Royal Ministry for Foreign Affairs
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Contents

1 Background

During the last few years the Swedish legislature has passed into law a series of Acts and Statutes dealing with the environment. Among them is the Nature Conservancy Act of 1964, which created machinery for safeguarding particularly valuable land and water resources. A measure of cardinal importance is the Environment Protection Act of 1969, whereby industries that impose a burden on the environment were made subject to a system of obligatory concessions and special supervision by the environment-protection authorities. Another milestone was the 1971 Marine Dumping Prohibition Act banning the dumping of wastes in water. A further point is that the facilities for husbanding the country's land and water resources have been improved as from January 1 1973 by amendments to the legal provisions governing building and other land usage.

Another area in which legislation has just been reformed is the usage of products hazardous to health and the environment. This new body of law, which came into force on July 1 1973, forms the subject of the present paper. The basic provisions are to be found in the Act on Products Hazardous to Health and to the Environment (Swedish Code of Statutes 1973:329). An English translation of the Act is attached hereto as Appendix 1. Regulations for the implementation of the Act are contained in the Ordinance on Products Hazardous to Health and to the Environment (Swedish Code of Statutes 1973:334), which deals in detail with the manufacture, sale, other handling and importation of various kinds of hazardous products. An English translation of the Ordinance is included as Appendix 2.

This paper is essentially a summary account of the considerations motivating the new legislation. The commentary is thus intended for readers wishing to obtain a general overview of the contents of the new legislation.

2 The Main Outlines of the Legislation

The new legislation on products hazardous to health and the environment represents a substantial broadening and tightening-up of public control over products within its scope, which in principle means all products that by reason of their chemical or similar properties are liable to cause harm to human health or the environment. Older legislation in this sphere did not give the authorities broad enough powers to intervene against the chemical products that are, or may be suspected as being, dangerous to human beings and the environment.

The main principle embodied in the Act is that the harming of people or the environment by chemical products is to be prevented as far as possible. Two chief avenues of approach are chosen. Firstly, anyone who manufactures, sells, or otherwise handles or imports chemical products is charged with a duty to take such steps and observe such precautions as are needed to prevent or counteract any ill effects arising from the products. Secondly, the authorities exercise surveillance over the relevant operations and have powers to intervene with coercive measures in order to ward off injurious effects. A basic principle is that the mere suspicion that a chemical product may be harmful to man or the environment means that producers etc. must adopt precautions and that the authorities have powers to intervene against the product.

The Act takes the form of a central outline statute. It contains basic provisions governing the manufacture, sale, other handling and importation of products hazardous to health and the environment, and it empowers the King-in-Council or an authority designated by the King-in-Council to promulgate special orders and regulations on various aspects of the implementation of the Act. Using these powers the King-in-Council has decreed, through the Ordinance on Products Hazardous to Health and to the Environment, that certain kinds of hazardous product may be handled or imported only by special permission, and that special conditions shall apply to other kinds of product in this category. There have also been outright bans laid on the handling of hazardous products of specified kinds.

A Products Control Board, specially created for this purpose, is responsible for the implementation of the new legislation. Routine supervision to ensure that the legislation is being complied with is exercised centrally by the National Environment Protection Board and

the National Board of Industrial Safety. Supervision in the field is handled by the County Administrations, the Industrial Safety Inspectorate and the Public Health Committees. The supervisory authorities have certain means of coercion at their disposal. Compliance with the Act is also ensured by penal provisions.

In order to make the authorities better informed on the health and environmental hazards associated with chemical substances, certain laboratories and other examination facilities have been augmented. At the same time, an inquiry is in progress into the question of setting up an information system for environmental protection. A proposal to this end is expected by the autumn of 1973.

The question of liability to redress damage caused by hazardous products, among other things, regardless of where culpability lies, is likewise the subject of a current inquiry.

3 Purview of the Legislation

3.1 Products Hazardous to Health and to the Environment

The Act is applicable to products hazardous to health and the environment. According to a definition in the Act, such products comprise substances and preparations which, by reason of their chemical or physico-chemical properties and handling, are liable to cause harm to health or the environment (§ 1, 1. of the Act). Also included in the concept of products hazardous to health and the environment, for the purposes of the Act, are products that contain or have been treated with substances or preparations as just mentioned, if the said products, by reason thereof and having regard to their handling, are liable to cause harm to man or to the environment (§ 1, 2. of the Act). The term "substance", in this context, covers elements and chemical compounds. Also included are biological natural products, such as certain drugs made from parts of plants. The term "preparation" is taken to mean solutions e. g. emulsions, mixed powders and pastes. It should be noted that chemical products that are to be regarded as free from risks are not counted as products hazardous to health and the environment. To come within the definition the products must pose specific hazards. The relevant types of injurious effects, as is apparent from the definition just given, are effects of a chemical or physico-chemical nature, but not harmful consequences that are to be regarded as purely physical or mechanical effects. A point to be observed is that it is not only the inherent hazardous properties of a product but also the dangerous properties it may assume during various forms of handling that are of importance to its classification as hazardous to health or the environment.

If so directed by the King-in-Council the application of the Act may also be extended to products besides those just mentioned, if this is of special importance from the standpoint of public health or environmental protection.

3.2 The Mere Risk of Harm is Relevant

A basic thesis that is of the utmost significance in the implementation of the Act is that even the suspicion of risk constitutes sufficient grounds for intervention under the Act. As is apparent from the above definition

of the term "products hazardous to health and to the environment", the fact that a product is "liable" to cause damage is sufficient to render the Act operative. One consequence of this, according to the preliminary studies, is that if a producer wishes to market an insufficiently known chemical product, and if he has reason to presume that the product is dangerous from the standpoint of public health or environmental protection, then he must take this risk into account in making up his mind whether to market the product or not. A further corollary of the basic thesis is that the authorities do not need to wait until damage has been done before they intervene. Well-founded suspicion is in itself enough to justify action. If the suspicion of hazards has arisen, then in order to avoid prohibitions or restrictions the producer must prove, as far as is possible in the present state of science, that the suspicion is groundless. Otherwise he must resign himself to having his product treated by the authorities as hazardous to health and the environment. Thus the burden of any uncertainty as to the hazardous nature of a product falls not upon the public but upon those who wish to market it.

3.3 Rulings Service

The new legislation contains provisions concerning the duty of the Products Control Board to furnish, in certain cases, a "rulings service" which would supply inquirers with a ruling as to whether a particular product, having regard to its properties and its stated or probable use, comes within the purview of the Act. The provision of this service is mandatory insofar as concerns the health-hazard rating of chemical products. When it comes to their environment-hazard rating, on the other hand, it is facultative. Only if it is of great importance from the public standpoint and if circumstances so permit is the Products Control Board obliged to furnish a ruling as to whether a product is hazardous to the environment (§ 5 of the Ordinance). This limitation is prompted by the apprehension that an unlimited duty to supply rulings would tie up the Board's resources to the detriment of other urgent tasks. A fee is chargeable for investigations that are needed for the rulings service.

3.4 Exceptions from the Act

With its wide-ranging purview, the Act overlaps with or borders upon several other areas of law. Products that are effectively subject to direct product control under another title are explicitly exempted from it. Among them are pharmaceuticals, foodstuffs, animal feeds, and radioactive substances and other sources of ionising radiation. Moreover, the

Act is only partially applicable to flammable and explosive products (§ 3).

In the preliminary studies, special attention was paid to the matter of co-ordination between the new Act and the pre-existing industrial-safety legislation. The new Act will have far-reaching effects on the working environment. In the section on the justifications for the Act, however, it is clearly stated that the new Act is not intended to encroach upon or supersede the industrial-safety legislation. The idea is that the industrial-safety legislation will remain in full force side by side with the new Act. A consequence of this, mentioned in the same section, is that general restrictions on the handling of products hazardous to health and the environment – in the working life of the community or in other contexts – that are promulgated pursuant to the new Act should be taken by the industrial-safety authorities as a basis for their deliberations and regarded as minimum requirements that must be satisfied under all circumstances. At the same time it is assumed that the industrial-safety authorities, using their powers under the Industrial Safety Act, will issue complementary or stricter regulations for the handling of chemical products when this is necessary to satisfy industrial safety standards. Thus the hazards to the health of employees will be countered, just as at present, by special measures coming under the heading of industrial safety, supplementary to general products-control legislation.

4 Precautions and Control

4.1 Introduction

The preliminary studies for the new Act stress the need for vigilance as regards chemical products. Our current knowledge of the properties and effects of various chemical substances is limited. This is notably true as regards the long-term effects of modern chemical products. The output of chemical products is growing rapidly, and we can expect to see continued technical development. Expanding knowledge of the inter-relationships of chemistry and biology may reveal that chemical products subject man and his environment to greater hazards than we have so far believed. The preliminary studies also bring out the necessity of having flexible legislation in this sphere. An apprehended injurious effect may have to be countered with dissimilar measures for different products. Moreover, the vigour with which society intervenes in any given case will have to be gauged by striking a balance between on the one hand the hazard associated with the product and on the other hand the need for the product. Furthermore, continued progress in the sphere of science will call for constant reconsideration of rules and decisions. Swedish legislation should also be made compatible, insofar as is possible, with international conditions. These considerations rule out the use of excessively cut-and-dried controls.

4.2 General Provisions

The general and fundamental provisions on the conditions applying to the manufacture, sale, other handling and importation of products hazardous to health and the environment are to be found in §§ 5–9 of the Act.

As the basic rule for the handling of products hazardous to health and the environment, § 5 enacts that it is the duty of anyone manufacturing, selling or otherwise handling or importing such products to take such steps and otherwise observe such precautions as are necessary to prevent or minimise damage to human beings or the environment. This overall rule of prudence is intended to serve as a guide both for those who in one way or another are involved in the handling of a product and for the authorities who are appointed to consider permit applications, exercise

supervision and so on. The preliminary studies contain a detailed exposition as to the significance of the rule. Among other things it is made clear that the rule imposes an obligation to hold to a minimum the employment of that constituent in a product which renders it hazardous to public health or the environment. If the hazardous substance has no bearing on the use for which the product is intended, it would be reasonable to interdict the sale of the product until the said substance has been excluded from it. It is further observed that in assessing the permissibility of marketing a product containing a dangerous substance the feasibility of replacing the said substance by another that would be harmless or at least less dangerous should be taken into account. If it is possible to come up with an acceptable substitute that is less hazardous, there should be no need to accept any other product.

The aforementioned rule of prudence is supplemented by general provisions on the duty of investigation and marking. As regards the duty of investigation it is laid down that the manufacturer and importer, in particular, must inquire into the composition and other properties of the product from the standpoint of public health or environmental protection. In this context, the term "manufacturer" is taken to mean any entrepreneur who has taken part in the process of production, whether he was concerned with the production of the starting material, later processing, the assembly of various parts or the final readying for the market or for any other purpose, and whether he did his manufacturing under sub-contract or for his own account. In practical terms, there is a difference in the liability of those who for example synthesise a new substance and those who at a later stage, by making various changes and additions, work it up into the finished end-product. Under all circumstances, each person forming a link in the chain must consider not only the risks involved in his own manufacturing operations but also the risks attendant upon the purpose to which he supplies his product. It is probable that certain stages of manufacture involve little if any change in the product from the standpoint of risk. A particular liability rests upon the entrepreneur who changes the "risk content" of the product, e.g. by coating parts of a toy with toxic paint. Further, the manufacturer who puts the finished product onto the consumer market shoulders a particularly heavy liability. The duty of investigating the effects of a product on public health and the environment extends as far as is permitted by investigation methodology, etc. Manufacturers and importers must keep themselves informed on research in the area and on technical development. In the justifications for the Act the view is advanced that the requirements as to investigation should be stepped up at the pace permitted by the rising level of scientific knowledge.

How hazardous a product is will depend in general on how it is used. One step which the manufacturer, importer, seller and on occasion other handlers of chemical products must take in order to prevent ill effects is to furnish information on their product so that the individual citizen who comes into contact with it is aware of the associated hazards. This must be done by some form of marking on the product. The duty of marking means that the product must be clearly marked with information of importance from the standpoint of public health or environmental protection.

Over and above this, the hazards associated with the use, storage, transportation, destruction and handling of products hazardous to health and the environment must be countered by various protective measures. The King-in-Council or such public authority as the King-in-Council may designate is empowered to promulgate special regulations concerning precautions and the duty of investigation and marking according to § 5. As will emerge in the next section the King-in-Council has made use of these powers in the Ordinance on Products Hazardous to Health and to the Environment in order to issue various detailed regulations on precautions and the duty of investigation and marking and has furthermore delegated the said powers primarily to the Products Control Board.

The rules establishing the duty of producers, sellers and others dealing with chemical products to lead the way in adopting protective measures and other precautions in the handling of hazardous products, are expected to obviate many drawbacks. But besides this the new Act arms the authorities with effective powers to intervene as necessary against various hazardous products in various situations with more or less far-reaching measures. Thus under § 6 of the Act, for example, the King-in-Council or such public authority as the King-in-Council may designate is empowered to order that some particular kind of hazardous product may be handled or imported only by special permission or that the handling or importation of such product shall be subject to other special conditions. The preliminary studies attach particular importance to the permit requirement laid down in § 6. Under this rule, the number of product groups subject to pre-market licencing can be expanded as circumstances dictate. In this pre-market licencing the responsible authority is to assess the risk associated with the product and to match the risk against the usefulness of the product. If the product is approved, the authority can stipulate conditions aiming directly at the prevention of ill effects. Such conditions can be emended as occasion arises. In the preliminary studies for § 6 it is further pointed out that dissimilar measures must be adopted for different products so as to deal with the risks that in various respects are associated with the products. The

King-in-Council has utilised the powers granted by § 6 to lay down in the Ordinance on the implementation of the Act broadly framed rules on caution in the employment, storage, transportation, destruction and other handling of such products along with precisely worded provisions dealing with various forms of handling.

For cases in which a product may pose a material threat to public health or entail the risk of serious environmental damage, the King-in-Council or such public authority as the King-in-Council may designate is empowered by § 7 to lay an immediate ban on all handling or importation of the product. According to the preliminary studies this provision is concerned among other things with products that in the shorter or longer perspective may be apprehended to be carcinogenic, to cause foetal damage, or to produce genetic changes. Also included are products whose ill effects in any individual case may not be very serious but which may affect many victims by reason of widespread usage, e.g. cosmetics and toiletries.

§ 8 of the Act makes it obligatory for anyone who for commercial purposes handles or imports products of any kind to furnish such public authority as the King-in-Council may designate, in the manner prescribed by the said authority, with information on a product such as its composition, its other properties and its handling, to the extent necessary for assessing the danger presented by the product to public health or the environment. According to the preliminary studies, the primary objective of this provision is to make it easier for the Products Control Board to procure the underlying data for the risk assessment on which interventions by the authorities under the Act must be based. The need to be able to intervene against a dangerous product previously regarded as risk-free likewise renders it imperative to have access to data on the usage of the product so that the risk factors, after the event at any rate, can quickly be pinpointed. Having regard to the available resources, the intention is that the reporting duty will have to be employed initially in respect of products that might conceivably pose hazards to public health or the environment.

4.3 Regulations Governing the Implementation of the Act

Under the Act on Products Hazardous to Health and to the Environment the King-in-Council has promulgated regulations governing the implementation of the said Act. As already noted, these regulations are contained in the Ordinance on Products Hazardous to Health and to the Environment, which is included as Appendix 2 to this commentary. From a legal point of view the Ordinance distinguishes the following four groups of

hazardous products:

1. poisons and dangerous substances,
2. pesticides,
3. PCB and PCB products,
4. other products hazardous to health and the environment.

The hazardous substances that can be apprehended to cause harm to man are sub-classified as *poisons and dangerous substances.* Poisons are substances that carry very grave health risks in use. Dangerous substances are not quite so hazardous. Whether a given substance belongs to one type or the other can be ascertained from reference schedules published by the Products Control Board. Permits are mandatory for the commercial manufacture of and trade in poisons. As for the commercial manufacture of and trade in dangerous substances, it is sufficient for those concerned therein to file a notification thereof with the Industrial Safety Inspectorate. In principle, permits are likewise mandatory for the importation of poisons. With some exceptions, anyone intending to use poisons in the exercise of his occupation must file a notification thereof with the Industrial Safety Inspectorate. In order to avoid the risks involved in the handling of poisons and dangerous substances the Ordinance includes regulations as to how poisons and dangerous substances must be marked and packed and also how they are to be stored.

On the subject of the duty of marking, it is prescribed that the package of any poison or dangerous substance of which the possession is transferred must be clearly and unequivocally marked in the Swedish language with

the name of the product and an indication of its character as a poison or dangerous substance,

a warning text setting out the hazards associated with the product and such other directions as to appropriate handling of the product as may be needed to prevent ill effects,

particulars as to the substance or substances that give the product its hazardous character and such other contents data or quantity data as the Products Control Board may prescribe,

the name and place of domicile of the manufacturer, or, in the case of a product manufactured abroad, the importer.

When a poison is transferred the package must moreover be marked with the name and place of domicile of the seller.

The Products Control Board may direct that the provisions pertaining to poisons and dangerous substances shall also apply to certain products that contain, or have been treated with, a poison or a dangerous substance. A poison or a dangerous substance that is classifiable as a pesticide, as a PCB or a PCB product is covered instead by the special

provisions applying to these groups of hazardous products.

The rules concerning *pesticides* are based on a duty of registration applying to any "substance or preparation that is intended for use as a safeguard against damage to property, sanitary nuisances or other comparable nuisances caused by plants, animals, bacteria or viruses". Failing registration, a product must not be sold or used. And registration is refused if

it is to be apprehended that the pesticide will entail such disadvantages from the standpoint of public health or environmental protection that it would be imprudent to use it in pest control,

it is unsuited for its purpose by lack of effectiveness, or

the name of the pesticide is to be regarded as misleading in point of composition, effect or other properties of the pesticide or could lead to confusion with some other pesticide.

In connection with the registration of a pesticide the Products Control Board must specify how the pesticide package is to be marked. The marking must indicate the name and sphere of application of the pesticide, the names and quantities of active constituents in the pesticide and of other constituents therein that are significant from the standpoint of public health or the environment, and any other particulars that may be needed to avoid ill effects. Upon registration, other special conditions may be prescribed for the prevention of ill effects. If new facts come to light concerning a pesticide, its registration may be revoked. If the use of a particular pesticide is associated with special hazards to human beings or the environment unless certain precautions are carefully observed, the product may be sold only by persons holding permits to sell it, besides which permits are required for those who are to use such products as well. A considerable body of other provisions has been promulgated in order to eliminate the hazards inherent in handling pesticides. If it has a particular bearing on public health or environmental protection the Products Control Board may direct that the provisions governing pesticides shall extend to other products which, in properties and application, are closely allied to pesticides.

Permits are also required to a large extent in connection with *PCB and products containing PCB.* PCB as such must not be imported or handled without a permit. A transformer or a capacitor that has a higher rating than two kilovolt-amperes (reactive) must not be offered for sale, transferred or commissioned without permission if it contains PCB. PCB products of the following kinds must not be offered for sale, transferred or used commercially without permission: paints, printing inks, caulking and sealing compounds, hydraulic oil, lubricating oil, cutting oil, heat-transfer media, and separate capacitors with a rating of two

kilovolt-amperes or less. The Products Control Board may decree that these rules shall also apply to a kind of PCB product other than those just enumerated if it has a high content of PCB or is used on a large scale. Like other hazardous products, PCB and PCB products are subject to marking rules.

As regards certain *other products hazardous to health and the environment,* they must not be offered for sale or transferred if they contain or have been treated with any hazardous substance or preparation and thereby are liable to cause harm to human health. This ban applies to medical requisites and sanitary articles, garments and materials for garments, toys and ceramic household ware. It may further be observed that the National Social Welfare Board has power to direct that a specific substance must not be incorporated into cosmetics or toiletries that are offered for sale or used professionally.

As for the matter of waste disposal it can be mentioned that the Products Control Board may direct that a hazardous product or a waste derivative thereof may be destroyed, converted or otherwise dealt with only with the special permission of the Board. The preliminary studies also emphasise how important it is that producers of chemical substances should be fully alive to the question of waste disposal at as early a stage as possible, which means while the product is still in the development stage. In line with this, the producer should ascertain whether the destruction of the proposed product would entail problems from the standpoint of environmental protection or whether it would be particularly costly. If he finds that it would, then the product should not, in the absence of very pressing reasons, be released onto the market. If a product is subject to permit requirements it rests with the permit-issuing authority to take the possibility of destruction difficulties into account in assessing the permissibility of the product.

