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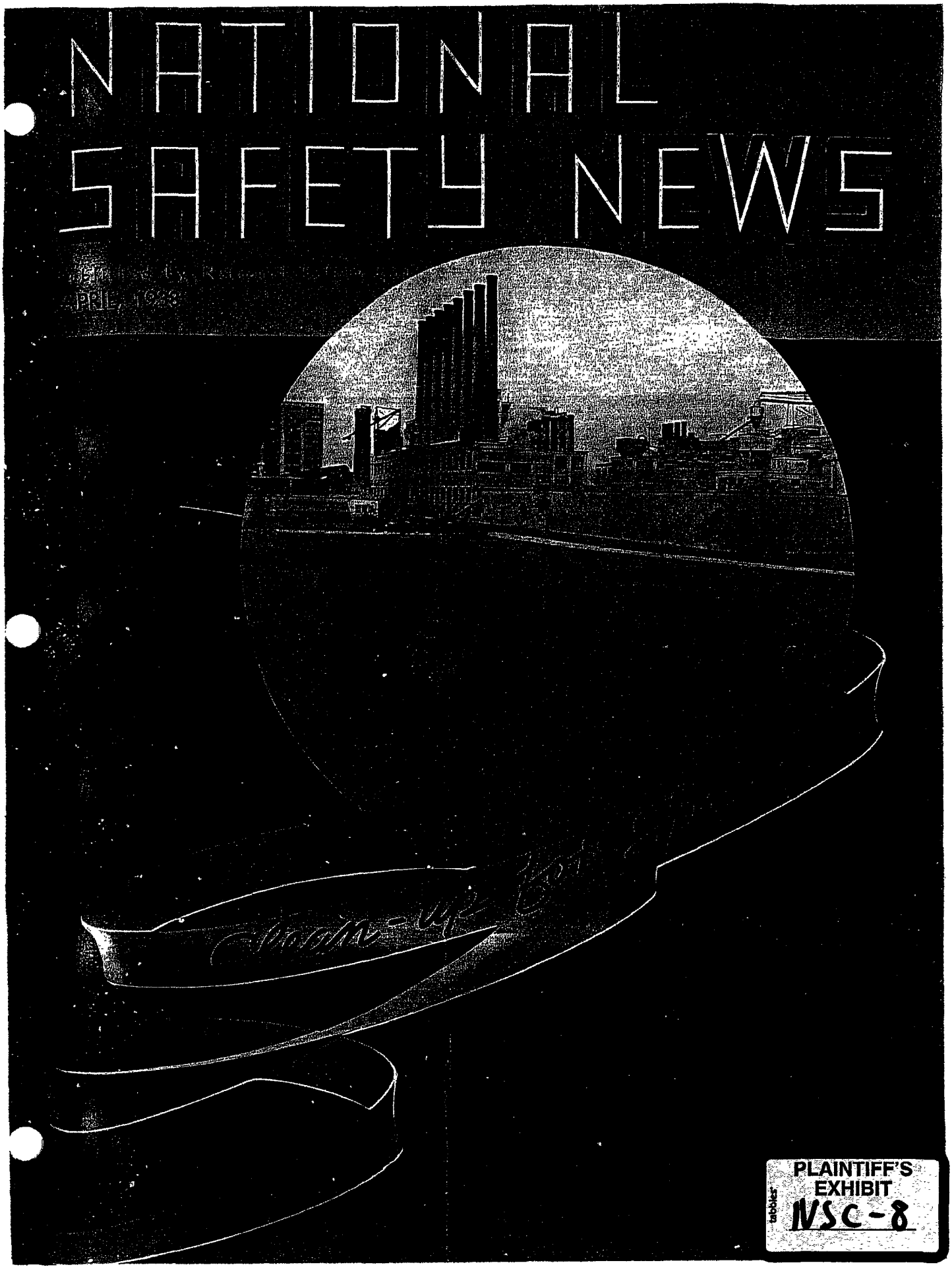

"Mixed" Dusts and "Protector" Dusts

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Experiments show that certain dusts inhibit the action of silica dusts. More research is needed, however, to obtain conclusive data

IN 1933 we undertook a field study for one of the gypsum companies and were impressed by the fact that men who had been exposed for many years to atmospheres containing gypsum dust showed no evidence of silicosis. Experiments were then inaugurated in which animals were compelled to inhale high concentrations of quartz mixed with gypsum dust. Both guinea pigs and white rats failed to develop the silicotic reactions which would have been expected from the amount of silica introduced into the atmosphere.

