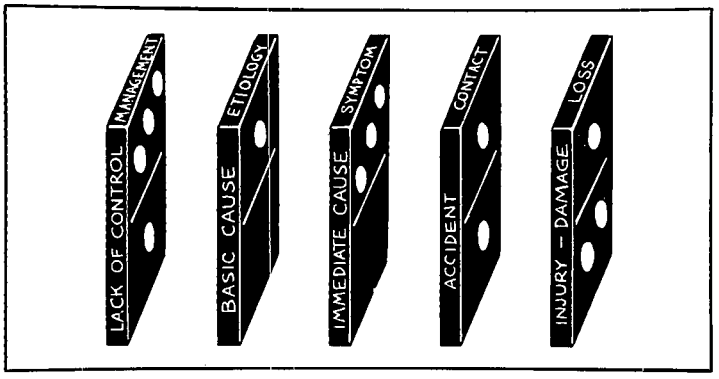
(2) Legal responsibility which must be complied with in order to stay in business. Injury prevention is most important and is obtained by training personnel, safeguarding machines and equipment, providing safe work environments and personal protective equipment.

(3) Responsibility to workers. Productivity and profits depend a great deal on the wellbeing of employees and their attitude toward their work and their employers. Is the efficient worker not the best asset and is his continuing usefulness not dependent on his safety?

Management is responsible for the conditions in which hazards exist or develop and loss occurs. Is it not obvious that management should take all reasonable steps to control such loss?

The control of loss causation depends on the quality of management and its performance of the management functions of planning, organising, leading or motivating and controlling.

The domino cause and effect sequence



The domino sequence introduced by Heinrich[2] more than 30 years ago to illustrate the accident sequence has been updated by Bird[3] to explain the five loss control factors. Failure in any one will cause the subsequent dominoes to fall and result in a loss.

In loss control management according to Bird[3], "Each of the five factors in the sequence serves as a guide for action that could prevent, control, or ameliorate the end result of the sequence. While the immediate cause (or middle factor in the sequence) has historically been the target of attack, the greatest potential for prevention and control is at the starting point of the sequence, with the *lack of management control* factor. This statement is not meant to demean the importance of the control effort at other points in the sequence, but rather to place in proper perspective the values of professional management and new technology in tune with the many rapid advances of this decade."

The cause and effect sequence of downgrading incidents

LACK OF CONTROL — MANAGEMENT

FAILURE TO MAINTAIN WORK PERFORMANCE STANDARDS FOR:

- Hiring and selection
- Engineering Controls
- Purchasing Controls
- Incident Investigation
- Planned Inspections
- Incident Recall
- Rules and Practices
- Group Meetings
- Supervisory Training
- Special Skill Training
- Proper Job Instruction
- Proper Job Analysis
- Standard Job Procedures
- Planned Observation
- Protective Equipment
- General Promotion
- Personal Communications
- Incident Analysis
- Proper Job Indoctrination
- Behaviour Reinforcement

BASIC CAUSE — ETIOLOGY

PERSONAL FACTORS	JOB FACTORS
1. Lack of knowledge or skill	1. Inadequate work standards
2. Improper motivation	2. Inadequate design or maintenance
3. Physical or mental problems	3. Inadequate purchasing standards
	4. Normal wear and tear
	5. Abnormal usage

IMMEDIATE CAUSE — SYMPTOM

UNSAFE PRACTICES	UNSAFE CONDITIONS
1. Operating without authority	1. Inadequate guards or protection
2. Failure to warn or secure	2. Defective tools, equipment, substances
3. Operating at improper speed	3. Congestion
4. Making safety devices inoperable	4. Inadequate warning system
5. Using defective equipment	5. Fire and explosion hazards
6. Using equipment improperly	6. Substandard housekeeping
7. Failure to use personal protective equipment	7. Hazardous atmospheric conditions: gases, dusts, fumes, vapours
8. Improper leading or placement	8. Excessive noise
9. Improper lifting	9. Radiation exposures
10. Taking improper position	10. Inadequate illumination or ventilation
11. Servicing equipment in motion	
12. Horseplay	
13. Drinking or drugs	

ACCIDENT CONTACT

TYPES OF INCIDENTS

1. Struck against
2. Struck by
3. Fall to below
4. Fall on same level
5. Caught in
6. Caught on
7. Caught between
8. Contact with electricity, heat, cold, radiation, caustics, noise, toxic or noxious substances
9. Overexertion (overload)

INJURY — DAMAGE — LOSS

INJURY OR ILLNESS	PROPERTY DAMAGE
Serious	Minor
Reportable	Serious
Compensable	Major
Disabling, Lost Time or Major	Catastrophic
Death	Note: Classification of damage varies with locally established values. There is no standard.
Catastrophic (Multiple Deaths)	

The loss control programme

To set up a loss control programme it is necessary to:

(*a*) Gather the facts
(*b*) Evaluate the facts
(*c*) Prepare action plans
(*d*) Set up a programme to implement the action plans.