5 Control Machinery

5.1 Authorities

As already observed the Products Control Board is responsible for the implementation of the new legislation. It rests with the Board to promulgate general regulations on handling and import, to direct, to co-ordinate and in broad outline to monitor all other aspects of product control, and to function as an agency for dealing with matters that may arise as a consequence of the new legislation on products hazardous to health and the environment. Accordingly, it will be part of the work of the product-control agency to initiate and co-ordinate surveys of the field and investigations of products that can be suspected of being hazardous.

The Products Control Board has ten members: the heads of the National Environment Protection Board, the National Board of Health and Welfare, the National Board of Industrial Safety, the National Food Board and the National Consumer Board, along with five others specially appointed by the King-in-Council. Of these specially appointed members, three represent the employees and one represents the business community.

From practical considerations the central responsibility for the day-to-day monitoring of compliance with the Act and the implementation regulations has not been laid upon the Products Control Board. Instead, with certain exceptions relating to movements by air and water, it is divided between the National Board of Industrial Safety and the National Environment Protection Board – the former acting within its sphere of activity and the latter over the rest of the field. The more detailed supervision is exercised by the Industrial Safety Inspectorate, which is subordinate to the Board of Industrial Safety. In other respects, the County Administration exercises the more detailed supervision within the county and the Public Health Committee the immediate supervision within the commune.

5.2 Powers of the Supervisory Authority

According to § 12 of the Act the supervisory authority has the right to receive upon request the information and documents needed for the exercise of supervision. The effect of this provision is that the supervisory authority, following a special decision on the matter, is authorised to call for more detailed data on the origin, composition, other properties, intended use, turnover and so on of a particular hazardous product, and to examine invoices, account books, packing notes, delivery vouchers, laboratory records, analysis reports and so on.

The supervisory authority has coercive powers at its disposal to secure compliance with the provisions of the Act. Under § 13 for example, it can act against infringements of the handling regulations applying to a particular product by issuing prohibitions, by requiring protective measures to be taken, and in other such ways. But the right to invervene is confined to cases in which it is manifestly necessary, in other words to incontestable instances of infringement. In the preliminary studies for this provision it is pointed out that the authority should in the first resort endeavour to see that matters are put right voluntarily by furnishing counsel and directions. The right to prohibit should be used with restraint. Circumstances in which a prohibition would be conceivable would be when there is reason to apprehend a serious hazard and the party concerned cannot immediately produce data establishing that the apprehension is unfounded. The supervisory authority can put further force behind the orders it issues by attaching a penalty for non-compliance to them. If anyone fails to take steps which he is directed to take, the authority can also direct that rectification be made at his expense. According to the preliminary studies, this power should in general be viewed as a last resort whereby the supervisory authority can correct an abuse or other disamenity of a nature hazardous to public health or the environment.

In the pursuance of its supervisory activities the supervisory authority can also require admittance to any premises used in connection with the handling of hazardous products and can conduct inspections and take samples there.

Thus the supervisory authority has powers, coupled with various coercive instruments as just described, to monitor the handling of products hazardous to health and the environment. In this context, however, it should be noted that deciding whether or not a product is hazardous is not primarily a matter for the supervisory authorities. If the authority, in exercising its supervisory function, encounters the question of whether a product is hazardous or not, the point should be referred to the Products Control Board for review, unless delay would entail manifest danger (see § 59 of the Ordinance).

A basic prerequisite in ascertaining how hazardous chemical substances are is access to laboratories and other resources for investigation. For the time being, pending the reports of certain commissions of inquiry among

other things, the laboratory question has been solved on an ad hoc basis only. This was done by strengthening the resources of the National Environment Protection Board's present investigation laboratory and the department of industrial medicine at the National Board of Industrial Safety. In addition, special funds have been placed at the disposal of the Products Control Board for investigations.

6 Penalties, etc.

Anyone violating the provisions of the Act on Products Hazardous to Health and to the Environment renders himself liable to penalties of various kinds. Fines or prison sentences of not more than one year may be imposed on any person infringing an order, prohibition or condition promulgated under the Act. Liability to punishment subsists only if the offender has acted wilfully or negligently. The same penalties may be imposed on anyone who wilfully or by gross negligence violates the general rule of prudence laid down in § 5 of the Act.

A sanction of another kind may be brought to bear upon a person who, in cases where permits are required, has been granted due permission to carry on a particular activity. A permit of this kind is liable to revocation at any time. This step may also be taken, for example, if the composition of an approved product is found to have been modified, or if new hazards come to light that were not known to be associated with the product at the time when it was approved. As mentioned earlier, a supervisory authority can also step in with an order or ban that is manifestly needed to ensure compliance with the Act or with regulations issued pursuant to the Act.

A question of great interest concerns the way in which, and the extent to which, compensation may be made payable to a person who suffers injury because a product has proved to possess harmful properties. The new legislation does not contain any rules on this point, nor are there in any other legislation any special rules of compensation concerning product injuries. Thus the only resource available at present is the body of general rules on damages. In addition, various insurance rules may be applicable. It is a matter of uncertainty how far the liability to pay compensation under the general rules of damages extends in the case of product injuries. At all events it is clear that many of those who fall victim to a "product injury" will have no means of securing full compensation. In principle there is little likelihood of being able to claim damages unless some mistake has been committed in the manufacture or handling of the product. However, the Swedish Government has recently appointed a special commission to work out a system that would be applicable to product injuries.

Appendix 1 Act on Products Hazardous to Health and to the Environment

(Swedish Code of Statutes 1973:329)

Introductory provisions

§ 1 For the purposes of this Act, the term "product hazardous to health and to the environment" is taken to mean

1. any substance or preparation which, by reason of its chemical or physico-chemical properties or handling, is liable to cause harm to human beings or to the environment,
2. any product which contains or has been treated with a substance or preparation as defined in subparagraph 1, if the said product, by reason thereof and having regard to its handling, is liable to cause harm to human beings or to the environment.

If it is of special importance from considerations of public health or environmental protection, the King-in-Council may direct that the provisions of the Act concerning hazardous products shall extend to a product not covered by the first paragraph, subparagraphs 1 and 2, of this section.

§ 2 For the purposes of this Act, the term "handling" is taken to mean manufacture, processing, treatment, packaging, storage, transportation, use, collection, destruction, conversion, offering for sale, transfer or other comparable proceedings.

§ 3 The Act does not cover products that are to be regarded as

1. foodstuffs according to the Food Act (1971:511),
2. pharmaceuticals according to the Pharmaceuticals Act (1962:701),
3. animal feeds according to the Act (1961:381) on the manufacture of and trade in animal feeds, etc.

The Act likewise does not apply to radioactive substances and other sources of ionising radiation.

In the matter of flammable or explosive products the Act is applicable only insofar as such product is hazardous to health or the environment for reasons other than those for which it is classed with the said product categories.

§ 4 The King-in-Council, or such public authority as the King-in-Council may designate, is empowered to grant exemption from the application of the Act in the case of some particular kind of product or some particular form of handling or importation.

The King-in-Council, or such public authority as the King-in-Council may designate, is empowered to grant the Armed Forces exemption from the application of the Act.

Precautions, permits, etc.

§ 5 Anyone handling or importing a product hazardous to health and to the environment shall take such steps and otherwise observe such precautions as are necessary to prevent or minimise harm to human beings or the environment. It is the particular duty of anyone manufacturing or importing such a product to inquire carefully into its composition and other properties with a bearing on public health or environmental protection. The product shall be clearly marked with information of importance from the standpoint of public health or environmental protection.

The King-in-Council, or such public authority as the King-in-Council may designate, is empowered to promulgate special regulations concerning precautions and the duty of examination and marking as referred to in the first paragraph of this section.

§ 6 If considerations of public health or environmental protection so dictate, the King-in-Council, or such public authority as the King-in-Council may designate, is empowered to order that some particular kind of hazardous product may be handled or imported only by special permission or that the handling or importation of such product shall be subject to other special conditions.

Applications for permits according to the first paragraph of this section shall be considered by such public authority as the King-in-Council may designate.

§ 7 If it is of special importance from considerations of public health or environmental protection, the King-in-Council, or such public authority as the King-in-Council may designate, may prohibit the handling or importation of some specific kind of hazardous product.

§ 8 Anyone who for commercial purposes handles or imports any substance, preparation or other product must furnish such public authority as the King-in-Council may designate, in the manner prescribed by the said authority, with all information on the composition, other

properties and handling of the product that is necessary for assessing the danger it presents to public health or to the environment.

§ 9 The public authority that the King-in-Council shall designate shall be empowered to order that anyone who for commercial purposes handles or imports any products hazardous to health and to the environment shall file a notification of the said activity.

§ 10 Regulations governing the duty of a public authority to issue a ruling, on request, as to whether a substance, preparation or other product is to be regarded as hazardous to health or to the environment are promulgated by the King-in-Council.

Supervision

§ 11 Supervision to ensure observance of this Act and of regulations and conditions issued pursuant thereto is exercised by such public authority as the King-in-Council may designate.

§ 12 A supervisory authority has the right to receive upon request the information and documents needed for the exercise of supervision pursuant to this Act.

§ 13 The supervisory authority is empowered to issue such orders and prohibitions as are manifestly needed to ensure compliance with this Act or with regulations promulgated pursuant thereto.

The supervisory authority may attach a penalty for non-compliance to any order or prohibition which it issues.

If any person fails to discharge a duty imposed upon him by this Act or by regulations and conditions promulgated pursuant to this Act or by order of the supervisory authority, the said authority can direct that rectification be made at his expense.

§ 14 For purposes of supervision according to this Act the supervisory authority is empowered to require admittance to any area, buildings or other premises used in connection with the handling of products hazardous to health and to the environment and to conduct inspections or take samples there. No compensation is payable for samples taken.

The police authorities have a duty to furnish such enforcement services as are required for the exercise of supervision pursuant to this Act.

Liability to defray the expenses incurred by the supervisory authority

in taking and examining samples shall be governed by orders issued by the King-in-Council or such public authority as the King-in-Council may designate.

§ 15 The King-in-Council may direct that a special fee shall be payable in a matter subject to this Act.

Penalties, etc.

§ 16 Any person wilfully or negligently violating any regulation, prohibition or condition promulgated pursuant to the second paragraph of § 5 or §§ 6–8 shall on conviction be fined or imprisoned for not more than one year. Any person who wilfully or through gross negligence violates the first paragraph of § 5 shall be sentenced to the same penalty.

Liability under the first paragraph of this section does not subsist in the case of an offence punishable under the Criminal Code.

Any person who wilfully or negligently fails to file a notification under an order issued pursuant to § 9 or to discharge obligations imposed upon him by § 12, or who makes a false statement on a material point in an application or notification subject to this Act shall on conviction be sentenced to a fine.

Liability for the importation or attempted importation of a product in violation of a regulation issued pursuant to this Act is covered by the provisions of the Act (1960:418) concerning penalties for goods smuggling.

§ 17 Any person who has taken official cognisance of a matter subject to this Act shall not improperly disclose or make use of what he has thereby learned concerning occupational secrets or business circumstances. Any person who wilfully or negligently violates this prohibition shall on conviction be sentenced to a fine or imprisonment for not more than one year. The case may be publicly prosecuted only if an injured party institutes criminal proceedings or if prosecution is in the public interest.

§ 18 Goods that have been the subject of an offence under this Act, or the value thereof, together with the gain accruing from such an offence, shall be declared forfeit, unless this is manifestly inequitable.

§ 19 For the furtherance of the interest of consumers in the area of products hazardous to health and to the environment, an organisation that qualifies as a paramount organisation under the Right of Association and

Negotiation Act (1936:506) is entitled to lodge an appeal against a decision made under this Act insofar as this is permissible under regulations promulgated by the King-in-Council.

This Act comes into force on July 1 1973.

The Act cancels and supersedes

1. the Poisons Act (1962:702),
2. the Pesticides Act (1962:703),
3. the PCB Act (1971:385).

If any law or other statute contains a reference to a regulation that is replaced by a provision of this Act, the new provision shall apply in its stead.

Any decision as to prohibitions, regulations, permits, dispensations or registration that was adopted pursuant to older provisions shall be deemed to be promulgated by authority of the corresponding provision of this Act, unless otherwise directed by the King-in-Council or by such public authority as the King-in-Council may designate.

The King-in-Council or such public authority as the King-in-Council may designate is empowered to sanction such waivers of this Act as are needed to ameliorate transitional difficulties encountered by the business community.

Appendix 2 Ordinance on Products Hazardous to Health and to the Environment

(Swedish Code of Statutes 1973:334)

Introductory provisions

§ 1 For the purpose of this Ordinance, the term "manufacture" is taken to mean production and purification or other processing.

The validity of provisions concerning manufacture extends in applicable parts to packaging or operations comparable therewith, unless otherwise explicitly stated.

Poisons and dangerous substances

§ 2 Substances that are classifiable as products hazardous to health and to the environment and are liable to cause harm to man are sub-classified as poisons or dangerous substances.

The poison classification includes substances that are mainly used in the production of pharmaceuticals and that the National Board of Health and Welfare has designated as poisons, and other substances whose handling is associated with very grave hazards to health. Other substances under the main heading are classified as dangerous substances.

§ 3 The provisions of this Ordinance concerning poisons also apply to any preparation hazardous to health that contains a poison, if the presence of the said poison is instrumental in rendering the preparation hazardous to health.

The provisions of this Ordinance concerning dangerous substances also apply to any preparation hazardous to health that contains a dangerous substance, if the hazardous nature of the preparation is solely due to the presence of the said substance.

If special considerations so indicate, the Products Control Board is empowered to exempt a preparation as referred to in the first or second paragraph of this section from the application of the Ordinance.

§ 4 If considerations as to human health risks so dictate, the Products Control Board is empowered to direct that the provisions of the Ordinance pertaining to poisons or dangerous substances shall also apply to a product as referred to in § 1, paragraph 1, sub-paragraph 2, of the Act (1973:329) on Products Hazardous to Health and to the Environment.

§ 5 The Products Control Board has a duty to publish reference schedules listing substances covered by § 2.

§ 6 The right to manufacture poisons commercially pertains solely to

1. persons who under the terms of the Pharmaceuticals Act (1962: 701) are qualified to manufacture pharmaceuticals in general,

2. persons who hold a permit to manufacture the poison in question.

Applications for permits under paragraph 1, sub-paragraph 2 of this section are dealt with by the County Administration. A permit may relate to a specific kind of poison or to poisons in general, and may be valid for a specified period or until further notice.

Manufacture as covered by paragraph 1, sub-paragraph 2 of this section shall be under the charge of a suitable manager approved by the Industrial Safety Inspectorate.

§ 7 A permit pursuant to § 6, paragraph 1, sub-paragraph 2 is subject to partial or total revocation

1. if the holder of the permit disregards any provision of the Act (1973:329) on Products Hazardous to Health and to the Environment or any regulation promulgated pursuant to the Act,

2. if there is no approved manager or if the approved manager fails to exercise supervision over operations,

3. if the operations are otherwise conducted in a manner posing a threat to order and safety.

Before a permit is revoked the County Administration shall, unless special circumstances dictate otherwise, afford the manufacturer an opportunity to rectify the situation.

§ 8 The right to manufacture dangerous substances commercially pertains solely to

1. persons qualified for the commercial manufacture of poisons,

2. persons who have notified the Industrial Safety Inspectorate that they propose to manufacture a dangerous substance.

A dangerous substance may be packed and repacked without any notification as referred to in paragraph 1, sub-paragraph 2 of this section.

§ 9 The right to import poisons pertains solely to

1. persons who are entitled to manufacture the poison in question commercially or to trade therewith,

2. the principal of an institution or corresponding section of a university or college and the principal of an investigating laboratory, research institute or similar body that is owned by or enjoys the financial support of the State, a county commune or commune, on condition that the poison in question is needed for the work of the said body,

3. persons who hold a special permit to import the poison in question.

A traveller may import into the realm, without special permission, a poison for his own use.

Notwithstanding the first paragraph of this section, poisons may be transshipped or otherwise conveyed under customs control or stored in a bonded warehouse or in a free port.

§ 10 Applications for permits under § 9, paragraph 1, sub-paragraph 3, if filed by an applicant conducting a business, shall be dealt with by the County Administration of the county in which the business is conducted; otherwise they shall be dealt with by the County Administration of the county in which the applicant is resident. A permit may be granted only if the applicant needs the poison in the exercise of his occupation and is considered capable of handling the poison in a safe manner.

§ 11 If a poison has been submitted for customs clearance to a person who is not entitled to import it, and if an import permit is not granted, he shall transfer the consignment to a person who is entitled to import it, failing which he must re-export it.

If the said consignment is not imported, transferred or re-exported within four months from the date on which it is to be regarded as having been received by the customs post, or within such longer period as the Board of Customs may decide, the consignment and its packaging shall be forfeit to the State, unless this is manifestly inequitable. Property that becomes forfeit to the State shall be dealt with in the manner decided by the Products Control Board.

§ 12 The right to trade with poisons pertains solely to

1. persons who by due authority have manufactured the product in question,

2. persons who are entitled to conduct retail trade in pharmaceuticals,

3. persons who hold a permit to trade with the poison in question.

Applications for permits under paragraph 1, sub-paragraph 3 of this section shall be dealt with by the County Administration. A permit may relate to a specific kind of poison or to poisons in general, and may be valid for a specified period or until further notice.

For trading in poisons elsewhere than at a pharmacy there shall be a suitable manager approved by the Industrial Safety Inspectorate.

§ 13 Revocation of a permit to trade with poisons shall be covered by provisions corresponding to those of § 7.

§ 14 The right to trade with dangerous substances pertains solely to

1. persons who have manufactured the substance in question or are qualified to trade with poisons,

2. persons who have notified the Industrial Safety Inspectorate that they propose to trade with a dangerous substance.

Notification according to paragraph 1, sub-paragraph 2 of this section is not required when a dangerous substance is offered for sale in the closed original package in which the product was acquired.

§ 15 Poisons may be transferred only to persons who, according to the first paragraph of § 9, are qualified to import the poison in question and to persons who intend to use the poison in question in the exercise of their occupation. Furthermore, a poison may be furnished by a pharmacy to a person who has reached the age of 18 and can show that he needs the poison in question for artistic, technical, scientific or other comparable purposes.

§ 16 The right to use poisons commercially pertains solely to

1. persons who are qualified for the import or commercial manufacture of poisons,

2. persons who have notified the Industrial Safety Inspectorate that they propose to use poisons in the exercise of their occupation.

Notification is not required for the commercial use of poisons in the case of

1. activities in which poisons are used only occasionally or in extremely small quantities,

2. laboratory use at research laboratories, schools or other educational institutions,

3. medical analysis operations under the supervision of a physician, dentist or veterinary surgeon.

§ 17 If the Industrial Safety Inspectorate has received a notification according to paragraph 1, sub-paragraph 2 of § 16, the Inspectorate shall issue written confirmation thereof.

§ 18 A package containing a poison or dangerous substance that is transferred shall be clearly and unequivocally marked in the Swedish language with

1. the name of the product and an indication of its character as a poison or a dangerous substance,

2. a warning text setting out the hazards associated with the product and such other directions as to appropriate handling of the product as may be needed to prevent ill effects,

3. particulars as to the substance or substances that give the product its hazardous character and such other contents data or quantity data as the Products Control Board may prescribe,

4. the name and place of domicile of the manufacturer or, in the case of a product manufactured abroad, the importer.

When a poison is transferred the package shall also be marked with the name and place of domicile of the seller.

The Products Control Board has powers to reduce the marking obligation described in the first or second paragraph of this section.

§ 19 Poisons or dangerous substances that are transferred shall be enclosed in a package that can be regarded as giving adequate safety in the handling of the product and whose design does not entail any risk of confusion with some other product.

§ 20 Regulations governing the storage of poisons or dangerous substances will be issued by the Products Control Board, except that the National Board of Health and Welfare will issue regulations governing the storage of poisons or dangerous substances at pharmacies.

§ 21 Poisons and dangerous substances that are classifiable as pesticides, PCB or PCB products are instead covered by §§ 22–45.

Pesticides

§ 22 For the purposes of this Ordinance, the term "pesticide" is taken to mean a substance or preparation that is intended for use as a safeguard against damage to property, sanitary nuisances or other comparable nuisances caused by plants, animals, bacteria or viruses.

