demic training in engineering In such cases, it is especially important that the safety professional seek the advice and help of personnel within the company who are responsible for establishing engineering design criteria and for setting up job procedures

The ultimate objective of all the company's engineering personnel is to design equipment and processes and to plan job procedures so that exposure to injury is eliminated or controlled It is the safety professional's job to see that engineering personnel are acquainted with the particular hazards involved and the methods of eliminating them

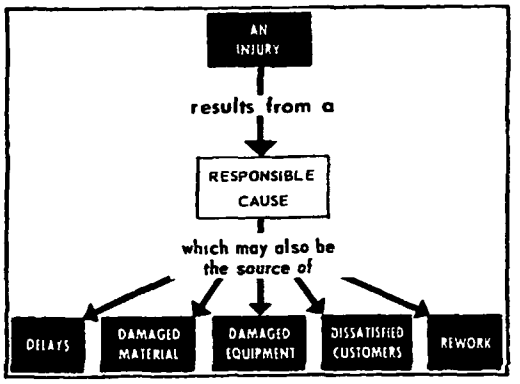

FIG 4-2 – An injury is significant because it points to its basic cause, which may also be responsible for other operating hindrances (shown at bottom of chart)

Courtesy Hartford Accident and Indemnity Co

The safety professional should be able to discuss with management and the various supervisors involved the conditions responsible for accidents or potential accidents He might well remember that, in making his corrective suggestions, he will be more successful if he can demonstrate that an injury is only one of *many* hindrances to efficient production

The safety professional who has the necessary knowledge and skills for preventing accidents should be able to make recommendations for effective use of the facilities at hand for more efficient as well as safer production

Unsafe acts, unsafe conditions

In most industrial accidents, *both* an unsafe condition and an unsafe act are contributing factors In almost 80,000 work injuries reported in Pennsylvania in 1960, an unsafe condition was identified as a contributing factor in 98 4 per cent of the nonfatal manufacturing cases ° In the same study, an unsafe act was identified as a contributing factor in 98 2 per cent of the nonfatal manufacturing cases

It must be remembered that an unsafe condition, in addition to being a direct cause of accidents in itself, often can lead people to *perform unsafe acts* Many times, an unsafe act is the result of poor machine design, inadequately planned methods, and other engineering deficiencies Thus, elimination of a hazard caused by an unsafe condition may also reduce the likelihood of injury from an unsafe act

When an injury occurs, the unsafe condition is often not as glaringly evident as the unsafe act Unless a careful study is made of the accident, the correctible physical hazard may escape notice

Engineering for safety, therefore, should have as it objectives both the elimination of hazardous conditions and the reduction of unsafe acts

Machine Design

Machinery ranks fourth as a source of disabling work injuries, accounting for about 10 per cent of all such injuries Further pointing to the need for safe design of machines is the fact that they rank second as a source of permanent partial injuries, according to N S C 's *Accident Facts*

The design of machinery and equipment is an evolutionary process It is always changing and dynamic, because design engineers constantly acquire wider experiences in the course of their everyday work These experiences give them a broader scope and more initiative at the drawing board This initiative, however, will be disciplined by the practical consideration of designing the

° Pennsylvania Department of Labor and Industry, Harrisburg, Pa *Industrial Injuries in Pennsylvania* 1960