Subsequently field studies in the iron ore, cement and other industries furnished evidence that other non-silicious materials might prevent or at least retard the inhalation of silica dust. Animal experiments with mixtures of hematite and quartz dust have shown very definite evidence of protective action against silica.

Calcium flouride apparently falls in the same category. Granite, a natural mixture of quartz and various silicates, is known to cause silicosis in human beings but its action is so slow that fifteen or twenty years of exposure is necessary before disease develops. Inhalation experiments with this dust have invariably failed to produce silicosis in animals.

Recent injection experiments have demonstrated that tissue reaction to quartz in this combination is long delayed. The same quantity of quartz that would provoke specific tissue changes in two months, if it were injected in pure state, is held in check for two years when it is administered with the silicates of granite.

A paper read at a special meeting of Air Hygiene Foundation, Inc., Pittsburgh, Pa., November 30, 1937.

Such observations in animals are not new, for experiments have frequently failed to reproduce disease with mixtures of silica and other substances which are well known causes of silicosis in human beings. Either the experimentor claimed to have caused the "early stages" of the disease, although his illustrations indicated that such was not the case, or he condemned the experimental method. In many cases he concluded that associated irritations of the lungs due to infection, mine gases, etc., were essential. It seems much more probable that the failures were due to the presence of protectors which delayed the rate of reaction to silica.

Modifying Factors

Quite recently the Banting Institute has published a report of experiments in which it was shown that metallic aluminum had prevented the development of silicosis in rabbits. The observations covered a period of six months during which time controls subjected to pure quartz dust developed early silicotic nodules. Animals breathing a mixture of quartz containing one per cent aluminum formed no nodules.

These observations would seem to furnish another example of the same general principle. This protector is apparently active in very small quantities. Whether it will continue to prevent silicotic fibrosis from developing over a period of several years remains to be demonstrated.

The evidence now available makes it seem improbable that a silica hazard is defined solely by the number and size of the silica particles in an industrial atmosphere. The other components of a dust modify its action. Some may inhibit, others retard and perhaps some will be found to prevent its injurious effects. Because these possibilities are recognized it becomes difficut to set up definite standards of permissible dustiness in industrial atmospheres. A concentration of quartz particles which may be extremely dangerous when associated with "contaminating" particles of one type may be quite harmless when mixed with some other material.

Not enough is known about the action of protector substances to warrant the recommendation that they be employed to prevent silicosis in industry. Our aim should be to reduce existing dust concentrations rather than to increase them by adding more dust. Even though it may be shown that the health hazard is slight or non-existent, excessive dust concentrations are at best a nuisance; they often interfere with effective production and in extreme cases they add an accident hazard. I would very strongly oppose the recommendation that protector ducts be used to attempt to prevent silicosis at the present time.

Fragmentary Knowledge

But I do believe that we should attempt to discover more about their action. At present our knowledge is fragmentary. We know that many apparently unlike substances may act as inhibitors. Some are more potent than others. Some seem to exert their effects within the body, preventing the silica from acting on the tissues. Some, like gypsum, seem to combine with the silica in the atmosphere, forming clumps which are too heavy to remain suspended in air and too large to pass the barriers of the nose and upper respiratory tract.

We should know more about the underlying principles which govern the behavior of different mixtures. We should investigate the action of various substances commonly associated with quartz in industrial atmospheres. If they have protective action, we should discover in what proportions they are effective. We should know whether their effects is permanent or temporary. We should discover how and why such substances influence the reaction to silica by the body.

With such information at hand it may be possible to apply the knowl-

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