The term "pesticide" shall not be taken to mean

1. a product intended for use in the preparation of foodstuffs, pharmaceuticals or other comparable products,

2. paints, varnishes, tars and other products that are mainly employed for other purposes than those stated in the first paragraph of this section, unless the said products, by a special denomination or by other means, are stated to be intended for use as pesticides.

§ 23 If it is of particular importance from the standpoint of public health or environmental protection the Products Control Board may direct that the provisions of §§ 24–38 on pesticides shall extend to other products which, by reason of their properties and use, are closely allied to pesticides.

§ 24 The commercial manufacture of pesticides that are to be regarded as poisons or dangerous substances and the import of pesticides that are to be regarded as poisons shall be covered by provisions corresponding to those of §§ 6–11.

§ 25 Pesticides must not be offered for sale, transferred or used without being registered with the Products Control Board.

The Products Control Board has power to grant exemption from the duty of registration according to the first paragraph of this section if this is necessary for scientific testing. If there are exceptional grounds for so doing, the Board may also grant exemption in the case of products for combatting plant-infesting pests or plant diseases.

§ 26 An application for the registration of a pesticide shall be filed with the Products Control Board by the manufacturer.

A manufacturer who is not domiciled in Sweden must have an agent resident here.

§ 27 A pesticide shall not be accorded registration if

1. it is to be apprehended that the pesticide will entail such disadvantages from the standpoint of public health or environmental protection that it would be imprudent to use it in pest control,

2. it is unsuited for its purpose by lack of effectiveness, or

3. the name of the pesticide is to be regarded as misleading in point of the composition, effect or other properties of the pesticide or could lead to confusion with some other pesticide.

§ 28 If the use of a particular pesticide is associated with special hazards to human beings or to the environment unless prescribed precautions are carefully observed, the Products Control Board shall state this in connection with its registration.

§ 29 In registering a pesticide the Products Control Board shall specify how the pesticide package is to be marked. The marking shall disclose

1. the name and sphere of application of the pesticide,

2. the names and quantities of active constituents in the pesticide and of other constituents therein that are significant from the standpoint of public health or the environment,

3. any other particulars that may be needed to avoid ill effects.

In registering a pesticide the Products Control Board may prescribe other special conditions for the prevention of ill effects.

§ 30 The registration of a pesticide may be revoked if conditions are disregarded, if circumstances alter, or if the fee laid down by the Ordinance (1970:42) on Pesticide Fees is not paid within the prescribed time.

A manufacturer wishing to remove a pesticide from the register shall notify the Products Control Board thereof in writing. The registration then lapses after the expiry of the year following the year in which the said notification reached the Board.

§ 31 The right to trade in pesticides covered by § 28 pertains solely to

1. persons who by due authority have manufactured the pesticide in question,

2. persons who are entitled to trade in poisons in general,

3. persons who hold special permits to trade in such pesticides.

Applications for permits under paragraph 1, sub-paragraph 3 of this section shall be dealt with by the County Administration. A permit may relate to a specific kind of pesticide or to such products in general, and may

be valid for a specified period or until further notice.

For trade within the meaning of sub-paragraphs 1 and 3 of the first paragraph of this section there shall be a suitable manager approved by the Industrial Safety Inspectorate.

§ 32 Revocation of a permit according to § 31 paragraph 1 sub-paragraph 3 shall be covered by provisions corresponding to those of § 7.

§ 33 The design of the package for pesticides that are transferred shall be covered by provisions corresponding to those of § 19.

§ 34 Pesticides covered by § 28 may be transferred only to persons who are qualified to trade with such products or to persons who are qualified to use such products according to § 35 or who have such a person employed in their business.

§ 35 Pesticides covered by § 28 may be used only by persons holding the relevant permit.

Permit applications are dealt with by the National Board of Agriculture insofar as they concern activities bound up in the main with agriculture, forestry or horticulture; in other cases they are dealt with by the National Board of Health and Welfare. Permits are valid for a specified period. More detailed regulations for the granting of such permits are issued by the National Board of Agriculture or by the National Board of Health and Welfare respectively, in consultation with the Products Control Board.

§ 36 Regulations for the spreading of pesticides from the air above ploughland are issued by the Products Control Board.

The Products Control Board has power to grant such exemption from the prohibition against the spreading of pesticides over areas other than ploughland according to the Act (1972:123) prohibiting the spread of pesticides from the air as is referred to in § 2 of the said Act.

§ 37 Commercial disinfecting of grain or potatoes with pesticides specified by the Products Control Board may be carried out only with special permission. The granting and revocation of such permission is governed by provisions corresponding to those of the second paragraph of § 31 and of § 7 sub-paragraphs 1 and 3.

Grain, potatoes and other seed stock that have been disinfected with pesticides may be used only as seed stock. Such seed stock may be stored only in packaging of a kind prescribed by the Products Control Board.

Such packaging may not be used for any other purpose.

The disinfecting of spring seed grains is governed by the provisions of the Ordinance (1965:530) containing special provisions on the disinfecting of spring seed grains.

§ 38 Pesticides that are particularly harmful to pollinating insects must not be used to treat plants during the period in which pollination can take place.

If there are pressing grounds for so doing, the National Board of Agriculture may grant exemption from the first paragraph of this section.

In connection with pest control carried out professionally using a pesticide covered by the first paragraph of this section, records shall be kept as prescribed by the National Board of Agriculture.

PCB etc.

§ 39 For the purpose of this Ordinance, the term "PCB product" is taken to mean a product that is hazardous to health or the environment by reason of its content of PCB (polychlorinated biphenyls).

§ 40 PCB shall not be imported or handled without permission.

§ 41 A transformer or a capacitor that has a higher rating than two kilovolt-amperes (reactive) must not be offered for sale, transferred or commissioned without permission if it contains PCB.

§ 42 PCB products of the following kinds must not be offered for sale, transferred or used commercially without permission:

1. paints, printing inks, caulking compounds and sealing compounds,
2. hydraulic oil, lubricating oil, cutting oil,
3. heat-transfer media,
4. separate capacitors with a rating of two kilovolt-amperes or less.

§ 43 Permit applications according to §§ 40–42 are dealt with by the Products Control Board.

§ 44 The Products Control Board has power to direct that § 42 shall apply correspondingly to a kind of PCB product other than those

covered by § 41 or § 42, if it has a high content of PCB or is used on a large scale.

§ 45 A package or other wrapping intended for PCB or a PCB product as covered by § 41, § 42 or § 44 shall be clearly marked to the effect that it contains PCB. The same applies to any such PCB product that is not packaged or otherwise wrapped.

The Products Control Board has power to grant exemption from the marking obligation according to the first paragraph of this section.

Other products hazardous to health or to the environment

§ 46 Products of the following kinds must not be offered for sale or transferred if they contain or have been treated with any substance of preparation as referred to in § 1 sub-paragraph 1 of the Act (1973:329) on Products Hazardous to Health and to the Environment and are thereby liable to cause harm to human health:

1. medical requisites and sanitary articles,
2. garments and materials for garments,
3. children's toys,
4. ceramic household ware.

It is likewise forbidden to offer for sale or to transfer matches whose head composition contains white or yellow phosphorus.

§ 47 The National Board of Health and Welfare has power to direct that a specific substance must not be used as a constituent in cosmetics or toiletries that are offered for sale or used professionally.

§ 48 Phenyl acetone (benzyl methyl ketone, 1-phenyl-2-propanone), or any preparation containing this substance from which the said substance can easily be recovered, is governed by provisions corresponding to those dealing with poisons in §§ 6, 7, 9–13, 15–17 and 20.

General provisions

§ 49 The Act (1973:329) on Products Hazardous to Health and to the Environment is not applicable to tobacco products. The Act is applicable to technical spirits and alcoholic preparations only insofar as the hazardous nature of the product is derived from some constituent other than ethyl alcohol.

§ 50 The Products Control Board will issue further regulations on precautions and on the duty of examination and marking as laid down in the first paragraph of § 5 of the Act (1973:329) on Products Hazardous to Health and to the Environment.

§ 51 The Products Control Board has power, and may empower police authorities, to direct that road movements of products hazardous to health and to the environment may take place only by special permission or, if it is of particular importance from the standpoint of public health or environmental protection, to prohibit such movements.

§ 52 The Products Control Board may direct that a product hazardous to health and to the environment or a waste derivative of such a product may be destroyed, converted or otherwise dealt with only with the special permission of the Board.

§ 53 The Products Control Board will issue further regulations according to the first paragraph of § 6 of the Act (1973:329) on Products Hazardous to Health and to the Environment insofar as concerns special conditions for the handling or import of hazardous products other than a prohibition to handle or import such products without special permission.

§ 54 Regulations according to §§ 8 and 9 of the Act (1973:329) on Products Hazardous to Health and to the Environment will be issued by the Products Control Board. Information as referred to in § 8 of the Act shall be furnished to the Products Control Board.

§ 55 At the request of the party concerned the Products Control Board shall issue a ruling as to whether a specified product, having regard to its properties and to its stated or probable use, is to be regarded as hazardous to health.

If it is of great importance from the public standpoint and if the circumstances so permit, the Products Control Board may, at the request of the party concerned, also issue a ruling as to whether a specified product, having regard to its properties and to its stated or probable use, is to be regarded as hazardous to the environment.

For any investigation that is required for a ruling according to the first or second paragraph of this section, the party requesting the ruling shall pay an investigation fee to an amount corresponding to the cost of the investigation. If, in view of the character of the investigation, it is manifestly unreasonable to charge a fee in such an amount, the Board may set the fee at a lower amount.

§ 56 In cases concerning movements of products hazardous to health and to the environment by air, water or rail transport, the relevant central administrative authority shall be substituted for the Products Control Board in the provisions of §§ 50, 53 and 54.

In the matter of movements as referred to in the first paragraph of this section the relevant central administrative authority, or police authorities invested with the necessary powers by the said authority, may direct that movements of products hazardous to health and to the environment shall take place only by special permission, or, if it is of particular importance from the standpoint of public health or environmental protection, may prohibit such movements.

Before a central administrative authority as referred to in this section issues any prohibition or order under this Ordinance the said authority shall consult with the Products Control Board. Before the Board issues any prohibition or order under this Ordinance that has a bearing on movements by air, water or rail, the Board shall consult with the relevant central administrative authority.

§ 57 Persons handling products hazardous to health and to the environment shall follow the cautions and other instructions for the handling of the products that are communicated by marking or by other means according to this Ordinance or to regulations issued in connection therewith.

Supervision

§ 58 The National Environment Protection Board and the National Board of Industrial Safety exercise, with the exceptions mentioned in the third paragraph of this section, the central supervision to ensure compliance with the Act (1973:329) on Products Hazardous to Health and to the Environment and with regulations issued pursuant to the Act – the Board of Industrial Safety within its sphere of activity and the Environment Protection Board over the rest of the field.

The more detailed supervision is exercised by the Industrial Safety Inspectorate, working under the Board of Industrial Safety. In other respects, with the exceptions mentioned in the third paragraph of this section, the County Administration exercises the more detailed control within the county and the Public Health Committee the immediate control within the commune.

In cases concerning movements of products hazardous to health and to the environment by air or water, supervision as referred to in the first and second paragraphs of this section is exercised by the relevant central administrative authority.

§ 59 If, in the exercise of control according to § 58, the question arises as to whether a particular product is to be regarded as hazardous to health or the environment, the said question shall, unless there is manifest danger in delay, be referred to the Products Control Board for consideration. In this connection, the first and second paragraphs of § 55 shall apply correspondingly.

§ 60 The costs incurred by the supervisory authority in sampling and examining samples shall be defrayed, to the extent and on the conditions prescribed by the Products Control Board, by the party in respect of whose business the sampling and examination was carried out.

If the examination of a sample reveals that an offence has been committed under the Act (1973:329) on Products Hazardous to Health and to the Environment or under regulations issued pursuant to the said Act, the responsible party shall defray the costs of sampling and examination.

Appeals, etc.

§ 61 Any party dissatisfied with a decision of the Public Health Committee or police authority according to the Act (1973:329) on Products Hazardous to Health and to the Environment or according to regulations issued pursuant thereto may lodge an appeal with the County Administration. Appeals against decisions of the Industrial Safety Inspectorate are lodged with the National Board of Industrial Safety.

§ 62 Any party dissatisfied with a decision issued in a special case by the County Administration, the Products Control Board or a central administrative authority according to the Act (1973:329) on Products Hazardous to Health and to the Environment or according to this Ordinance may lodge an appeal with the Fiscal Court of Appeal, unless otherwise indicated by the second paragraph of this section or by § 3 of the Act (1972:123) prohibiting the spread of pesticides from the air.

Any party dissatisfied with a decision other than those referred to in the first paragraph of this section that has been issued by the Products Control Board or a central administrative authority according to the Act (1973:329) on Products Hazardous to Health and to the Environment or according to this Ordinance may lodge an appeal with the King-in-Council. For the furtherance of the interest of consumers in the area of products hazardous to health and to the environment, appeals against such decisions may be lodged by an organisation that qualifies as a paramount organisation under the Right of Association and Negotiation Act (1936:

506). The provisions of this paragraph also apply to appeals against decisions of the Products Control Board in special cases involving the registration of pesticides.

§ 63 A public authority may require compliance with its decision notwithstanding the fact that an appeal has been lodged against it.

§ 64 Further regulations on the implementation of the Act (1973:329) on Products Hazardous to Health and to the Environment and of this Ordinance will be issued by the Products Control Board, except that in the case of movements of hazardous products by air, water or rail such regulations will be issued by the relevant central administrative authority.

§ 65 Regulations that are issued under this Ordinance and that manifestly are of material economic significance are subject to ratification by the King-in-Council.

1. This Ordinance comes into force on July 1 1973.
2. The Ordinance cancels and supersedes

the Ordinance (1963:441) on the implementation of the Poisons Act of December 14 1962 (No. 702),

the Ordinance (1963:442) on the implementation of the Pesticides Act of December 14 1962 (No. 703),

the Ordinance (1969:17) on the manufacture, import and transfer, etc., of phenyl acetone,

the PCB Ordinance (1972:34).

3. The Products Control Board, or in the case of movements of hazardous products by air, water or rail the relevant central administrative authority, is empowered to sanction such waivers of this Ordinance as are needed to ameliorate transitional difficulties encountered by the business community.

REFORMS IN THE ADMINISTRATION OF LABOUR PROTECTION

by Jaakko Riikonen, M. Pol. Sc.
Director-General of the National Board of Labour Protection

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REFORMS IN THE ADMINISTRATION OF LABOUR PROTECTION

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HISTORICAL BACKGROUND

In Finland the first protective labour law was implemented at the end of the 1870s, when the disadvantages of industrialization began to be felt. The legislation regulating the observance of these acts was formulated during the first decades of this century. The most important act concerning the supervision of labour protection was the Industrial Inspection Act, which was adopted by Parliament in 1927 and based on the Industrial Inspection Statute of 1917.

In the main, the Industrial Inspection Act remained unchanged for more than forty years. However, in the course of those years a number of attempts were made to amend this act and revise the system of labour protection. There were four successive committees which dealt with the problem and submitted proposals for the development of the system: the first committee was appointed in 1935, the second in 1947, the third in 1958, and the fourth in 1967. This last one was appointed to plan labour protection, but it also dealt with industrial inspection. However, the comprehensive reforms which the committees proposed did not come about. Only minor reforms were made and, in its essentials, the system remained unchanged.

It was not until 1971 that the Ministry for Social Affairs and Health appointed two committees to plan the reform of the Industrial Inspection Act and the re-organization of labour protection as a whole. On the basis of the proposals of these committees, Parliament adopted two bills, the Act on the Administration of Labour Protection, issued on July 24, 1972, and the Act on the Supervision of Labour Protection, issued on February 16, 1973.

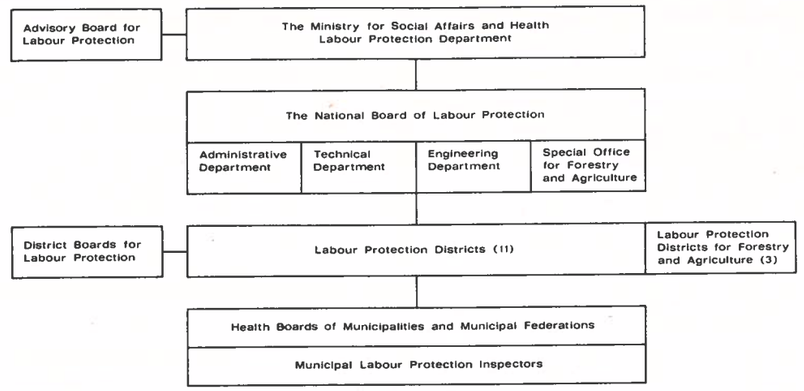
MAIN FEATURES OF THE OLD SYSTEM

The former Industrial Inspection Act included provisions concerning the supervision of labour protection and the organization of inspection. This act designated the Ministry for Social Affairs and Health as the highest authority supervising labour protection. Both the state and local authorities carried out industrial inspection. The state inspection authorities were responsible for the inspection of industrial establishments where at least five employees worked and where the installed machine power exceeded five kilowatts (seven horsepower). In 1970 there were roughly 9 400 establishments of this type employing about 401 000 people. The state inspection authorities also superintended public institutions, such as schools, hospitals, welfare centres and prisons, although regular inspections were not the rule. It was estimated that in 1971 there were some 30 000 establishments of this type with about 215 000 employees. Moreover, the state inspection authorities also supervised labour safety in felling and floating. The local authorities were responsible for the industrial inspection of small handicraft shops, work in agriculture and its subsidiary activities, retail shops, offices and warehouses, restaurants, hotels and cafeterias, as well as on temporary sites primarily for building. It was calculated that in 1970 there were roughly 88 800 places of this type providing 537 000 jobs.

For purposes of state industrial inspection, the country was divided into eight districts, while for the regulation of labour protection in felling and floating, three districts were used.

Local authority industrial inspection was performed under the control of state inspectors.

ORGANIZATION OF LABOUR PROTECTION



Each municipality was to have an industrial inspector, who was subordinate to the Health Board of the municipality.

THE NEW SYSTEM OF LABOUR PROTECTON

According to the new acts, labour protection is in practice based on inspection by official organizations and on co-operation between employers and employees at work.

ORGANIZATION OF THE ADMINISTRATION

The reform of the administration of labour protection, which finally took effect on October 1, 1973, has not led to the abandonment of the bipartite division of responsibility between state and local authorities; however, state inspection has increased substantially in importance. The Ministry for Social Affairs and Health still acts as the highest decision-making body and co-ordinates the organization of labour protection. In the Ministry, labour protection matters are handled in a new Labour Protection Department. Furthermore, an Advisory Board for Labour Protection works in connection with the Ministry; the 29 members of the Advisory Board represent labour market organizations and groupings of labour protection experts.

A new central board, the National Board of Labour Protection, was set up to take care of the ordinary administration and supervision of labour protection. The new board, which is subordinate to the Ministry for Social Affairs and Health, started its activities in Tampere on October 1, 1973, and is the first central board to be located outside the capital. The Labour Protection Department of the Ministry deals with general legislative matters, the ratification of certain permanent provisions and with international relations. The National Board of Labour Protection supervises the activities of labour protection officials, drafts provisions concerning labour protection, deals with offences, supervises labour protection training and information, and compiles statistics on occupational accidents. It also drafts stipulations concerning the working environment, health care at work, tools and machinery, and provides guidance and advice for employers and employees in matters concerning labour protection. Furthermore, the Act on the Supervision of Labour Protection, which came into force on January 1, 1974, makes the National Board of Labour Protection the highest supervisory authority in these matters. The highest decision-making body in the National Board of Labour Protection is the Council, a collegial body, composed of the Director-General who acts as Chairman and the Department Chiefs who serve as ordinary members.

The National Board of Labour Protection is responsible for administration in the 11 districts. Each province, except the semi-autonomous

province of Ahvenanmaa — Åland, makes up one Labour Protection District. Each district has a Labour Protection Office, which may, in turn, have affiliate offices if needed. The country is divided into three districts for the purpose of labour protection in forestry and agriculture.

The expert authority in the Labour Protection District is the District Labour Protection Board. The Head of the District acts as Chairman of the District Board which has nine other members who generally represent labour market organizations. The functions of the District Board are similar to those of the Advisory Board; i.e., it deals with matters of principle concerning labour protection, makes proposals, and tries to promote co-operation between employers and employees in the field of labour protection. The forestry and agricultural District Protection Boards have eight members.