Gathering the facts

The first step would be to assess the total cost of accidents including all incidental costs as set out in NOSA Accident Cost report form No. 956 (Annexure 1). To this figure must be added the cost of non-injury accidents.

By using the iceberg analogy, non-injury or damage only accident occurrence may be ten times the number of injury accidents at a cost similar to the cost of injury accidents less medical aid and compensation of the injured person.

The loss control programme will also cover fire, explosions and security and the loss occurring in these areas should, therefore, be added.

The next step is to profile the existing situation.

There are three basic steps to profiling:

1. Determine what is being done in your organisation.
2. Evaluate how well it is being done, and
3. Draw up an action plan indicating what needs to be done. The action plan should contain both short term and long range objectives, and it is suggested that a period of five years may be required for total implementation of the programme.

The NOSA profile chart (annexure 2) may be used for Evaluation as follows:

1. Place your assessment of each item in the evaluation column using the yardstick — "How much more could management reasonably be expected to do to integrate the item with the normal production organisation so as to promote greater productivity with resultant improved profitability?"
2. Determine and note the outline of action to be taken to rectify each deficiency and indicate a target date for completion.
3. After all sections of the profile action plan have been completed, review them carefully and assign priorities.

Implementation

Once all the priorities are determined and the outline of the total loss programme for immediate and long-term objectives is finalised, assign responsibility, delegate authority and hold staff accountable for reaching the planned objectives. Review at frequent intervals.

Reporting

Reporting of damage (item 4.12 of the profile chart) is a critical factor but due to people involvement most difficult to obtain.

All downgrading incidents should be reported, using a prescribed form to ensure that all relevant data is obtained and recorded.

Where an incident or stoppage is due to failure of a part it should be investigated and reported, the object being to prevent a recurrence.

Training

Training in this respect is essential but it may also be necessary to slacken discipline. The principle of *fact* finding and not *fault* finding must apply. Examples of damage or downgrading incident forms used by *Corobrik*, Durban Cement and Perkins Engines (Annexures 3, 4) serve as examples of what these firms record.

The following examples of downgrading incidents occurred in sugar mills.

Example 1: Product loss incident. Product loss period 2-30 min. Loss of profit R2 500. Cause — blocked pipe in evaporator.

Etiological cause, supervisor error — failed to check vessels after cleaning — some boards were left behind and blocked vessel outlet.

Example 2: Product loss incident. Product loss 1-15 min. Loss of profit — deviation from target profit R1 250. Cause — valve burst.

Etiological cause, mechanical failure due to erosion.

Example 3: Non product loss incident. Loss of profit — deviation from target profit R5,61. Cause, automatic caneyard light control out of order.

Etiological cause, someone had switched control to manual.

Example 4: Non product loss incident. Loss of profit — deviation from target profit R30,25. Cause, burnt out motor.

Etiological cause, motor hosed down.

Example 5: Product loss, serious damage and one fatality — One mill train closed for more than one month due to runaway engine causing rupture of the fly wheel with serious damage to machines, structures and decapitation of a man outside the mill.

Immediate cause: Failure of governor on a steam engine.

Etiological causes,

1. Chain guide not properly adjusted
2. No emergency warning system for safe speed fitted to the engine
3. Control valves for engine not easily accessible.
4. Only one chain fitted. Two chains required for failsafe.

Example 6: This downgrading incident which resulted in serious stoppages or product loss incidents occurred on a mine where the material is piped in the form of a slurry. A particular pipe used to block regularly until the cause, a dogleg or bend in the pipe was eliminated by straightening.

What can be gained

In a loss control programme corrective measures must be kept within economic limits and weighted against probable gain.

The areas of gain are:

1. Continuous reduction in the cost of accidental damage of property, fire and theft.
2. Greater utilization of trained manpower and improvement in employee morale.
3. Improved efficiency.
4. Lower insurance premiums; up to 50% refund on W.C.C. assessments.
5. Overall improvement in profitability.