At the beginning of 1974, nearly 340 officials were employed in the state administration of labour protection, of these 21 were employed by the Labour Protection Department of the Ministry for Social Affairs and Health, 107 by the National Board of Labour Protection and 211 by district authorities. Compared with the former system, the number of persons working in this field has more than trebled.

The Municipal Health Board acts as the key labour protection authority on the local level. The new act charges the municipalities and federations of municipalities to employ full-time labour protection inspectors, who are subordinate to the Health Board. In certain cases the Ministry for Social Affairs and Health may permit a municipal health inspector to act as a labour protection inspector or may allow two or more local authorities to employ a single inspector. Municipalities receive central government funds to pay the salaries of the inspectors. Municipal labour protection is supervised by the state labour protection authorities.

The state and local governments have divided their labour protection activities so that the municipal labour protection official supervises establishments with less than ten persons and in which no equipment, substances, or practices are used which might cause harm to the employee or cause a sanitation hazard. Accordingly, the state labour protection authorities are to inspect construction sites and public institutions. Previously the local authorities were responsible for this. A total of 1 600 000 persons will be guaranteed labour protection through these activities.

On the local level the new system of labour protection is to be ready by the end of 1976. At the moment it is impossible to assess exactly how many municipal labour protection inspectors will be appointed, but it is estimated that their number will exceed 200.

THE SUPERVISION OF LABOUR PROTECTION AND CO-OPERATION BETWEEN EMPLOYERS AND EMPLOYEES

The Act on the Supervision of Labour Protection, which came into force on January 1, 1974, extended substantially the powers of labour protection officials. One of the defects of the former Industrial Inspection Act was the fact that the authorities were not able to enforce their recommendations. The new act gives the inspector the authority to give the employer instructions to take measures necessary for ensuring the safety of his employees. The official is also empowered to have measures carried out at the cost of the employer, or to prohibit the use of dangerous practices, machines or equipment, or to stop work in an establishment or in some part of it.

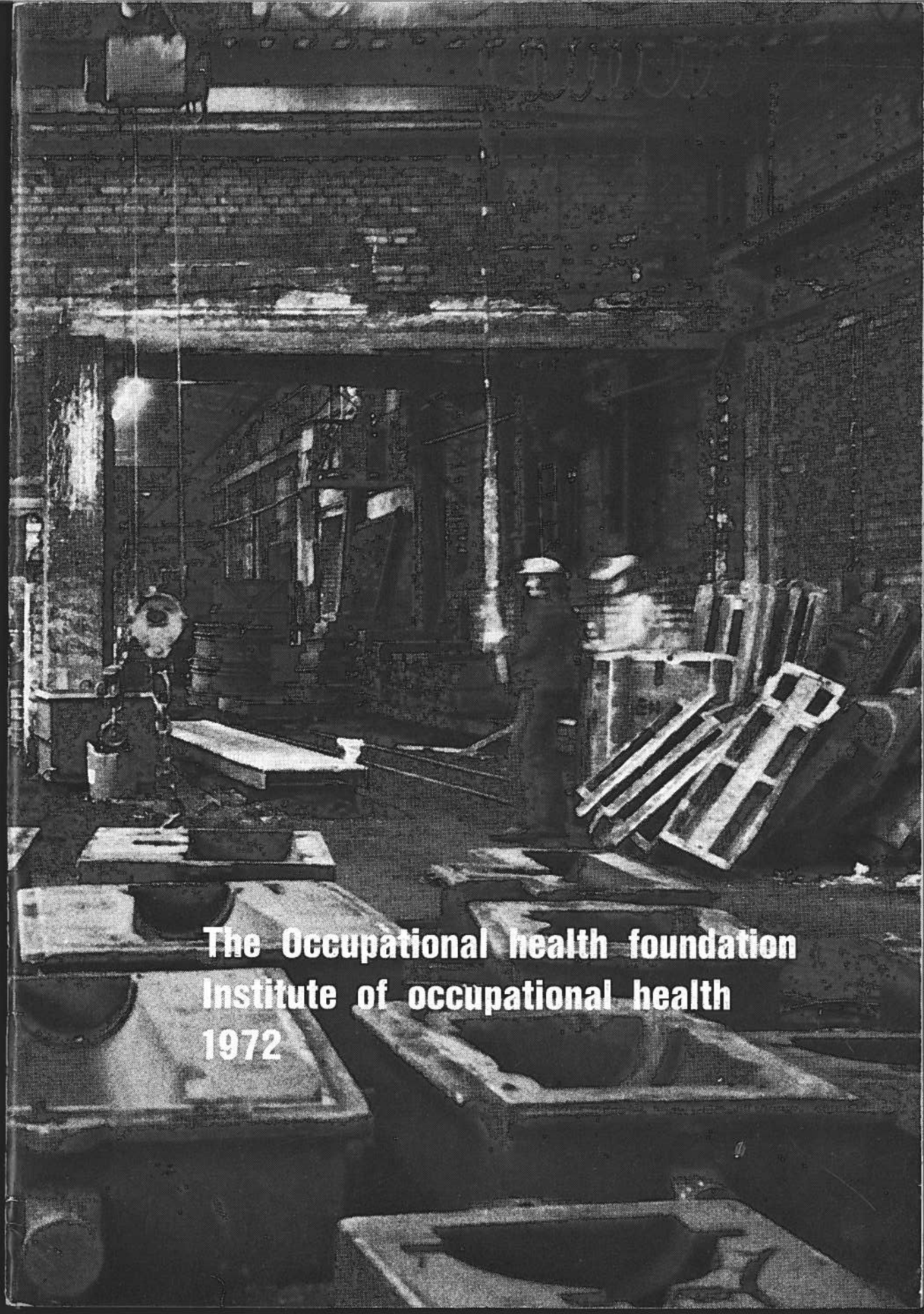
However, the measures promoting labour protection are not to be imposed solely by the labour protection officials. The Act on the Supervision of Labour Protection calls for co-operation between employers and employees in these matters. Accordingly, the employer shall appoint a labour protection supervisor, and in establishments with at least ten employees, the employees shall choose from among themselves a labour protection representative and two deputies for a period of two calendar years. Salaried employees also have the same right.

The labour protection representative is to be given time during working hours to see to labour protection matters. The labour protection representatives are authorized to obtain all information relevant for ensuring safety and sanitation and for making proposals and suggestions on these matters to the employer. Furthermore, the labour protection supervisor and the representatives shall be present at labour protection inspections, if the protection official considers it necessary.

In addition, in order to promote labour safety and sanitation, a Labour Protection Committee is to be appointed for two calendar years at a time in establishments which regularly employ 20 or more persons. This Committee is a joint body composed of representatives of the employer, the workers and the salaried employees; half of the members of the Committee will be chosen by the workers, one fourth by the salaried employees and one fourth by the employer.

FUTURE PROSPECTS

As labour protection at work is largely based on co-operation between the employers and employees, the future development of labour protection will greatly depend on the success of this co-operation. The number of inspectors and related personnel is limited, and it may not be possible to increase it substantialiy in the coming years because of the lack of public funds. Accordingly, the labour protection authorities may, even in the future, act only as advisory and co-ordinating bodies. Apart from intensifying the supervisory activities as provided by the act, main attention should be focussed on the development of labour protection training and research, and on the continuous monitoring of sanitation at work. This calls for co-operation between the various authorities responsible for health care in setting up regional occupational health centres and co-ordinating the activities of the technological research institutions.



The Occupational health foundation
Institute of occupational health
1972

CONTENTS:

The Occupational Health Foundation and the Institute of Occupational Health, Helsinki Finland, Annual report 1972

Edited by Martti J. Karvonen, M.D., Ph.D.

Labor Protection in reform and the Institute of Occupational Health

The responsibility for labor protection has traditionally been given to various bodies. In countries which became industrialized early, labor protection, too, started early and created its own occupational health service. In Finland, however, as in many other countries, the occupational health service is joined to the general health services. Industrial hygiene resources have been concentrated to the Institute of Occupational Health. Up until 1972 the Accident Prevention Association was responsible for accident prevention at work, and since then it's successor, the Occupational Safety Association, together with some insurance companies, have taken care of this activity. Social labor protection has been covered primarily by labor market organizations and by social insurance, while the Labor Inspection checks all sectors of labor protection.

The aim of labor protection is to guard the worker against physical and mental damage induced by work and to guarantee him a just reward and social security. The scope of labor protection is close to that imposed by the World Health Organization on health authorities, i.e. to further the physical, mental and social well-being of man. However, the social tasks of labor protection cover a much wider field of human needs than those dictated by health alone.

Since 1971, the labor market organizations have jointly been developing an infrastructure of occupational health and safety committees for every enterprise. A joint body, the Work Safety Center, activates the committees and helps them solve problems. In cooperation with other organizations the Center has launched country-wide safety education and information projects.

In 1972, new legislation on labor protection was enacted by the Finnish Parliament. The laws redefine the powers and duties of the Labor Inspection, change its organization, and considerably increase its personnel. With its new resources the Labor Inspection will be able not only to control but also actively to improve preventive labor protection at places of work.

Since the organization of labor protection was previously not able to meet increasing demands because of very limited resources, the Institute of Occupational Health had to take over some vital aspects of its work. Now after the reactivation of labor protection, the Institute will again be able to concentrate only on occupational health care and safety.

In January 1972, the Ministry of Social Affairs and Health appointed a committee to clarify the role of the Institute of Occupational Health and to reconstruct its activities. This was a continuation of the work started by the Committee on Occupational Health a few years earlier. The recommendations were presented in May 1972 and they have been positively commented upon since from all parties concerned.

The Ministry's committee felt that the Institute should continue to deal with research, education and training, information and publishing, and services. Research and development should be expanded insofar as additional public funds are awarded to the Institute. The Institute will act as a national advisory and reference center so that industrial hygiene measurements and other corresponding services will be transferred to the Labor Inspection and to the planned regional units of the Institute. The place of the occupational health service within the general medical services, which also are in the process of being reformed, has not yet been definitely determined. When this is done it will undoubtedly increase the educational and training duties of the Institute. But since the Institute's resources are too limited to meet the ever expanding demand for tutoring, universities and colleges should also include occupational health and safety education in their programs. The Institute will, however, continue to serve labor protection and other parties concerned by producing and distributing printed information.

The developing labor protection organization thus will take over tasks which the Institute of Occupational Health performs today. For example, some public health and health care services, such as rehabilitation and air pollution control, were originally started and developed by the Institute, but they should during the next few years be transferred to other units. Finland is in need of a comprehensive public health, research and development institute which would take care of these activities.

Occupational Health Foundation

The activity of the Foundation has even more distinctly than before concentrated on two main tasks, i.e. the planning and preparing of national occupational health care and the development and administration of the Institute of Occupational Health. The decision to establish a regional unit in Oulu was made and work began on premises formerly belonging to the University of Oulu as soon as necessary funds were awarded. The regional unit is a part of the national institute and operates in close liaison with the University of Oulu and the regional labor protection authorities.

A committee was appointed to negotiate with the parties concerned about the possibility of taking the Department of Rehabilitation from the Institute and forming an autonomous rehabilitation institute under the auspices of the Foundation.

The agreement between the State and the Institute was terminated by the State in December 1972. A working group was appointed to prepare a new agreement to be valid from the start of 1974.

The National Pensions' Institute awarded Fmk 440,000 for health research of stone- and construction workers. Thus the Institute's financial situation was 0.8 million Finnish marks better than in 1971. The money the Institute earned itself was Fmk 10,700,000 in 1972, an increase of Fmk 1,500,000 from 1971. The total income of Fmk 14,600,000 shows an increase of 18.6 % over 1971.

In 1972 the Foundation received Fmk 2,500,000 from the Slot Machine Association for the support of the Institute. The Ministry of Social Affairs and Health awarded Fmk 1,079,000 from accident insurance funds.

The Foundation has, during the past year, distributed a total of Fmk 16,975 as grants for research and study trips abroad.

Patrons' Association of the Institute of Occupational Health

The annual meeting of the Patrons' Association of the Institute of Occupational Health was held in June 1972 and reports on activity and finances were approved.

At the end of 1972, 19 cities, 79 private enterprises, 7 insurance companies and 37 employers' and employees' organizations were members. These 152 members paid Fmk 43,600 in membership fees, Fmk 45,000 of which was used to support the Institute.

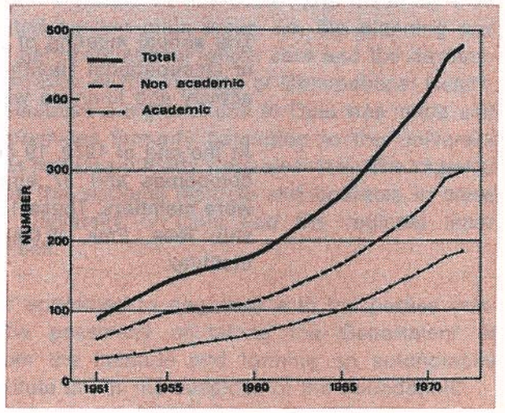
Institute of Occupational Health

During 1972 the long-term planning of the Institute's activity took a big step forward when the research program was completed. At the same time corresponding programs for education and information were being prepared.

In order to strengthen the economic-administrative capacity of the Institute another assistant director was appointed from the 1st of June. He is responsible for questions of economy, administration and personnel administration. During the summer an economic planning group was formed.

Some activities were reorganized at the suggestion of the committee appointed by the Ministry of Social Affairs and Health. In the Department of Medicine the main emphasis was transferred from general occupational health care of workplaces to actual occupational medicine by decreasing the number of patients by 7,000. At the same time the office of air protection and noise abatement was transferred out of the Institute.

The total number of employees by the end of the year was 475.



The level of education of the Institute's personnel.

STAFF 31. 12. 1972

	Med.	Ind. hyg.	Physiol.	TB	Psych.	Rehab.	EB	Gen.	1971	1972
Doctors	46		4			8	5	1	66	64
Psychologists	4		2		11	8			27	25
Chemists		7	1	5					7	13
Engineers		5	2	4					11	11
Other academic personnel	8	5	8	5	17	10	6	9	65	68
Occupational health nurses, nurses & physiotherapists	37		4			6			51	47
Ward maids, X-ray technicians, lab. nurses, masseurs, receptionists and other assistants at medical examinations	39		6	2		5	1		67	53
Technicians, lab. experts, precision mechanics, work evaluation personnel, non-academic research assistants and technical assistants	5	13	4	25	1	4	4	3	18	59
Office personnel	24	4	4	4	2	5	6	37	92	86
Housekeeping and maintenance personnel	8	1	1	4	1			31	51	46
Apprentices		2						1	10	3
Total	171	37	36	49	32	46	22	82	465	475

Research activities

The need for a definite research policy and for coordination of the research activities of the Institute led to the nomination of a working group at the end of 1971. Its immediate task was to define the general objectives and aims of the Institute's research as well as the criteria to be used in setting the priority areas. The working group presented its proposals in March 1972. According to one of its suggestions, the Board of Trustees appointed a Research Committee with representatives from the Institute, the Ministry of Social Affairs and Health (MSAH), the National Board of Health (NBH), the Finnish Employer's Confederation (FEC), and the Confederation of Finnish Trade Unions (CFTU).

The main objective of occupational health research is to increase the level of occupational health and safety as well as to equalize the distribution of these utilities in the working population. Occupational health here covers the physical, psychological and social aspects of health, when dependent on work and the working environment. Equalizing the presently differential distribution of occupational health and safety implies directing research toward occupational problems with high risk or toward known or suspected health requirements. Research on rehabilitation and non-occupational environmental protection will continue at the Institute as long as the corresponding departments stay within it.

The following areas were defined as objects of the Institute's research:

1) harmful chemical, physical and social agents and conditions in the environment, their effects on health and safety;

2) health and safety risks due to working itself (e.g., ergonomic risks);

3) interactions of these effects and risks;

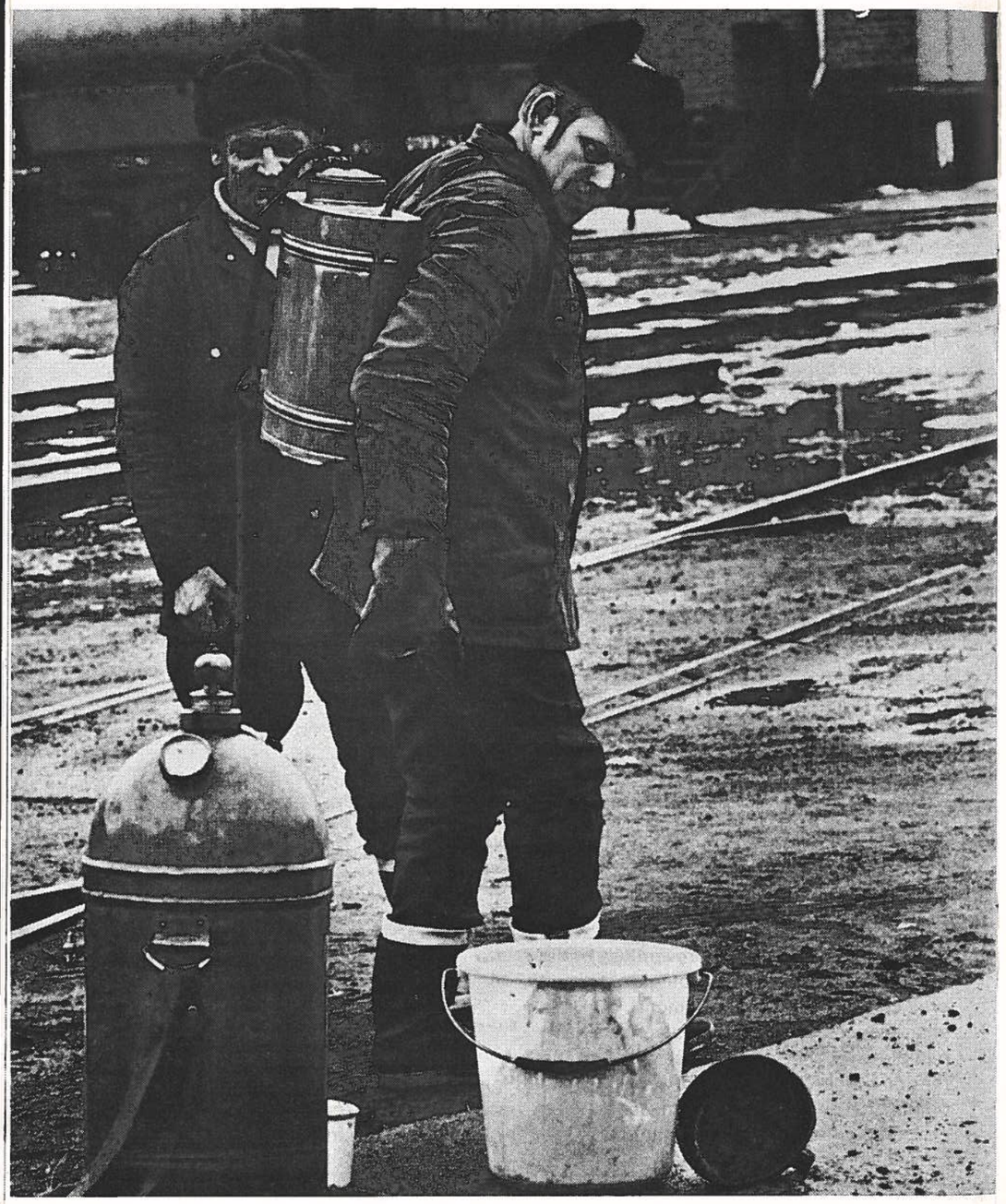
4) methodologic developments and applied research on improvement techniques of the working environment.

From the cost-benefit viewpoint, the emphasis of occupational research has to shift from the clinical to the preventive; yet, capacity for research in both areas has to be maintained.

This narrowing of the area means that several present research activities, such as those dealing with general medicine or public health, will disappear from the Institute's program when the projects now under way have been completed.

Seventy-seven projects are listed in the present research inventory. Some of them are composed of several sub-projects. Twenty-two projects concern exposure- or work-specific epidemiology or social research, e.g. asbestos, raw cotton treatment, lead, carbon disulfide, mercury, styrene, herbicides; granite, forest, foundry and construction work; and longshoremen. Some public health type projects are concerned with coronary heart disease epidemiology, two of them preventive trials. Examples of non-epidemiologic medical projects are the development of ultra sound technique in the diagnosis and pathology of the lungs, assessment of the role of lymphatic and blood vessels in the origin of pleural plaques, and comparison of different therapeutic techniques in low back pain. Five rehabilitation studies are in progress. The physiological research is directed toward heat transfer in the human body, physical activity, and cardiac performance. Ergonomic research is presently concentrated on office work, muscular fatigue in repetitive work, typewriter and computer maintenance, and printing shop problems. The psychological studies are centered on mental health problems connected with work, occupational analyses, and validity of selection and job placement tests. Accident prevention is represented by two projects. Physical description of working environments deals with dusts, chemicals, noise, and vibration; and studies of the general environment with air quality in rural, industrial, urban and base level areas, water quality, and developments in sampling and analysis techniques.

Some projects are described below. A more extensive treatment of the research projects appears in the recent volume of »Current Research Projects of the Institute of Occupational Health».



Subclinical effects of carbon disulfide

M. Tolonen, M.D.
A-M. Seppäläinen, M.D.
H. Hänninen, M.Sc.
M. Mäenpää, M.Sc.
Ch. Raitta, M.D.
T. Partanen, M.Sc.
M. Nurminen, M.Sc.

This epidemiological project, aiming at describing the picture of subclinical carbon disulfide poisoning, was started in 1972. The exposed group comprises 343 men exposed to carbon disulfide in a viscose rayon factory for five years or more, representing the full spectrum of carbon disulfide effects from clinical poisoning to no symptoms at all. The control group comprises 343 men matched with respect to age, birth district, type of work and social status. In all 100 exposed and 100 unexposed men have been selected from these cohorts for electroneuromyographic examinations; 60 exposed and 60 unexposed men for electroencephalography; 100 exposed and 100 unexposed men for neuroophthalmologic examinations (fluorescein angiography, aculosphygmography, fundus photography) and 220 exposed and 170 unexposed men for psychological testing which consists of a questionnaire, an interview, personality tests, testing of sensorimotor speed and visual accuracy, psychomotor performance, memory functions and intelligence. The results will be available by the end of 1973.

The health effects of 2,4—D and 2,4,5—T herbicides on exposed workers. A clinical and epidemiological study

V. Riihimäki, M.D.
J. Hassi, M.D.
S. Hernberg, M.D.
S. Asp, M.Pol.Sc.
A-M. Seppäläinen, M.D.
P. Karli, M.D.

The study was initiated by public health officials to clarify the claimed disease, death and disablement consequences of brush spraying with 2,4-D- and 2,4,5-T-containing herbicides. The exposed workers were employed by the State Highway Administration, the State Railroads, and the National Board of Forestry. The workers were mostly knapsack sprayers but one employer (State Highways) used a spraying rig mounted either on a truck or a tractor. No measurements on the quantity of personal exposure to 2,4-D or 2,4,5-T have been done.

The purpose of the study is to find out

1) whether there is a clinical disease or detectable pathological changes common to a great number of sprayers, i.e., a complex of symptoms and signs representing an intoxication, in the function of the nervous system and other organs
2) whether there is an excess mortality in various diseases, malignant diseases in particular, among the exposed population.

The study is divided into three substudies:

1) A group of 30 sprayers, with the longest exposure in a railroad district where »cases» were first reported by the mass media, was selected and clinically studied. The examination included a medical and working history, a physical examination, laboratory and X-ray examinations, neurophysiological examinations (EEG and ENMG) and a neurological examination. Neurophysiological and neurological findings are compared to those in a control group representing the healthy industrial population, age and sex matched.
2) An epidemiological mortality study. About 1,900 male subjects sprayed for at least two weeks during 1955—1971. Total and cancer mortality are calculated and compared with national mortality statistics, and also internally analyzed as dependent on exposure. A prospective follow-up of the mortality will be arranged.
3) A group of 20 persons with symptoms of illness during and after spraying were selected from 200 people who reported adverse effects from handling herbicides. The majority of them had long experience with spraying and the most common complaints were headache, giddiness, irritation in eyes and respiratory tract. The subjects are submitted to a clinical examination supplemented by psychological testing.

Changes in peripheral circulation in lumberjacks using a chain saw

T. Kumlin, M.D.
M. Wiikeri, M.D.
V. Viljanen, M.D.
S. Sundberg, M.Sc.

An essential contributing factor in the beginning of traumatic vasospastic disease is an occasional vasoconstriction in the hands. This may later lead to organic changes. About half of the regular lumberjacks using a chain saw year round display Raynaud's syndrome. The reproduction of this syndrome is a difficult and unreliable diagnostic method when done in the laboratory. The present pilot study concerns a vibration simulator and circulation in the fingers in connection with the simulation. The circulation is followed with a photoplethysmograph and ultra sound equipment. In some cases, a complete loss of pulse was observed during exposure; this is a serious indication for terminating work with vibrating tools. Clinical and X-ray data are included and analyzed in relation to the simulation, plethysmographic, ultra sound and exposure data.

Working conditions in foundries and mortality of foundry workers

Coordinator: S. Hernberg, M.D.
Data processing: T. Partanen, M.Sc.

In 1971, the labor market organizations agreed that a survey of the working conditions in all Finnish iron and steel foundries be undertaken by the Institute of Occupational Health. The survey comprises four subprojects; it is the most extensive research project at the Institute.

1) Survey of silicogenic dust concentrations

E. Siltanen, M.Sc.
M. Koponen, M.Sc.
B. Engström, M.Sc.
J. Reponen, B.Sc.
A. Kokko, M.Sc. (Eng.)

Dust measurements are made in all iron and steel foundries in Finland, as well as in some other metal foundries, altogether about 90 foundries. By the end of 1972, 20 foundries had been studied. Dust samples are collected on millipore filters or, using a MSA Mixt-Flow Air Sampler, on polystyrene filters. The fine fraction of the dust is separated by liquid elution or liquid sedimentation, and the contents of quartz, crystobalite and tridymite are determined by X-ray diffraction. The individual exposure of selected workers is further evaluated using personal samplers (Casella or MSA Personal Sampler). The purpose of the survey is to get an overall impression of the dust situation in Finnish foundries. In addition, the data obtained will serve as a basis for preventive measures on the individual foundry level. For this purpose, special attention is paid to the effect of various factors on the dust conditions, e.g., different systems of ventilation, seasonal variations, different working processes, etc. It is hoped that the results of this study will serve as a basis for regulations and control of dust in foundries.

2) Survey of potentially harmful chemical substances

M. Virtamo, M.Sc.
A. Tossavainen, M.Sc.

All foundries have received a questionnaire on the chemicals in use. On the basis of the replies, the most harmful substances have been selected for closer study, among them resins used as core binders.

Twenty foundries will be subjected to detailed measurements, four steel foundries, eight iron foundries and eight other metal foundries. In addition to the chemicals used as core binders, metal fumes will be measured from all foundries. About 20 metals will be submitted to comparative analyses by different methods.

Preliminary data have revealed that high concentrations of carbon monoxide are liberated in connection with casting and cooling of the moulds. The concentration of CO will be measured from various sites in the foundries during various types of work. Also the concentration of carbon monoxide in exhaled air will be measured.

3) Mortality and morbidity of foundry workers

R. Kärävä, M.D.
R-S. Koskela, M.Pol.Sc.

This study deals with effects of foundry work on mortality, morbidity, age and indications for retirement. All skilled workers with at least a year's employment between 1950 and 1970 in a foundry (about 20 foundries are selected for this survey) from the basic cohort from which about 2,000 men will be selected for closer study. The following data will be collected: morbidity, sickness absenteeism, turnover, age, cause of retirement and cause-specific mortality and mean survival time.

4) Prevalence of silicosis, heart disease, hearing loss and eczema

R. Kärävä, M.D.
M. Wiikeri, M.D.
E. Vaheri, M.D.
V. Pirilä, M.D.

All workers presently employed in the 20 foundries selected for the survey (2) will be screened by chest X-ray, electrocardiography and audiometry. The purpose of the screening is to estimate the prevalence of silicosis, hearing loss and cardiac disease. The skin of the face, neck, hands and arms will be examined by a nurse. When any sort of skin disease is present, a color photograph will be taken and sent to a dermatologist for evaluation. On the basis of inspection of the pictures, those workers requiring further examination will be selected.

Styrene exposure in the reinforced plastics industry

E. Härkönen, M.D.
P. Kalliokoski, M.Sc. (Eng.)
S. Hietala, M.Sc. (Eng.)

In order to evaluate styrene exposure in the reinforced plastics industry, air samples are collected by means of a portable pump from the breathing zone of the workers into active charcoal tubes during an 8-hour working day. The method has been developed at the Department of Industrial Hygiene. The average concentration of styrene was observed to vary within the range of 1—180 ppm. The concentration can be kept under the present TLV-level by means of efficient general ventilation.

In connection with the study a biological test for styrene exposure based on the mandelic acid concentration in urine is being sought. Present observations suggest that an 8-hour exposure to styrene at the TLV-level results in a urinary mandelic acid concentration of about 2,000 ppm.

Morbidity, mortality and living conditions of lumberjacks

K. Nygård, M.Pol.Sc.
P. Fabritius, M.D.
T. Kumlin, M.D.
J. Nummi, M.D.
M. Nurminen, M.Sc.
S. Sundberg, M.Sc.
M. Wiikeri, M.D.

An evaluation of effects of lumbering on health, working capacity, and mortality is attempted with a pretested questionnaire mailed to 3,000 former or present lumberjacks with a minimum of 20 months' exposure to forest work. The questions relate to risk factors (occupational environment, living conditions, and habits), morbidity, working capacity, views on occupational health and safety deficiences, need for occupational health care, and suggestions for rearranging compensation and pension systems.

Part of the respondents will be selected for further measurements concerning lumbosacral diseases, diseases due to vibration, physiological aging and effects of noise. The lumbosacral diseases will be assessed by lumbosacral X-ray and clinical examination. The effects of vibration are to be assessed by clinical examination and microfocus X-ray of hands, as well as by evaluation of peripheral circulation. Physiological aging will be measured by a darkness adaptation test of the eye, reaction time tests, vibration sensitivity of the skin, audiometry, and an osteoporosis index developed for interpretation of hand

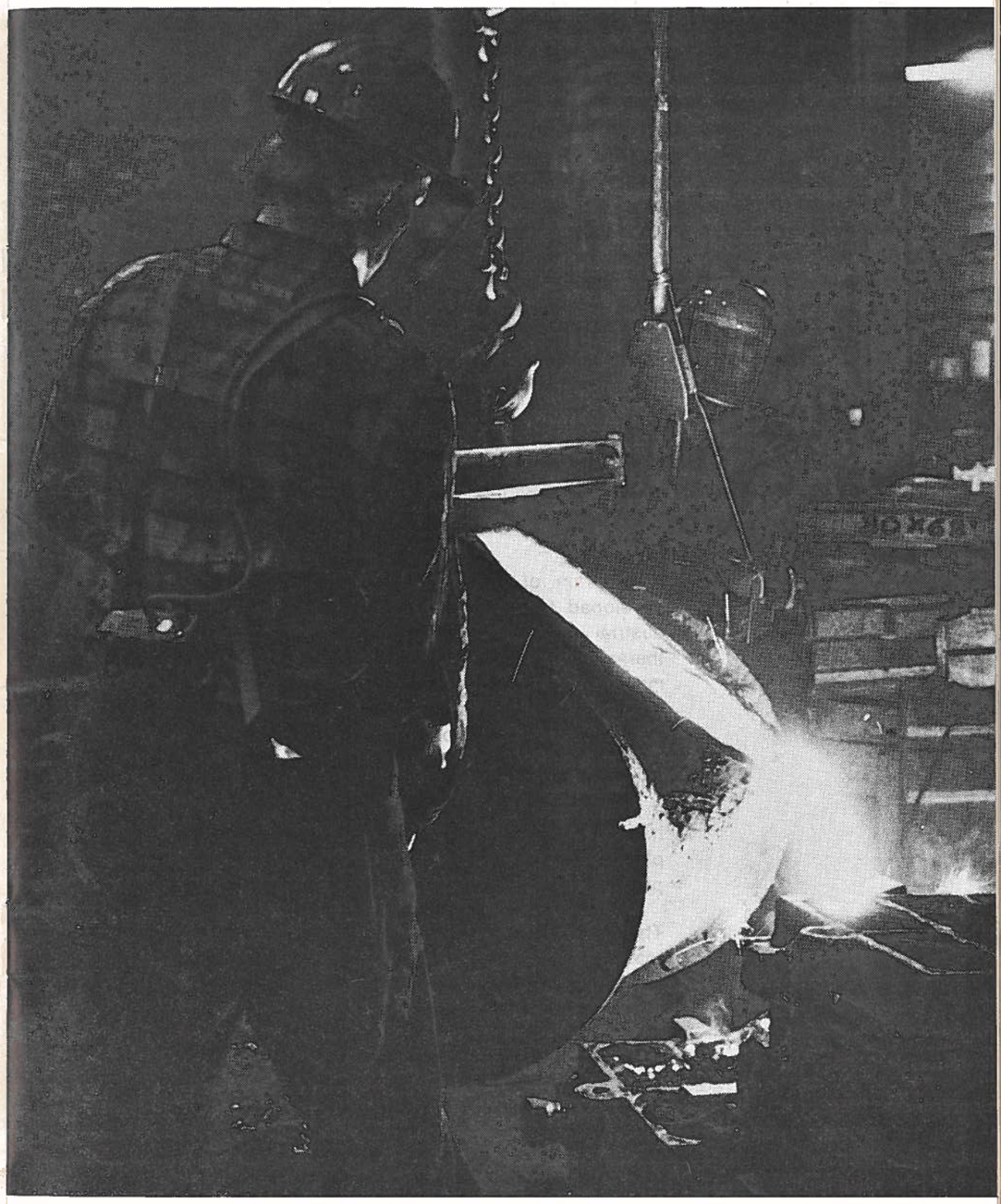
X-ray. In addition, the psychological Digit Symbol Test, estimation of maximal oxygen uptake and anthropometric measures will be used.

On the basis of the results suggestions for occupational protection of lumberjacks will be made.

Community air quality in industrial areas

A. Laamanen, Ph.D.
A. Ryhänen, M.Sc. (Eng.)
Y. Rautanen, M.Sc.
A-L. Riekkinen, M.Sc.
R. Kartastenpää, M.Sc.
K. Markkanen, B.Sc.

This study is an evaluation of community air quality in relation to industrial activity. Special attention is paid to pollutant components, methodological developments and control techniques. The basis for the general evaluation of community air quality is specified for various branches of industry. Case studies from the pulp and paper industry, ore processing, iron and steel production, fertilizer manufacture, production of construction and structural materials, lead-emitting industries, oil refineries and energy production are included. An essential part of the study is an air protection system model for industrial town planning, augmented by suggestions for standards to be used in industrial planning and surveillance, and viewpoints on protection economy in industry.



Training and education

The training activities of the Institute during 1972 were characterized by the same increasing need for training as there had been during 1970 and 1971. This growth has been shown in the demand for courses, seminars and lecturers. Because of limited resources, some training activities have been transferred to other institutes.

Committees appointed by the Ministry of Social Affairs and Health have planned national occupational health and safety training. Representatives of the Institute have participated in this work. The Institute's internal training and education committee has been responsible for general planning, while the training office takes care of coordination and practical work within the Institute.

A program of expert training and specialization has been developed for industrial hygienists. Similar programs for industrial psychologists, industrial nurses and industrial physiotherapists are being prepared. So far only the training requirements for physicians in industrial medicine have been approved by the Finnish National Board of Medicine. They include a three-year specialization at the Institute.

Thirty-eight courses and seminars were organized in 1972 (30 in 1971). The 1,400 students (1,470 in 1971) were occupational health and safety specialists and other personnel from workplaces. These figures do not include the 19th annual Occupational Health Days in which 800 persons participated.

The courses can be classified according to the following main topics: industrial medicine, industrial hygiene, occupational safety, ergonomics, rehabilitation, personnel selection and occupational health (general).

Occupational safety campaigns were arranged. In Lahti and Vaasa members of the Institute lectured at and inspected various institutes and workplaces.

Members of the staff lectured outside the Institute at both university and basic levels. Most of the lectures were continuing

education for people from workers' and employers' organizations, workplaces and enterprises.

Written material has been prepared both in order to improve the effectiveness of the training given by the Institute and to help teachers outside the Institute. The teaching packages now ready in ergonomics and in occupational safety include written lectures, instructions, supporting material and slides.

People from the Nordiska Hälsovårdshögskolan (Scandinavian School of Public Health) in Göteborg attended lectures at the Institute, while members of the staff of the Institute have lectured at international congresses and expert meetings.

Courses for the Institute's own personnel have been arranged for lecturers, secretaries, office personnel, field personnel and new workers. Research workers have had their own advanced training program. Elementary and secondary level language courses have been arranged in English and French. Intra-institute training has increased. Members of the staff have attended courses outside the Institute, in Finland and abroad.

Information and publication activity

The increasing demand for knowledge about occupational health and safety was demonstrated by the number of inquiries for material and publications. When occupational safety activity was effectuated on the national level, we began to get an idea of what information and training material the public wanted. Emphasis was put on getting knowledge to the people in an easily digestible, useful form.

Information

In 1972, 12 press conferences were organized, two of them were especially addressed to editors from the labor market press. Four press releases completed the contacts with the daily press.

A total of 226 foreign visitors from 27 countries visited the Institute during 1972. Sixty of them came individually and stayed here a total of 378 days. The Finnish visitors were mainly nursing students, and members of occupational safety and production committees.

Publications

The most demanding task has been the editing of the Työ Terveys Turvallisuus-periodical (»Work Health Safety»). Ten issues were published and its circulation was 38,000. A poll is being taken to find out how the periodical corresponds with the expectations and information demands of the readers.

One English and ten Finnish scientific reports were published in the series, »Reports from the Institute of Occupational Health». The scientific periodical »Work-Environment-Health» was published by the Institute of Occupational Health from 1962 to 1971. At the beginning of 1972 »Work-Environment-Health» became an independent journal under the auspices of the Occupational Health Foundation of Finland. The editorial board was extended to include leading scientists from the Scandinavian countries with the ultimate aim of developing the journal into an inter-Scandinavian periodical covering the fields

of occupational hygiene, preventive medicine, occupational toxicology, accident prevention, work physiology, work psychology, ergonomics, rehabilitation and environmental pollution. In 1972, three issues were published. The number of subscriptions has increased rapidly and the circulation now covers about 40 countries.

Twelve issues of two popular series came out in 1972, and new editions of nearly all earlier published guide booklets on nutrition, physical therapy, and applied ergonomics were published. A total of 45,000 copies of the ergonomic check list and instruction booklet have been printed.

The occupational safety teaching package consisting of 21 hours of lectures, 160 slides, and supporting material was distributed towards the end of the year. A similar package on ergonomics is available.

The Institute distributed via its own and other information media 20 million pages of written material.

Service activity

During 1972 the emphasis has been transferred to activities that directly improve the health of the working population or protect the individual from health hazards. An illustration of this is that the number of people treated at the Department of Medicine has decreased while the number of investigations done by the Department of Industrial Hygiene at places of work has increased.

General Department

When the new post of assistant director was filled in June, the General Department became a planning as well as an executive unit. The new assistant director is the head of the General Department and the Institute's personnel director. The department is divided into the following offices and units: administration, financial, real estate and maintenance, information, and training and education, as well as the library and the typing pool.

A permanent economic planning group was formed to serve as a coordinating organ between the advisory committee and the departments in matters of economic administration and cost accounting.

The group prepared an account system which is to be adopted at the beginning of 1973. From that time on bookkeeping, cost accounting and wage accounting will be done by data processing.

In the autumn, an experiment in departmental democracy was begun. There will be regular department meetings to which the units will select representatives. The aim is to give the employee the chance to influence the department's activity, to improve communications and to make work more effective and pleasant.

Library

The library, being the main Finnish library in the field of occupational safety and health has served the staff of the Institute and also been open to the public. In addition to books, reports and periodicals, the material in use includes a rather large, classified collection of reprints and photocopies as well as the

International occupational safety and health information centre (CIS) card file. The library has participated in the inter-library loan system and maintains a photocopy service. Information service in the form of literature searches and answering subject inquiries has been provided.