Acknowledgement

We are indebted to Joe Shakespeare of Perkins Engines for the Perkins Damage investigation report as well as the Perkins Fire Report (Annexure 4) and a pamphlet on loss control (Annexure 5).

REFERENCES

1. John A. Fletcher and Hugh M. Douglas — Total Loss Control, Associated Business Programmes, London.
2. W. F. Heinrich — Industrial Accident Prevention. McGraw-Hill Book Co.
3. Frank E. Bird Jnr. — Management Guide to Loss Control. Institute Press, Atlanta.
4. Simonds, R. H. and Grimaldi, J. V.— Safety Management, Irwin.

Annexure 1

Nosa Form 956

ACCIDENT COST REPORT

(To be completed in addition to Injury Report Form)

Person injured..... Describe property damaged..... Co. No..... .... Department..... Date..... Time..... Acc. Serial No.....

	R. c.
1 *Injured Worker*	
1.1 How much time did worker lose in day of injury for which he was paid .....hrs at.....	
1.2 Make up salary (difference between W.C. payments and payments made by firm).....	
1.3 No. of additional trips for medical aid ..... hrs. at ..... and transport costs ..... miles at	
1.4 Additional time lost by employee, for which he was paid by company ..... hrs at	
1.5 Medical cost to Company (not covered by Workmen's Compensation Insurance)	
2 *Non-Injured Worker/s* (Onlookers and helpers)	
2.1 No. of workers who lost time because of talking, helping at accident and watching ..... workers at ..... hours each at	
2.2 No. of workers who lost time waiting for material or equipment ..... about how much each	
2.3 Overtime to make up lost production. No. of workers	
3 *Supervision*	
3.1 Initial supervisor's time ..... hrs at	
3.2 Additional Cost of time of higher supervision on investigation (not Safety Dept. charges) ..... hrs. at	
3.3 Time of supervisor or other for training new worker ..... hrs. at	
4 *Damage to property*	
4.1 Net cost to repair material or equipment	
4.2 Net cost to replace material or equipment	
4.3 Obsolescence prior to depreciation time	
5 *Other Costs* (not covered are, e.g.)— Public liability claims, cost of renting, replacement equipment and buildings, etc.	
TOTAL	
6 Moneys recovered from insurance Companies	
Ratio insured to uninsured costs...../.....	

Annexure 2

NOSA PROFILE CHART (8 *pages*)

Section	Maximum Marks	Evaluation	Action Plan	Target Date	Priority
1.00 *Premises and Housekeeping* 300 Housekeeping means a place for everything and everything in its place so that optimum use is made of valuable floor space with commensurate cleanliness and reduced handling time. 1.10 *Premises* Are the following under control? 1.11 *Condition of Building and Floors* Are they clean and in good state of repair commensurate with the age of the building? Are all floor openings suitably covered?	40				
1.12 *Good Lighting (Natural and Artificial)* Are adequate lighting standards maintained? That is, is there optimum natural lighting with minimum glare? Are windows and light fittings cleaned at routine intervals? Is emergency lighting fitted?	20				
1.13 *Ventilation* Ventilation adequate for: The control of toxic or irritating dusts? Fumes? Mists? Organic solvents? Biological agents and occupational infections? Any other item which could cause skin diseases (dermatitis)? Where ventilation cannot control the hazard has engineering revision been used to isolate the process?	30				
1.20 *Housekeeping* Have the following aspects been incorporated? 1.21 *Aisles and Storage Areas demarcated* Have all aisles, pathways, roadways, storage areas and areas beneath electrical switch-gear been suitably demarcated? Is the demarcation marking renewed when necessary and does the work force obey the demarcation lines, i.e. are the areas, etc. kept clear and free of extraneous material at all times?	30				