Department of Medicine

The main emphasis has been on the diagnosis, care and prevention of occupational diseases and on health examinations. The focus of long-range planning has been placed on developing occupational medicine activities. As of July 1972 there were 10 young doctors specializing for three years in occupational medicine at the department.

The number of outpatients with suspected occupational disease has grown considerably and was 4,445 by the end of the year. The majority of the visits (2,000) were for dermatological problems. The staff members serve as consultants, visit workplaces and do research.

Because of the Institute's new policy to concentrate on preventive medical services, occupational research and training, the number of working people eligible for care by the Institute was reduced by 7,000.

The field clinic, consisting of a mobile unit and a stationary unit, has concentrated on epidemiological studies of various occupational groups. In the spring of 1972 the clinic moved to an industrial district 4 kilometers from the Institute where it serves enterprises in the area as an occupational health center. The section has studied granite workers, longshoremen, prisoners of war, as well as byssinosis, styrene and carbon disulfide poisoning.

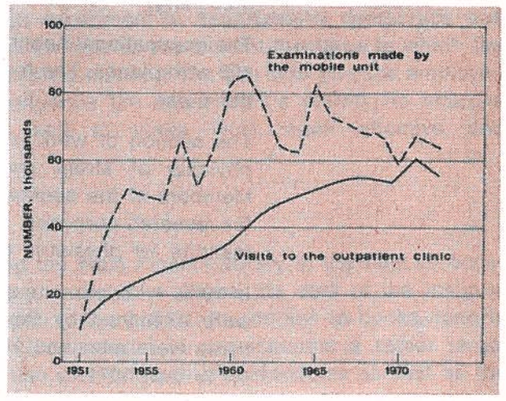
The occupational health nurses acted as consultants and visited 102 workplaces. The Institute's own personnel paid 703 visits to the nurse.

The section of work physiatrics has concentrated on the prophylaxis of strain damage of the musculoskeletal system. Members of the section visited workplaces as consultants and for research purposes. A total of 33,385 visits were made to the Institute for physiatric care.

In 1972, 1,129 persons suspected of having occupational disease were examined by the unit of occupational medicine; 849 of these were men and 280 were women. This is an increase of 45 % over 1971.

	1971	1972
Frequency		
Repeated visits	245	391
One visit only	536	738
Total	781	1,129
Occupational disease		
Diagnosed	512	660
Uncertain	48	86
No disease could be diagnosed	221	383
Total	781	1,129
Requests for examination came from		
Insurance company	140	177
Physician at the workplace	166	279
Private physician	123	243
Employer	264	291
Own initiative	15	33
Sickness insurance	8	9
Hospital	63	87
Local pensions' institute	2	10
Total	781	1,129

The most common exposures	Number of patients examined	%
Vibration	167	15
Aromatic hydrocarbons	141	12
Inorganic lead	109	10
Aliphatic hydrocarbons	95	8
Asbestos dust	89	8
Quartz dust	88	8
Noise	56	5
Other inorganic dusts	50	4
Carbon disulfide	41	4
Cotton dust	38	3



The character of the field clinic examinations changed in 1968. Fewer persons are now examined but more comprehensive health screening projects are carried out.

Department of Epidemiology and Biometry

The increasing importance of epidemiology in the field of occupational health, and the great number of epidemiologic research projects raised the question of coordination and integration. The Department of Epidemiology and Biometry was established at the beginning of 1972 as a solution to this problem. It consists of a section for biometry, a section of epidemiology and social sciences, and three ad hoc project groups. The main functions of the department are defined as follows:

1) Coordination of all epidemiologic research activity (in the Institute); planning and carrying out epidemiologic projects;
2) Carrying out statistical operations and data processing (for the Institute);
3) Planning and carrying out sociologic and sociomedical research projects;
4) Taking part in the development of the Institute's scientific research program;
5) Acting as consultant in problems related to general research methodology, epidemiology, biometry, and social sciences;
6) Organizing training programs for junior research workers.

All these activities started in 1972. The most extensive research projects concern a nationwide study on occupational lead exposure, environmental lead exposure, and the picture of subclinical carbon disulfide poisoning. In 1972, a nationwide survey of foundry environment and health of foundry workers was started as a joint project with the Department of Industrial Hygiene. The department has taken part in a number of other epidemiologic projects.

In August, an international advanced course on epidemiologic methods in occupational health was arranged with 36 participants from 10 countries. Professor Olli Miettinen from Harvard University, Boston, was the teacher. In addition, regular seminars on research methodology have been arranged during 1972. The department has also taken part in the training of specialists in occupational medicine.

The section of biometry with its three statisticians has been responsible for statistical design and data analyses in several intra-departmental, extra-departmental and inter-departmental research projects. The data preparation and statistical processing unit has been involved in preparation of person-registers for

large cohort studies, preparation of data collection sheet and questionnaires, data file preparation, including keypunching; minor calculations, and computer programming. The computer processing was arranged as services bought from three computer centers. The National Register of Occupational Diseases and the National Tuberculosis Register are located and maintained at the department. Annual summary tabulations for administrational needs of the Institute were prepared at the section of biometry.

Department of Physiology

Preventive occupational health work has been developed with emphasis on research and training. New audiovisual material has been produced to make it possible to cut down on the staff's lecturing time. Contacts with persons already trained are maintained with the help of written material.

The clinical physiology section has taken part in the epidemiological study of cotton industry workers, and in the study concerning the effect of cold exposure on coronary patients.

The sports medicine clinic has functioned at full capacity concentrating on health examinations of athletes, and check-ups during training. In addition, material was gathered on the effect of special training at school on children's physical capacity.

In the exercise physiology section the emphasis has been on estimating the minimum amount of daily physical activity necessary for sedentary workers. The study on the biological effects of vibration continued. A review was published on the detrimental effects of using a chain saw, particularly effects from vibration and carbon monoxide.

Ergonomic section

Progress has been made in 1972 towards getting ergonomic considerations into workplaces in the planning phase.

Research projects have been even more extensive than before. The mapping of working conditions in the printing industry has been the most comprehensive study. Studies on muscle fatigue are still being planned.

The scope of service work has been broadened. Two lengthy studies were an evaluation of imported microfilm reading equipment and a report on the organization of the microfilm reading room. Brief consultations have decreased.

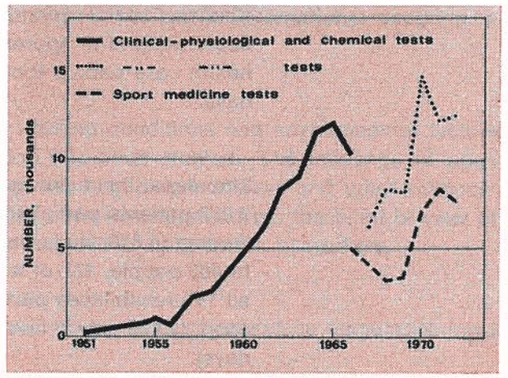
Five issues of the ergonomic bulletin have been published in Finnish. A good deal of emphasis was put on preparing training material. The result was a Finnish teaching package for a week-long ergonomics course containing lectures, instructions, 150 slides and student material. The Rationalization Federation takes care of routine training for workplace planners with the help of the teaching package.

Occupational safety section

Cooperative work both within and outside the Institute has characterized the sections's activity during 1972. A handbook, »Health and Safety at Work» (in Finnish), and an occupational safety teaching package (see Information and publication activity) were edited. The section has continued to take part in regional work safety campaigns as organizers, inspectors and lecturers.

Training activity has concentrated on courses for chiefs of safety. Perhaps the most time was spent in performing the secretarial duties of the committee appointed by the Ministry of Social Affairs and Health to plan occupational safety education on the national level.

Results have been compiled in the interview study on sheet-metal workers' accident risks and in the study on the effects of guidance on motor performance. The results of the study on the effect of the menstrual cycle on accident frequency, and of the lathe project have been analyzed.



Physiological tests.

Department of Rehabilitation

According to the recommendations of the committee appointed by the Ministry of Social Affairs and Health, the department started to plan how it will move from the institute and form a separate institute.

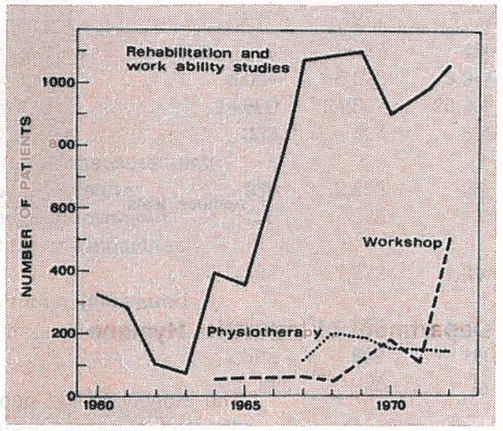
Because rehabilitation is becoming more extensive and many-sided all the time, there is a new need for consultation in regard to personnel training and development projects. The authorities, too, need information from an institute specialized in rehabilitation research and training. Preliminary discussions indicate that the department can develop in this direction.

The primary service objective is to rehabilitate people so that they can return to work, and 49 % of the patients did so. At the beginning of 1972 a physiotherapy unit was added, workshop activity increased when the work adjustment program began, and closer cooperation with the surrounding industry was achieved.

The coordination of research, development projects and training were concentrated to a newly established unit with two researchers and two research assistants. Three new studies, mental health, depression and health attitudes, and a study in co-operation with the education department of the Finnish National Board of Forestry of forest workers' occupational analysis were begun. They will be completed during 1973. Two reports in the mimeographed series on method research have been published. Nineteen social work, psychology and physiotherapy students began long-term apprenticeships at workplaces. A total of 124 health care people took part in four courses for a total of 412 days.

The department served 1,705 people during 1972. A total of 1,057 patients participated in the rehabilitation and work ability studies (6,610 study days). Physiotherapy treatment was given to 488 people, 177 of whom took part in heart rehabilitation. In all 140 rehabilitees participated in work evaluation at the workshop (2,473 days) and 20 in work adjustment programs (619 days).

There are 28 beds at the department for patients from outside Helsinki and if necessary accommodation can be arranged in downtown Helsinki.



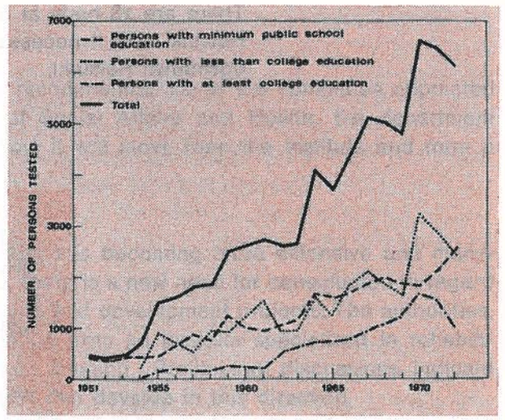
Rehabilitation studies and treatment.

Department of Psychology

Service activity in the field of aptitude testing has been continued. Test methods have been developed. Validity studies of school entrance tests, of pilot aptitude tests and of tests for Finns working abroad in the field of international cooperation have been done.

The influence of working conditions and environmental factors on job statisfaction has been studied. The influence of open plan office arrangements, gliding workdays and other rationalization activities has been investigated from the point of view of work process and subjective statisfaction of workers.

Within the department, variations of workplace democracy have been tried out.



Aptitude tests.

Department of Industrial Hygiene

The activity of the department during the past year has been directed towards research and training, however, the great demand for service has lengthened delivery time and made it difficult for the staff to devote time to training people outside the Institute and to preparing written material.

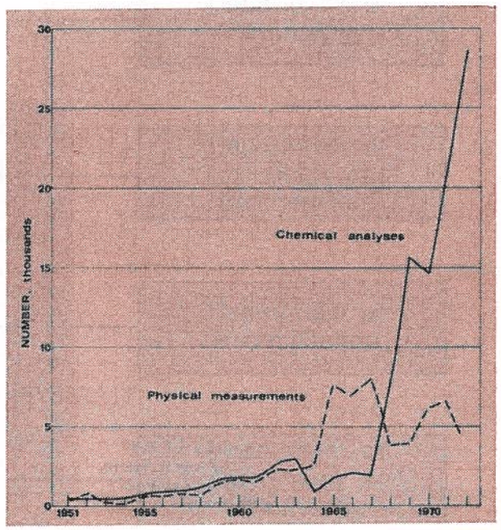
In April a foundry study was begun in cooperation with the Department of Epidemiology and Biometry; this research study is the largest one at the Institute. Additional personnel were employed and trained to help in the dust and chemical projects of the foundry study. Two other projects are a study of paper machine noise in cooperation with the producers of the machines, and a study of styrene exposure in the reinforced plastics industry.

The field measurements of dust, noise and vibration in the stone workers study were completed, as were the dust measurements of the byssinosis study in the cotton industry.

The halothane studies in operating theaters were continued. New methods based on active charcoal gas adsorption were developed for the evaluation of workers' exposures. Injurious air pollution generated by thermal pyrolysis in the plastics industry and by soldering work were analyzed and methods were developed for taking measurements at work places.

The octave analyzer for noise and vibration analysis was replaced by the one-third octave real-time analyzer; this will help with noise abatement. Members of the staff formed a working group, appointed by the Ministry of Social Affairs and Health, and prepared a report and proposal on the need for industrial hygienists and industrial hygiene training.

	1970	1971	1972
Visits to the workplaces	316	486	496
Physical measurements	6,004	6,623	3,948
Chemical analyses	14,660	24,537	28,268
Written statements	333	424	559
Distribution of physical measurements			
temperature and moisture	959	2,253	286
ventilation and air movement	135	345	177
noise and vibration (measured only)	502	1,272	1,207
noise and vibration (measured and analyzed)	1,796	2,093	2,042
lighting	2,598	632	180
light density	14	28	56
Distribution of chemical analyses			
gases, vapors and poisonous dusts	11,270	16,438	17,793
mineral and other dusts	920	1,573	3,137
technical products	349	249	339
development and analyses	2,121	6,277	6,999



Measurements and analyses of the working environment.

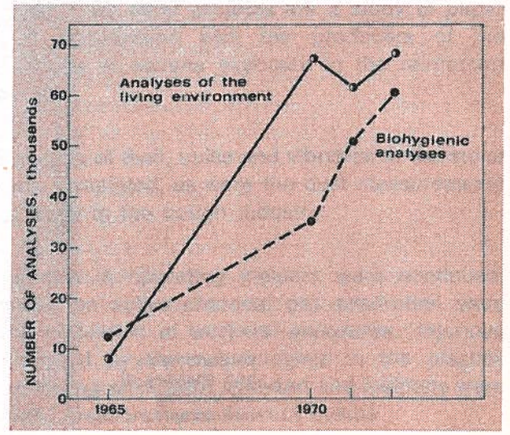
Department of Toxicology and Biochemistry

The present structural and functional framework of the department has been guided both by its development plan and by its financial situation.

More research based on agreements, service investigations and various analyses were carried out than in 1971, and control, follow-up and rather extensive investigations have been done.

The department has concentrated on training persons who need specialist knowledge in this particular field. There have been three students preparing their academic theses this year. The department's air conservation library has served persons within and outside the Institute. The office of air conservation and noise abatement was transferred from the department at the end of the year.

The department has cooperated with various departments, institutes, specialists and authorities in areas of research, service and transfer of information.



Studies of the living environment and biohygienic analyses.

ORGANIZATION OF THE OCCUPATIONAL HEALTH FOUNDATION AND THE INSTITUTE OF OCCUPATIONAL HEALTH

BOARD OF TRUSTEES OF THE FOUNDATION

Government rep. 10	Labor market organizations 3 + 3	Occup. safety assoc. 1	Helsinki city 1

EXECUTIVE COMMITTEE OF THE INSTITUTE

Government rep. 2	Labor market organizations 1 + 1	Helsinki city 1	IOH 1

Director of the Institute

Advisory committee

Collegium (dept. chiefs)

- General Department
- Department of Medicine
- Department of Physiology
- Department of Industrial Hygiene
- Department of Psychology
- Department of Toxicology and Biochemistry
- Department of Rehabilitation
- Department of Epidemiology and Biometry

AREAS OF DEPARTMENTAL ACTIVITY

General Department
- — administration
- — economy
- — maintenance
- — information
- — training and education
- — library

Department of Medicine
- — section of occupational medicine
- — outpatient clinic
- — specialists
- — X-ray
- — clinical laboratory
- — physiotherapy unit
- — clinical psychologists
- — field clinic
- — occupational health nurses

Department of Physiology
- — occupational physiology
- — ergonomics
- — clinical physiology and its adaptation to mass investigations
- — maintenance of physical performance capacity and its relation to health
- — occupational safety
- — sports medicine

Department of Industrial Hygiene

Chemical occupational hygiene
- — gases
- — poisonous dusts
- — mineral dusts
- — laboratory

Physical occupational hygiene
- — temperature
- — noise and vibration
- — light
- — ventilation and other preventive techniques

Department of Psychology
- — aptitude tests
- — occupational psychology studies
- — traffic psychology studies

Department of Toxicology and Biochemistry

Laboratory section
- — laboratory investigations

Project section
- — industrial toxicology projects
- — projects for protection of the living environment
- — ecological projects

Field section
- — local and regional environmental protection statements

Office of air conservation and noise abatement

Department of Rehabilitation
- — evaluation of qualifications for work and rehabilitation
- — rehabilitation and vocational guidance
- — experimental rehabilitation
- — work evaluation

Department of Epidemiology and Biometry
- — sociological and sociomedical research projects
- — statistics
- — epidemiological research projects

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CURRENT RESEARCH PROJECTS 1973

AF

INSTITUTE OF OCCUPATIONAL HEALTH
HELSINKI FINLAND

CURREN RESEARCH PROJECTS 1973

INSTITUTE OF OCCUPATIONAL HEALTH

Haartmaninkatu 1, SF-00290 Helsinki 29, Finland

Vammala 1973, Vammalan Kirjapaino Oy

CONTENTS:

PROSPECTS FOR OCCUPATIONAL HEALTH RESEARCH

Lack of coordination has been characteristic of research at the Institute of Occupational Health. Until recent years, the topics attacked have been largely selected on the basis of available material support rather than on actual priorities. The situtation necessitated the establishment of a coordinating organ, its immediate task being to define the general objectives and aims of the Institute's research as well as the criteria to be used in setting the priority areas. A Research Committee was appointed in March, 1972. Its members have a variety of scientific expertise, and represent policy-making organizations such as the Ministry of Health and Social Welfare, the National Board of Health, the Confederation of Finnish Trade Unions and the Finnish Employers' Confederation. The Committee's first task was to prepare the short-term Research Development Program of the Institute of Occupational Health. It was completed and approved the following October as the official research program of the Institute.

The general objective of occupational health research is to increase the level of occupational health and safety, as well as to equalize the distribution of these utilities in the working population. Occupational health here covers the physical, psychological and social aspects of health, when dependent on work and the working environment. Equalizing the presently differential distribution of occupational health and safety implies directing research toward occupational problems with high risks or toward known or suspected health requirements. Research on rehabilitation and non-occupational environmental protection will continue at the Institute as long as the corresponding departments stay within the Institute.

The following problem areas are objects of occupational health research: harmful chemical, physical and social agents and conditions in the environment, their effects on health and safety; health and safety risks due to the work itself

(e.g., ergonomic risks); interactions of these effects and risks; methodologic developments and applied research on improvement techniques of the working environment. From the cost-benefit viewpoint, the emphasis of occupational research has to shift from the clinical to the preventive; yet, capacity for research in both areas has to be maintained.

The Research Committee is presently working to specify priority areas for research. The criteria are the number of exposed, the severity of adverse effects on health, the prevalence and incidence of them, the suitability of research in solving the problem, the urgency and potential applicability of the solution, and the personnel, equipment and financial resources. A large multidisciplinary project organization is emerging, with optimal coordination of work hygienic, epidemiologic, medical, psychological and sociological expertise.

We share the belief that coordination and programming of research will result in improved application of scientific information for the benefit of the working population.

RESEARCH PROJECTS: A PROGRESS REPORT

A number of research projects in progress are listed below, with short descriptions of the present status of each project. The projects are selected to represent the most important current research activities at the Institute.