Annexure 2 — *continued*

Section	Maximum Marks	Evaluation	Action Plan	Target Date	Priority
1.22 *Good Stacking practices* Is maximum use made of floor space and are stacks securely bonded, built up or broken down in accordance with NOSA pamphlet 454?	50				
1.23 *Factory and Yard clear of superfluous material* Has all superfluous material and junk been removed from the premises? Is there adequate provision for the stacking of usable scrap?	60				
1.24 *Scrap Bins and removal system* Are there sufficient bins for scrap and wastes strategically positioned throughout the plant? Are these bins clearly demarcated? Are the bins emptied at routine intervals and properly cleansed? Are air-tight bins provided for the storage of materials likely to ignite spontaneously? Does your company have a written pollution policy? Has a comprehensive programme been developed covering the treatment of air pollutants? Solid pollutants? Liquid pollutants? Are the permissible discharge limits known? Have critical potential sources of pollution been identified? Have procedures for measurement and evaluation of quality and quantity of discharge been set up? Have engineering, operation and maintenance controls been established? Is there an emergency procedure to meet serious pollution situations? Is liaison maintained with regulatory agencies? Is liability coverage provided?	30				
1.25 *Colour Coding* Are standard colour codes as specified by the South African Bureau of Standards used and maintained? See NOSA pamphlet 451.	40				
2.00 *Electrical, Mechanical and Personal Safeguarding* 650 2.10 *Mechanical Equipment* 2.11 *Machine Guarding* Has a detailed survey been made of every machine and moving mechanism in the factory to determine requirements for total safe operation? The simple test is, what would happen if someone were to fall with hands outstretched — could he be caught up in the moving parts? Do specifications for all new equipment specify detailed safety requirements? Have adequate guards been designed, fabricated and installed on all machines originally purchased without suitable guards? Are clearances for adjustable guards clearly laid down and are these adhered to? Does supervision ensure that guards are always replaced after adjustments or maintenance? Is suitable sound-proof partitioning used to isolate excessively noisy areas? Are adequate shields provided to protect workers from excessive heat and other forms of harmful radiation?	150				
2.12 *Lock-out System and usage* Has your company got a written lock-out system policy? Are all switches locked out with a lock-out device and padlock before employees work on the equipment?	40				
2.13 *Labelling of Shut-off Valves, Switches and Isolators* Are all valves, switches and isolators suitably labelled to ensure that the correct switch is operated?	30				

Annexure 2 — *continued*

Section	Maximum Marks	Evaluation	Action Plan	Target Date	Priority
2.14 *Ladders and Handrails, etc.* Are all ladders numbered and checked at routine intervals? Are the results entered in the NOSA Ladder Register? Are hazardous areas fenced off? Are handrails and toeboards used to prevent persons or objects falling from working areas?	40				
2.15 *Lifting Gear and Records* Is all lifting gear checked and tested at routine intervals and are the results entered in NOSA log-books designed for this purpose? See NOSA pamphlet 568.	40				
2.16 *Compressed Gases* Are compressed gas cylinders always secured in a vertical position, either on a suitable trolley or against a firm support? Is the use of copper connections for acetylene piping prohibited?	30				
2.20 *Electrical Equipment* 2.21 *Monthly Checking of Portable Electrical Equipment* Has a qualified person been delegated to check all electrical equipment including domestic appliances, drawing power from a wall socket? Does this check include earth continuity and polarity testing? Are these inspections conducted at routine intervals and are the results entered in the NOSA Portable Electrical Register?	40				
2.22 *Earth Leakage Relays* Are approved type earth leakage relays or alternative safety devices acceptable to the Chief Inspector of Factories utilised on all portable electrical hand tools?	30				

Annexure 3

DURBAN CEMENT
INCIDENT REPORT AND INVESTIGATION FORM

Route: S.O. W.M. P.M. S.O. *Ref.:* .....

A. *Person involved or reporting*
Name ..... Co. No..... Occupation .....
Time in this job ..... Section .....

B. *Incident Report* When occurred:
Specific location of incident .....
Full description of incident indicating possible cause, nature and extent of damage .....
Witnesses ..... *Item damaged* .....
Supervisor's Signature.....

C. *Investigation Report* by ..... Date .....

Was equipment used in normal work	Yes/No
Was correct equipment provided and available	Yes/No
Was correct equipment used	Yes/No
Was correct procedure laid down	Yes/No
Was procedure followed	Yes/No
Was person sober and fit	Yes/No
Was person working overtime	Yes/No

If yes, how many hours? .....
Causes of incident:.....
Action taken or planned .....
Responsible person ..... W/O No..... Date .....
Completion Date: .....

D. *Cost Analysis*

Material Cost		R.....
Man hours lost	Hours.....	R.....
Machine or production hours lost	.....	R.....
Investigation time hours	.....	R.....
Other costs		R.....
Total Actual Incident Cost		R.....

Estimated potential loss — Hours ..... Cost .....

Comment .....

.....
Works Manager

Annexure 4

PERKINS ENGINES — FIRE REPORT
Fire No.
Damage Control No.

Date of incident ..... Time Alarm received .....
Location of incident .....
Person raising alarm (Name and Clock No.) .....
Alarm raised by..... Manual Press Button.....
Telephone Call..... Automatic Detection ..... Running Call.....
Details of Incident.....
Probable Cause .....
Extent of Damage .....
Any personal injury .....
Any major production loss or delay .....
Estimated total damage costs R.....
Equipment used .....
Did Automatic Systems operate..... Sprinklers.....
CO_2..... Any Other..... Was City brigade called.....
Time of call..... Time of arrival.....
Time P.E.C. crew returned to Station .....
Comments by Chief Fire Officer or officer in charge.....
Signature..... Date .....
Recommendations by Area Manager concerned .....
Signature..... Date.....
Comments by Loss Prevention Manager.....
Signature..... Date.....
Have these recommendations been actioned? YES/NO
If not, give reasons .....
Signature..... Date.....
Perkins Fire Brigade personnel attending:
Officers.....Men.....
Report circulated to:

Director Plant Operations	Forward Planning Manager
Director Manufacturing Planning	Facilities Manager
Director Engineering	Plant Manager concerned
Plant Engineering Manager	Unit Risk Manager
Vice-President Admin., Toronto	Tomenson, Saunders, Toronto

This form must be completed and returned to Loss Prevention Manager within 24 hours of fire outbreak.

Annexure 5

PERKINS ENGINES — LOSS CONTROL

1. Loss prevention is becoming recognised as a specific management activity.
2. Total Loss Control embraces All incidents or situations which, if allowed to continue, give rise to unnecessary expense. In the area of manufacturing this includes:
   (*a*) Accidents which injure people and cause damage to property.
   (*b*) Fires which could be a cause of major loss of property and even of life.
   (*c*) Breaches of Security manifested by theft, sabotage, fraud and so on.
3. The Company has a clearly defined Loss Prevention Policy.
4. Since loss control is essentially a management function, the foreman or supervisor, as a member of line management, has definite responsibilities in the task of minimising losses.
5. An employer has well defined obligations to ensure the safety and welfare of the people he employs.
6. Many of these obligations are embodied in Factories Act or other statutory requirements.
7. Failure to comply with statutory requirements is a criminal offence for which the factory occupier (or in some instances his agent or servant) may be prosecuted.
8. The standard of safety demanded by the Company is more stringent than the bare legal requirements which are regarded as minimal.
9. All accidents and dangerous occurrences MUST be investigated with a prime objective of establishing the cause of the occurrence and devising preventive measures.
10. The Loss Prevention Department provides staff assistance to line management in the implementation of effective loss control procedures.

POLICY STATEMENT

It is the Policy of the Company that:

Situations or conditions giving rise to personal danger or being a possible source of damage to plant, facilities or equipment or having other operational or consequential loss potential shall, as far as possible, be eliminated from the Company's operations.

Where this is not feasible effective counter measures shall be devised and applied to minimise the risk of such occurrences.
A Loss Prevention organisation, competent to assess the significance of potential hazards and to determine the most effective preventive action shall contribute to the attainment of this objective.

The techniques employed by the Loss Prevention Department shall embrace all currently accepted and proven procedure and new developments will be studied and adopted whenever justified.
Management and supervisory personnel shall be instructed and trained to identify and to eliminate hazards from their areas of control as a fundamental and essential management responsibility.
Other works and staff employees shall, by appropriate training and instruction, be equipped to avoid day to day hazards to health and safety.

No soundly conceived project having as its objective a substantial improvement in operational safety standards shall fail of implementation through inadequate financial provision.

SECTION SELF-INSPECTION

1. Inspections to be carried out on a monthly basis by the Section Foreman and his Safety Representative.
2. No fixed times for the inspections. To be carried out at the Foreman's convenience.
3. Inspection report to be completed listing hazards or defects found and the corrective action that has been, or is being taken. Action and target dates to be put in where necessary.
4. Recurring hazards or defects to be recorded.
5. Three copies of inspection report to be issued. One copy to Area Manager, one to General Foreman and the third to Safety Officer.
6. Common hazards check list to be used as a guide to the sort of problems that may be found.
7. The inspection report need not be restricted to items conventionally considered as "SAFETY". It can be used to highlight any condition which interferes with the efficiency of a section.
8. Inspection report to be completed by Foreman and Safety Representative, in conjunction.

Perkins Engines Company, Peterborough
Issued by: Safety Department, Eastfield