EPIDEMIOLOGIC STUDIES OF VARIOUS EXPOSURES AND OCCUPATIONS

FINNISH ASBESTOS STUDY

*L. Noro, M.D.**
K. Ahlman, M.D.
A. Laamanen, Ph.D.
M. Wiikeri, M.D.
E. Siltanen, M.Sc.
*E. Taskinen, M.D.***
T. Partanen, M.Sc.
*L. Meurman, M.D.****

This is an extensive study on the epidemiology and the specific features of anthophyllite asbestosis. In connection with this study, an epidemiologic and methodological investigation is being performed, the aim of which is to study the frequency of pleural plaques and to evaluate which is the most sensitive method for their detection. Asbestos dust measurements are also being performed on outdoor air in the counties around an asbestos mine in eastern Finland and in the surroundings of asbestos factories. The exposure level of the asbestos workers studied is evaluated with the aid of dust measurements in the quarry, the asbestos mill, and in asbestos product plants.

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(Ahlman, K., Siltanen, E., Rintala, E., Partanen, T. & Wiikeri, M.: Anthophyllite mining and milling as a cause of asbestosis. Asbestosis conference, Lyon 1972, conference proceedings, in press.

Siltanen, E.: Industrial hygiene measurements at asbestos cement plants. Asbestos inom AC-industrin, Paraisten Kalkki Company, Muijala (1971), 8—13, 16—18 (Swedish).)

A STUDY OF THE MORTALITY OF WORKERS IN AN ANTHOPHYLLITE ASBESTOS FACTORY IN FINLAND

M. Nurminen, M.Sc.

The epidemiology of asbestos-related diseases is investigated in a retrospective cohort study of 1 030 workers employed at an anthophyllite asbestos mining factory in eastern Finland. The cohort was defined as the group of workers with a minimum exposure of three months who had started employment at any time between 1936 and 1966. The main analysis was of mortality up to the end of 1968. The cause-specific mortality experience of the workers was contrasted with the mortality predicted by the age- and sex-specific rates for the total Finnish population. The hazards of exposure to anthophyllite asbestos dust are indicated in the main results of the study:

1) The cohort of workers had excess overall mortality accounted for by cancer of the lung, bronchus and trachea, respiratory tuberculosis, and other respiratory diseases.
2) Asbestosis, as an underlying or contributing cause, was registered on the death certificate of every fifth deceased member of the cohort.
3) The mortality from lung cancer among asbestos workers with a minimum exposure of three months was in certain age groups over three times that expected.

(Nurminen, M.: A study of the mortality of workers in an anthophyllite asbestos factory in Finland. Work-Environment-Health 9 (1972): 3, 112—118.)

BYSSINOSIS IN FINNISH COTTON MILLS

1) Epidemiologic study

I. Häkkinen, M.D.
R. Harjula, M.D.
R-S. Koskela, M.Pol.Sc.
R. Berghäll

About 1 000 workers, a majority of them women, are employed in pretreatment of raw cotton in the five Finnish cotton mills. Workers in opening, blowing, carding and spinning rooms are exposed to dust containing residues of the cotton plant which is the cause of an occupational disease, byssinosis. The prevalence of byssinosis in Finland is not known. The Institute of Occupational Health initiated in 1970 an epidemiologic study of the prevalence of byssinosis and chronic bronchitis among the workers in the cotton industry. This study includes pulmonary function tests performed on all exposed workers. These tests are done three times on every subject: on Monday, both before and after work, and on Thursday. The subjects are also asked to fill out a questionnaire regarding respiratory symptoms.

A control group without any known occupational exposure affecting the respiratory system was selected. The mortality, disability rate and retirement age are also analyzed for both the exposed and the controls.

2) Dust measurements in the cotton mills

M. Koponen, M.Sc.

The total dust concentrations were measured in different locations of the mills using the membrane filter method. The survey revealed that in only two of the five mills the dust concentrations were below the TLV-value 1 mg/m³. The typical concentrations in carding rooms were 3—6 mg/m³.

3) Comparison of three tests measuring airway obstruction

R. Harjula, M.D.

Various methods for health screening of workers exposed

to organic dusts have been compared. About three hundred workers who were exposed to crude cotton and about two hundred unexposed workers were examined. Both the convenience of the method and its capacity to measure airway obstruction were considered. The methods were:

1) spirometry (McDermott's type spirometer)
2) expiratory CO_2 (Godart's capnograph)
3) total resistance of breathing (Lexington RRU-C)

All these tests were done before and after the first work shift of the week as well as at the end of the working week. The pilot study showed that the diagnosis of byssinosis in doubtful cases was strengthened by these methods.

(IV Conference on pneumoconiosis, Bucharest 1971, conference proceedings, in press.)

OCCUPATIONAL EXPOSURE TO LEAD IN FINLAND

S. Tola, M.D.
S. Hernberg, M.D.
J. Nikkanen, M.Sc.

The use of lead and lead compounds in Finnish industry is surveyed using statistical samples from various branches of industry. More than 1 500 workers in about 200 working places with varying degrees of lead exposure and, as a special project, 280 workers in two shipyards, have been studied.

Lead exposure in ship scrapping, secondary lead smelting, and electric storage battery manufacturing was unacceptably high. About 30 % of the values exceeded the highest recommended level of 70 μg/100 ml. The exposure was distinctly lower in storage battery repair shops than in manufacturing. Lead exposure was moderate in crystal glass manufacturing; only a few values exceeded 70 μg/100 ml. There were two PVC-plastic factories with unacceptable lead exposure, but the rest of them had quite acceptable conditions, obviously depending on differences in the working methods. In the shipyards exposure was fairly low; not a single value exceeded 70 μg/100 ml.

The survey revealed some hitherto unrecognized working places with unacceptable lead exposure, among them some

auto cooling system repair shops, some metal foundries, and a few car repair shops. The survey will be completed in 1973.

(Tola, S., Hernberg, S. & Valkonen, S.: Occupational lead exposure in Finland. I. Electric storage battery manufacturing and repair. Work-Environment-Health 8 (1971): 3, 81—85.
Hernberg, S., Tola, S. & Nikkanen, J.: Occupational lead exposure in Finland. II. Service stations and garages. Work-Environment-Health 9 (1972): 3, 102—105.)

LEAD EXPOSURE OF THE »NORMAL» URBAN AND RURAL POPULATION IN FINLAND

C-H. Nordman, M.D.
J. Nikkanen, M.Sc.
S. Hernberg, M.D.
A. Laamanen, Ph.D.
A. Ryhänen, M.Sc. (Eng.)

The purpose of this study is to assess the degree of lead exposure arising from »normal» urban and rural conditions and thus to provide control material for the survey of occupational lead exposure. Representative groups of inhabitants of rural, suburban, downtown and industrial areas have been examined. In June, 1972, a dietary study of 23 families living in a rural district was done in order to estimate the daily oral intake of lead through food and beverages. Concomitant measurements of the concentrations of lead in the air and the drinking water of the communities selected for the study have been performed. The blood lead concentration and the erythrocyte ALA-D activity have been used as parameters for absorption. Hair samples are also analyzed for lead. The general health of the subjects has been studied with the aid of a detailed questionnaire. The study performed on the population living in the vicinity of a secondary lead smelter clearly showed that the smelter exerted a distinct effect on the blood lead concentrations and that this was reflected in the ALA-D activity.

(Nordman, C-H., Hernberg, S., Nikkanen, J. & Ryhänen, A.: Blood lead levels and erythrocyte δ-aminolevulinic acid dehydratase activity in people living around a secondary smelter. Work-Environment-Health 10 (1973), in press.)

SUBCLINICAL EFFECTS OF CARBON DISULFIDE

M. Tolonen, M.D.
A-M. Seppäläinen, M.D.
H. Hänninen, M.Sc.
M. Mäenpää
*Ch. Raitta, M.D.**
T. Partanen, M.Sc.
M. Nurminen, M.Sc.

This epidemiologic project, aiming at describing the picture of subclinical carbon disulfide poisoning, was started in 1972. The exposed group comprises 343 men exposed to carbon disulfide in a viscose rayon factory for five years or more, representing the full spectrum of carbon disulfide effects from clinical poisoning to no symptoms at all. The control group comprises 343 men matched with respect to age, birth district, type of work and social status. In all 100 exposed and 100 unexposed men have been selected from these cohorts for electroneuromyographic examinations; 60 exposed and 60 unexposed men for electroencephalography; 100 exposed and 100 unexposed men for neuroophtalmologic examinations (fluorescein angiography, oculosfygmography, fundus photography) and 220 exposed and 170 unexposed men for psychological testing which consists of a questionnaire, an interview, personality tests, testing of sensorimotor speed and visual accuracy, psychomotor performance, memory functions and intelligence. The results will be available by the end of 1973.

* University Hospital of Helsinki

CORONARY HEART DISEASE IN VISCOSE RAYON WORKERS

S. Hernberg, M.D.
M. Tolonen, M.D.
M. Nurminen, M.Sc.

In 1967, an epidemiologic project was started in order to assess the effects of carbon disulfide on coronary heart disease incidence in the viscose rayon industry. The first five year follow-up has now been completed. The results show a more than two-fold excess mortality among 343 exposed workers, as contrasted with 343 comparable controls

from a nearby paper mill. Coronary heart disease was responsible for the entire excess mortality; the mortality ratio for this cause was almost five. The results were also compared with age-standardized national death rates. The figures obtained from the control group were smaller than those expected, while there was an over two-fold excess coronary death rate in the exposed group. Data have also been collected regarding nonfatal coronary disease, using hospital records, history taking and a standardized exercise electrocardiogram. The results will be available in the spring of 1973.

(Hernberg, S., Partanen, T., Nordman, C-H. & Sumari, P.: Coronary heart disease among workers exposed to carbon disulphide. Brit.J. Industr.Med. 27 (1970), 313—325.
Hernberg, S., Nordman, C-H., Partanen, T., Christiansen, V. & Virkola, P.: Blood lipids, glucose tolerance and plasma creatinine in workers exposed to carbon disulphide. Work-Environment-Health 8 (1971): 1, 11—16.)

STYRENE EXPOSURE IN THE REENFORCED PLASTIC INDUSTRY

H. Härkönen, M.D.
P. Kalliokoski, M.Sc. (Eng.)
S. Hietala, M.Sc. (Eng.)

In order to study styrene exposure in the reenforced plastic industry, air samples are collected from the breathing zone of the workers into active charcoal tubes during an 8-hour working day by means of a portable pump. The method has been developed at the department of industrial hygiene. The average concentration of styrene was observed to vary within the range of 1—180 ppm. The concentration can be kept under the present TLV-level by means of efficient general ventilation.

In connection with the study a biological test for styrene exposure based on the mandelic acid concentration in urine is being sought. Present observations suggest that an 8-hour exposure to styrene at the TLV-level results in a urinary mandelic acid concentration of about 2 000 ppm.

THE HEALTH EFFECTS OF 2,4-D AND 2,4,5-T HERBICIDES ON EXPOSED WORKERS
A CLINICAL AND EPIDEMIOLOGIC STUDY

V. Riihimäki, M.D.
J. Hassi, M.D.
S. Hernberg, M.D.
S. Asp, M.Pol.Sc.
A-M. Seppäläinen, M.D.
P. Karli, M.D.

The study was initiated by public health officials to clarify the claimed disease, death and disablement consequences of brush spraying with 2,4-D and 2,4,5-T containing herbicides. The exposed workers were employed by the State Highway Administration, the State Railroads, and the Forest Administration.

The workers were mostly knapsack sprayers but one employer (State Highways) used a spraying rig mounted either on a truck or a tractor. No measurements on the quantity of personal exposure to 2,4-D or 2,4,5-T have been done.

The purpose of the study is to find out

1) whether there is a clinical disease or detectable pathological changes in the function of various organs, e.g., the nervous system, common to a great number of sprayers, i.e., a complex of symptoms and signs representing an intoxication;
2) whether there is an excess mortality in various diseases, malignant diseases in particular, among the exposed population.

The study is divided into three substudies:

1) A group of 30 sprayers, with the longest exposure in a railroad district where »cases» were first reported by mass media, was selected and clinically studied. The examination included a medical and working history, a physical examination, laboratory and X-ray examinations, neurophysiological examinations (EEG and ENMG) and a neurological examination. Neurophysiological and neurological findings are compared to those in a control group representing the healthy industrial population, age and sex matched.

2) An epidemiologic mortality study. About 1 900 male subjects sprayed for at least two weeks during 1955—1971. Total and cancer mortality are calculated and compared with national mortality statistics, and also internally analyzed as dependent on exposure. A prospective follow-up of the mortality will be arranged.
3) A group of 20 persons with symptoms of illness during and after spraying were selected from 200 people who reported adverse effects from handling herbicides. The majority of them had long experience with spraying and the most common complaints were headache, giddiness, irritation in eyes and respiratory tract. The subjects are submitted to a clinical examination supplemented by psychological testing.

PSYCHOLOGICAL EFFECTS OF INDUSTRIAL POISONS

H. Hänninen, M.Sc.
K. Lindström, M.Sc.
M. Pulli, B.Sc.

An investigation concerning the effects of various toxic agents on psychological performance, mood and behavior is in progress. The research team has investigated the psychological symptomatology in workers with exposition of or poisoning due to carbon disulfide, lead, mercury, and industrial solvents. Methodological improvements are developed for the test battery, with special attention paid to mood changes and psychomotor symptoms.

MERCURY CONTENT IN BLOOD AND HAIR IN RELATION TO FISH CONSUMPTION

P. Sumari, M.D.
T. Partanen, M.Sc.
S. Hietala, M.Sc. (Eng.)

The aim of this study is to estimate the »natural» mercury levels in human blood and hair in various localities by correlating the Hg contents in blood and hair, and by estimating the increase in human Hg contents attributable to frequency

of fish meals, species of fish and Hg contents in fish. Mercury content in whole blood and hair have been determined for 835 subjects from 25 localities; these subjects were also interviewed as to fish consumption and related data. Mercury contents have been determined in fish samples from the waters where the subjects obtain the consumed fish. Human Hg values reaching the danger zone (whole blood $\geq$ 200 ng/g, hair $\geq$ 60 μg/g) have not been observed as yet; a few values exceeded the safety limits (20 ng/g for blood and 6 μg/g for hair). A correlation has been observed in some localities between fish consumption and human Hg values. The dependence of this correlation on Hg content in fish will be clarified.

(Sumari, P., Partanen, T., Hietala, S. & Heinonen, P.: Blood and hair mercury content in fish consumers. A preliminary report. Work-Environment-Health 9 (1972): 2, 61—65.)

WORKING CONDITIONS IN FOUNDRIES AND MORTALITY OF FOUNDRY WORKERS

Coordinator: S. Hernberg, M.D.
Data processing: T. Partanen, M.Sc.

In 1971, the labor market organizations agreed on a survey of the working conditions in all Finnish iron and steel foundries to be undertaken by the Institute of Occupational Health. The survey comprises four subprojects; it is the most extensive research project undertaken at the Institute.

1) Survey of silicogenic dust concentrations

E. Siltanen, M.Sc.
M. Koponen, M.Sc.
B. Engström, M.Sc.
J. Reponen, B.Sc.
A. Kokko, M.Sc. (Eng.)

Dust measurements are made in all iron and steel foundries in Finland, as well as in some other metal foundries, altogether about 90 foundries. By the end of 1972, 20 foundries had been studied. Dust samples are collected on Millipore

filters or, using an MSA Mixt-Flow Air Sampler, on polystyrene filters. The fine fraction of the dust is separated by liquid elution or liquid sedimentation, and the contents of quartz, crystobalite and tridymite are determined by X-ray diffraction. The individual exposure of selected workers is further evaluated using personal samplers (Casella or MSA Personal Sampler). The purpose of the survey is to get an overall impression of the dust situation in Finnish foundries. In addition, the data obtained will serve as a basis for preventive measures on the individual foundry level. For this purpose, special attention is paid to the effect of various factors on the dust conditions, e.g., different systems of ventilation, seasonal variations, different working processes, etc. It is hoped that the results of this study will serve as a basis for regulations and control of dust in foundries.

2) Survey of potentially harmful chemical substances

M. Virtamo, M.Sc.
A. Tossavainen, M.Sc.

All foundries have received a questionnaire on the chemicals in use. On the basis of the replies, the most harmful substances have been selected for closer study, among them resins used as core binders.

Twenty foundries will be subjected to detailed measurements, 4 steel foundries, 8 iron foundries and 8 other metal foundries. In addition to the chemicals used as core binders, metal fumes will be measured from all foundries. About 20 metals will be submitted to comparative analyses by different methods.

Preliminary data have revealed that high concentrations of carbon monoxide are liberated in connection with casting and cooling of the moulds. The concentration of CO will be measured from various sites in the foundries during various types of work. Also the concentration of carbon monoxide in exhaled air will be measured.

3) Mortality and morbidity of foundry workers

R. Kärävä, M.D.
R-S. Koskela, M.Pol.Sc.

This study deals with effects of foundry work on mortality,

morbidity, age and indications for retirement. All skilled workers with at least a year's employment between 1950 and 1970 in a foundry (about 20 foundries are selected for this survey) form the basic cohort from which about 2 000 men will be selected for closer study. The following data will be collected: morbidity, sickness absenteeism, turnover, age, cause of retirement and cause-specific mortality and mean survival time.

4) **Prevalence of silicosis, heart disease, hearing loss and eczema**

R. Kärävä, M.D.
M. Wiikeri, M.D.
E. Vaheri, M.D.
V. Pirilä, M.D.

All workers presently employed in the 20 foundries selected for the survey (2) will be screened by chest X-Ray, electrocardiography and audiometry. The purpose of the screening is to estimate the prevalence of silicosis, hearing loss and cardiac disease. The skin of the face, neck, hands and arms will be examined by a nurse. When any sort of skin disease is present, a color photograph will be taken and sent to a dermatologist for evaluation. On the basis of inspection of the pictures, those workers requiring further examination will be selected.

MORBIDITY, MORTALITY AND LIVING CONDITIONS OF LUMBERJACKS

K. Nygård, M.Pol.Sc.
P. Fabritius, M.D.
T. Kumlin, M.D.
J. Nummi, M.D.
M. Nurminen, M.Sc.
S. Sundberg, M.Sc.
M. Wiikeri, M.D.

An evaluation of effects of lumbering on health, working capacity, and mortality is attempted with a pretested questionnaire mailed to 3 000 former or present lumberjacks with a minimum of 20 months' exposure to forest work. The

questions relate to risk factors (occupational environment, living conditions, and habits), morbidity, working capacity, views on occupational health and safety deficiencies, need for occupational health care, and suggestions for rearranging compensation and pension systems.

Part of the respondents will be selected for further measurements concerning lumbosacral diseases, diseases due to vibration, physiological aging and effects of noise. The lumbosacral diseases will be assessed by lumbosacral X-ray and clinical examination. The effects of vibration are to be assessed by clinical examination and microfocus X-ray of hands, as well as by evaluation of peripheral circulation. Physiological aging will be measured by darkness adaptation test of the eye, reaction time tests, vibration sensitivity of the skin, audiometry, and an osteoporosis index developed for interpretation of hand X-ray. In addition, the psychological Digit Symbol Test, estimation of maximal oxygen uptake and anthropometric measures will be used.

On the basis of the results, suggestions for occupational protection of lumberjacks will be made.

(Sundberg, S.: Risk of carbon monoxide poisoning among workers using chain saws. Työterveystiedote 1 (1972) (Finnish).
Nygård, K.: Living conditions of forest workers. Työterveystiedote 3 (1972) (Finnish).
Sundberg, S.: Vibration exposure in forest work. Työterveystiedote 5 (1972) (Finnish).)

OCCUPATIONAL HEALTH PROBLEMS AMONG GRANITE WORKERS

K. Ahlman, M.D.
A-L. Backman, M.D.
R-S. Koskela, M.Pol.Sc.
I. Hannunkari

1. **Prevalence of pulmonary diseases, hearing loss, vibration syndrome, and mortality**

This is a study on the prevalence of silicosis, chronic bronchitis, tuberculosis and other pulmonary diseases among

granite workers. The investigation also deals with noise-induced hearing loss, the prevalence of vibration syndrome, and, to some extent, the general state of health. The study has been carried out in granite quarries, in granite cutting works, in crushing plants and in quarrying and loading enterprises. The study includes three subprojects.

1) A historical survey concerning the development of the trade and its working conditions in Finland.
2) A retrospective cohort study of 626 granite workers. The purpose of this project is to investigate the problems connected with retirement age, mortality and causes of death among granite workers. The analysis of the collected data is under way.
3) The health examination included a chest X-ray, a lung function test, audiometry, ECG and an electromyographic examination. Four questionnaires were used. The data are being analyzed.

2. Intensity of exposure to quartz dust

M. Koponen, M.Sc.

Dust measurements are carried out in 25 granite quarries, granite cutting and grinding plants. The quartz concentrations of respirable dust are analyzed using X-ray diffractometry. The mean quartz exposure is calculated for various jobs.

3. Noise and vibration in the stone industry

J. Starck, M.Sc.

The environmental conditions in the stone industry were evaluated with measurements and tape recordings of noise and vibration in 12 quarries and 16 processing plants. Noise recordings were obtained from 160 objects, vibration recordings from 65.

The noise from various machines and work phases was analyzed in 1/3 octaves with a real-time analyzer. The

estimation of maximum duration of exposure to noise and of the need for hearing examinations has been based on the A-noise levels measured, on the Resolution 637/71 concerning health examinations and on the International Recommendation ISO R 1999 (1971).

The loudest A-noise levels were detected near the worker who cut with flame, 126 dB (A), at the surface grinding machine, 119 dB (A), and at the drill boring machine, 112 dB (A). The average A-noise level of all measurements on tools exceeded 85 dB (A).

From the vibration recordings the frequency of the vibration was analyzed in the real-time analyzer and the results were compared with the vibration standard 626—66 of the Soviet Union. The standard gives the highest frequency permitted for vibration in 16...2000 Herz-octave bands. The vibration frequency of all hand-operated tools exceeded the Soviet standard; the average excess was three- to six-fold. The highest vibration frequencies were detected in the drill boring machines and chisel hammers.

The study has been extended to include the stone chopping plants, with the intention of measuring noise and vibration in four or five work places. The field measurements and analyses are not yet complete.

HEALTH OF LONGSHOREMEN

K. Ahlman, M.D.
*M. Lehtinen, M.D.**
A-L. Backman, M.D.
R-S. Koskela, M.Pol.Sc.

The objectives of this study are the assessment of health status, health attitudes and social conditions of longshoremen. The study started in 1968 in collaboration with the Finnish Harbor Pension Fund. In all, 986 longshoremen, that is, 10 %

* Finnish Harbor Pension Fund

of the employed longshoremen in the country, were subjected to the initial screening which included a chest X-ray, lung function tests, ECG, blood pressure and a 1-hour glucose tolerance test.

In 1971, a follow-up examination of the same longshoremen was performed. Since the previous investigation 140 subjects had changed jobs, retired or died. From the remaining group of 846 dockers, 682 persons were re-examined.

A questionnaire on social conditions was included in the 1971 phase. It was also mailed to the retired and to those who had changed over to other jobs since 1968. The questions concerned occupational history, absences, accidents, working capacity, habits, etc.

BACK DISEASES IN CONCRETE ARMORING WORKERS

G. Wickström, M.D.
J. Nummi, M.D.
M. Wiikeri, M.D.
*M. Lehtinen, M.D.**
J. Saari, M.Sc. (Eng.)
K. Lindström, M.Sc.
*H. Riihimäki, M.Sc.**
*P. Mikkola, M.Pol.Sc.**

Armoring workers in construction complain of aches and diseases in the back. They are working in a bent position, i.e., standing on the floor working with their hands at the toe level. All active workers in Uusimaa County, about 350 men, are submitted to a thorough radiological examination (whole spine, shoulders, elbows, wrists, knees and lungs), a thorough orthopedic examination by a physiotherapist, a general medical examination, and various laboratory tests. The prime goal of the study is the determination of the possible effects of working position on the back.

An ergonomic analysis of the working positions and the working loads will be made and the social conditions of the armoring workers will be studied.

* Construction Workers' Pension Fund

QUESTIONNAIRE STUDY ON HEALTH AND WORKING CONDITIONS OF CONSTRUCTION WORKERS

G. Wickström, M.D.
K. Kauppinen-Toropainen, M.Sc.
M. Nurminen, M.Sc.

The knowledge of the health of Finnish construction workers is scarce. To obtain a general view of the situation, and to clarify relevant facts for the future of the occupational health services for construction workers, a questionnaire study was undertaken. The questionnaires were mailed to a sample of 1 200 persons, members of the Union of Construction Workers and foremen. The subjects represented the various occupations in the branch; some 100 questions about present health, use of medical service, health hazards in working conditions, effects of working conditions on health, pay system, rate of job change, employer and place of living, are included in the questionnaire.

WORKERS' SUBJECTIVE EVALUATION OF THE HEALTH RISKS AT WORKING PLACES

R-S. Koskela, M.Pol.Sc.
S. Hernberg, M.D.

This is a questionnaire study on how workers experience their working conditions. The subjects are a 4 300-person sample of the members of the Central Labor Organization. The questionnaire contains questions about chemicals used, physical and ergonomic defects of work, evaluation of respondent's own health state and its connection with work, as well as about job satisfaction. Draught, noise and ergonomically faulty working positions were most often complained about. Back and joint diseases were the most prevalent diseases experienced as induced by work. In all 74 % of those working in ergonomically faulty positions, 72 % of those exposed to unsuitable temperatures and 78 % of those exposed to high humidity suffered from back and joint diseases. Fifty-three per cent of those exposed to chemical substances suffered from skin diseases. Sixty per cent of those exposed to noise

had suffered a hearing loss. A total of 52 % had the chance to contact a physician, 43 % a nurse and 23 % a safety engineer. Occupation groups with a relatively high risk seem to be, e.g., brick layers, construction workers, transport workers, farmers and lumberjacks, miners, steelworkers, and workers in the glass, ceramic and chemical industries. On the average, the most sought after work was day work without shifts in a small or mediumsize company.

(Koskela, R-S., Hernberg, S. & Hussi, E.: Workers' Subjective evaluation of the health risks at working places. Työterveyslaitoksen tutkimuksia 81 (1973) (Finnish).)

MEDICINE AND INDUSTRIAL MEDICINE

EFFECTS OF SOLVENTS UPON THE NERVOUS SYSTEM

A-M. Seppäläinen, M.D.
G. Hintze, M.D.
K. Lindström, M.Sc.

For prevention it is important to detect early and subclinical effects of solvents. Chronic carbon disulfide toxicity and its nervous effects have been studied for several years at the Institute while other solvents have gained less attention in this respect. A preliminary report has been presented on electroencephalographic and psychological findings of spray painters (Seppäläinen et al. Slanchev Bryag, Bulgaria 1971). It was shown that more than half of a group of 19 painters exposed to toluene, xylene, tetrachloroethylene and trichloroethylene, although the concentrations in the work room air were less than MAC, had abnormal EEGs, impaired motor performance in psychological tests and poor memory. There was a good concordance between psychological and EEG findings. The workers complained of tiredness, insomnia, drunken feelings and headache. The application of personal protective measures improved the state of most workers. Similar tests have been applied to a large number of workers exposed to solvents, the results are being collected and await further analysis.

CHANGES IN PERIPHERAL CIRCULATION IN LUMBERJACKS USING A CHAIN SAW

T. Kumlin, M.D.
M. Wiikeri, M.D.
V. Viljanen, M.D.
S. Sundberg, M.Sc.

An essential contributing factor in the beginning of traumatic vasospastic disease is an occasional vasoconstriction

in the hands. This may later lead to organic changes. About half of the regular lumberjacks using a chain saw year round display Raynaud's syndrome. The reproduction of this syndrome is a difficult and unreliable diagnostic method when done in the laboratory. The present pilot study concerns a vibration simulator and circulation in the fingers in connection with the simulation. The circulation is followed with photoplethysmograph and ultra sound equipment. In some cases, a complete loss of pulse was observed during exposure; this is a serious indication for terminating work with vibrating tools. Clinical and X-ray data are included and analyzed in relation to the simulation, plethysmographic, ultra sound and exposure data.

NEUROPATHY AMONG WORKERS USING VIBRATING TOOLS

A-M. Seppäläinen, M.D.
T. Kumlin, M.D.

Workers using vibrating tools frequently complain of paresthesia and pain in the upper limbs and also of Raynaud's syndrome. A probable cause of these symptoms is vibration-induced damage to the nerves. Neurophysiological methods have been used to study the function of peripheral nerves in the arms of workers using chain saws or pneumatic tools. The subjects were examined electromyographically. Nerve conduction velocity in the median and ulnar nerves and, especially, in the slower conducting fibers was determined according to Hopf's method. Signs of neuropathy have already been demonstrated in distal branches of nerves and in slower fibers. The investigation has four parts:

1) the study of the degree of neuropathy in clinically ill workers,
2) an epidemiologic field study of lumberjacks who have used chain saws for a varying number of years,
3) a comparison between chain saw forestry workers and users of pneumatic tools,
4) effects of stopping the exposure.

(Seppäläinen, A-M.: Peripheral neuropathy in forest workers. A field study. Work-Environment-Health 9 (1972): 3, 106—111.

Seppäläinen, A-M.: Do forest workers suffer from peripheral neuropathy? AI Reports (1972), in press.)

CONCENTRATIONS OF HALOGENATED HYDROCARBONS IN THE EXPIRED AIR AS INDICATORS OF EXPOSURE

A-L. Backman, M.D.
P. Pfäffli, M.Sc.

The concentrations of trichloroethylene and tetrachloroethylene in the expired air of persons with chronic occupational exposure have been studied. It was found that solvent concentrations in the expired air correlated with exposures. In the follow-up study simultaneous exposure to different solvents has been studied as well as the effect of simultaneous inhalation and absorption through skin on the concentration in expired air.

(Pfäffli, P. & Backman, A-L.: Some biological methods for estimating occupational trichloroethylene exposures. A preliminary report. Work-Environment-Health 9 (1972): 3, 140—144.)

EFFECT OF NEW LEAD EXPOSURE ON PARAMETERS INDICATING BIOLOGICAL DISTURBANCE A LONGITUDINAL STUDY

S. Tola, M.D.
S. Hernberg, M.D.
J. Nikkanen, M.Sc.
S. Asp, M.Pol.Sc.
S. Valkonen, M.Sc. (Eng.)

Changes in blood hemoglobin, hematocrit, erythrocyte ALA-D, urinary coproporphyrin and ALA excretion were studied in 33 workers during the course of their first occupational lead exposure, using weekly sampling of blood and

urine. The data were analyzed in relation to concomitantly measured values of lead-in-blood and lead-in-urine.

The results showed that ALA-D was the most sensitive indicator of lead effect, followed by urinary coproporphyrin and ALA. The inhibition of ALA-D occurred without time lag during the first days of exposure, and this inhibition closely reflected the concomitant rise in lead-in-blood. ALA and coproporphyrin reacted with a time lag of some two weeks. All of these laboratory tests reached a steady state during the follow-up. ALA-D showed the highest correlation to Pb-B and proved to be the most sensitive indicator of lead effect. The mean hemoglobin concentration was slightly lower at the end of the observation period of 3—4 months; the corresponding mean lead-in-blood was about 50 μg/100 ml.

(Hernberg, S., Tola, S., Nikkanen, J. & Valkonen, S.: Erythrocyte δ-aminolevulinic acid dehydratase in new lead exposure. Arch. Environ. Health (1972): 25, 109—113.
Tola, S., Hernberg, S., Asp, S. & Nikkanen, J.: Parameters indicative of absorption and biological effect in new lead exposure. A prospective study. Brit. J. Industr. Med. (1973), in press.)

PHYSICAL WORKING CAPACITY, PSYCHOLOGICAL PATTERN AND CATECHOLAMINE RESPONSE TO MAXIMAL EXERCISE IN HEALTHY MEN AND MEN WITH MYOCARDIAL INFARCTION

J. Hakkila, M.D.
R. Kärävä, M.D.
*E. Kiuru, M.D.**
H. Hänninen, M.Sc.

In all 118 unselected men of working age, with a history of myocardial infarction 18 months before, and 75 healthy men, with the same age and occupational distribution were compared. The average maximal physical working capacity (PWC) of the healthy men was 1 089 kpm/min. In the total infarction group the PWC was 58 % of that of the healthy group, 47 % in the group with angina pectoris and 69 % in the group without angina pectoris. The urinary excretion of epinephrine and norepinephrine reflecting the sympathoadrenal reaction induced by the maximal PWC test reached the same level in both groups. The implication is that the decreased PWC of the infarction group with and even without angina pectoris is associated with a remarkably increased sympathoadrenal response. The infarction group was more prone to depressive moods and slower in the intellectual and psychomotor performances.

* University Hospital of Helsinki

(Proceedings of a Symposium held in Bad Krozingen, October 18—20, 1972, in press.)

EPIDEMIOLOGY OF CORONARY HEART DISEASE

FINNISH HEART STUDY

M. J. Karvonen, M.D., Ph.D.
S. Punsar, M.D.
K. Nygård, M.Pol.Sc.
S. Kontkanen

The epidemiology of coronary heart disease (CHD) in two rural populations in eastern and western Finland is under investigation. This prospective cohort study started in these two rural male populations aged 40—59 years in 1959. The basic examination included collection of a standardized history and a physical examination, an ECG at rest and after exercise, serum cholesterol etc. The field examination was repeated in 1964 and 1969. CHD mortality in the eastern cohort was 9.1 % in ten years, in the western cohort 3.5 % ($p < 0.001$). The difference is partly due to the much poorer prognosis for CHD in the eastern population. The analysis of the ten year results is under way, and the groups will be followed until the terminal examination which is planned for 1974.

A separate analysis has been carried out as a ten year follow-up of the farmers and lumberjacks in the populations. The incidence of coronary heart disease has also been related to the war-time military service of the subjects.

(Punsar, S. & Pyörälä, K.: Cigarette smoking and the risk of death from coronary heart disease in East and West Finland. Scand. J. Clin. Lab. Invest. 25 (1970): suppl. 113, 38.

Punsar, S.: Prognosis of CHD in East and West Finland. Scand. J. Clin. Lab. Invest. 29 (1972): suppl. 122, 19.

Karvonen, M. J., Nygård, K. & Punsar, S.: Coronary heart disease in lumberjacks. Scand. J. Clin. Lab. Invest. 29 (1972): suppl. 122, 13.

Punsar, S. & Karvonen, M. J.: Angina pectoris and ECG abnormalities in relation to prognosis of coronary heart disease in population studies in Finland. Adv. Cardiol., in press.)

A CONTROLLED STUDY OF THE EFFECTS OF AN 18 MONTH PHYSICAL TRAINING PROGRAM ON MIDDLE-AGED MEN AND ONE-YEAR FOLLOW-UP RESULTS AFTER THE COMPLETION OF THE STUDY

P. Teräslinna, Ph.D.
*K. Pyörälä, M.D.**
S. Punsar, M.D.
R. Kärävä, M.D.
T. Partanen, M.Sc.
M. Jääskeläinen, Ph.D.
P. Oja, B.P.E.
*M. Pekkarinen, Ph.D.***
A. Koskela, B.P.E.

In all, 178 secondary manager-executive volunteers, aged 35—59 and displaying relatively high values in ischemic heart disease risk factors, were divided into two groups individually matched with regard to certain risk factors. One group was subjected to an 18 month training program (three sessions a week) and the other remained as a control group. In the exercise group a significant improvement in physical fitness became evident after three months' training. A slight additional improvement took place in most fitness variables during the first 12 months, after which the fitness level was maintained. The final increase in the mean predicted maximal oxygen uptake (max. VO_2) was 20 per cent. In the control group a slight improvement was observed in fitness variables; the mean increase of max. VO_2 being 6 per cent. At the end of the experimental period a statistically significant increase of heart volume was observed in the exercise group. In the resting ECG of the exercise group a trend to increase QRS amplitudes and a statistically significant increase in the sum of the T waves in leads V_1—V_6 was found.

* University Hospital of Helsinki
** Department of Nutritional Chemistry, University of Helsinki

A relatively strenuous training program of 18 months' duration resulting in definite cardiovascular training effects did not cause any significant effect on body weight, skinfold measurements, blood pressure, serum cholesterol, post-exercise S—T segment response and smoking habits. In the exercise group a slight improvement was found in measures of psychological performance.

After the completion of this 18 month study, a follow-up study of one year's duration was undertaken. A total of 164 of the 178 participants volunteered to continue. All volunteers were offered one exercise session a week. In all 51 men belonging to the original exercise group continued to train regularly (group I), 9 trained irregularly (group II) and 14 did not participate at all in exercise sessions (group III). During the one-year follow-up, the mean max. VO_2 showed a slight decrease (3 per cent) in group I, a clear decrease (13 per cent) in group II and no definite change in group III. In those men who originally belonged to the control group and who exercised once a week during the follow-up period, the increase in max. VO_2 was small (4 per cent).

(Larsen, D. A. & Malmborg, R. O. (editors): Coronary heart disease and physical fitness. Munksgaard, Copenhagen 1971, 261—265 and Scand. J. Clin. Lab. Invest. 29 (1972): suppl. 122, 21).

PHYSIOLOGY

INTERVENTION OF PHYSICAL ACTIVITY IN DAILY WORK

A. Koskela, B.P.E.
J. Ilmarinen, B.P.E.
R. Ilmarinen, B.Sc.
O. Korhonen, M.D.
M. Jääskeläinen, M.Sc.
T. Partanen, M.Sc.
*P. Komi, Ph.D.**
*H. Rusko, M.Sc.**

A total of 192 persons from an insurance company were selected as subjects in a physical activity intervention study. The subjects were matched into exercise and control groups with regard to age, sex, physical activity at work and leisure time, body weight and maximal oxygen uptake. Every time the subjects had to go upstairs or downstairs, the exercise group used stairs, the controls elevators. The subjects were measured before and after three and six months of the program. The measurements included the total body fat content, musculature of lower extremities, aerobic power, stairclimbing capacity, total force of leg muscles, force and electrical activity (EMG) of M.quadriceps femoris, perceived exertion (RPE) in aerobic tests, the amount and type of physical activity at work and leisure time, and opinions and attitudes towards physical activity. The exercise group maintained a daily record of stairclimbing; both groups recorded leisure time activity. The frequency and type of diseases and periods of absence from work were recorded. The analysis of results from the three month intervention period are in progress. The feasibility of daily stairclimbing activity was good: the exercise group climbed from 20 to 200

* Department of Biology of Exercise, University of Jyväskylä

floors per week without complaints or accidents. It seems possible to determine the minimum amount of physical activity required daily or weekly to maintain or improve the capacity of physical performance.

(IV Scandinavian Conference on Ergonomics, Helsinki 1972.)

STRAIN ON CORONARY PATIENTS INDUCED BY COLD AIR

R. Harjula, M.D.

This is a study on the effect of cold air on the working capacity of coronary patients. A pilot study showed that systolic blood pressure was elevated significantly when the temperature was about —2°C and the relative humidity 70—80 %. This happened even though the patients wore lumberjacks' clothing (warm but light suits). The group consisted of nine men who had suffered from myocardial infarction some years ago. The measurements will continue during 1973.

The aims of the study are:

1) determination of the extra strain on coronary patients working in cold conditions though adequate clothing is used,
2) assessment of the agreement between subjective symptoms and »objective» measurements,
3) determination of the differences in the extra strain at different temperatures between subjects and healthy people.

Thirty coronary patients and thirty healthy men will be subjected to temperatures of + 20°C, + 10°C, ± 0°C, — 10°C and — 20°C. Two measurements will be done at each temperature. Several parameters during rest and during maximal exercise tests will be measured (loading by Monarch's ergometer): questionnaires before and after the tests, subjective symptoms during the tests, heart rate, continuous ECG recording, blood pressure, peak expiratory flow rate before and after testing, total respiratory resistance before and after testing and catecholamine concentrations in urine.

REHABILITATION

ANALYSIS OF THE CLIENTELE AND METHODS USED IN THE REHABILITATION EXAMINATIONS (INCLUDING FOLLOW-UP)

Coordinator: P. Huju, M.Sc.

Different research groups of the department of rehabilitation of the Institute have investigated the following problems: the selection of clients for rehabilitation examinations; the basic condition (medical, psychological, social and vocational aspects) of rehabilitees; the correlations between rehabilitation recommendations and basic condition; the validity of methods; and the continuation of the rehabilitation process. A follow-up study of people who have participated in work testing is still in progress.

(Halonen, I.: Evaluation of working capacity. Työterveyslaitoksen tutkimuksia 65 (1971) (Finnish).)

REHABILITATION OF YOUNG CORONARY PATIENTS

E. Eskelinen, M.D.
J. Julkunen, M.Sc.
A. Tossavainen

The effect of rehabilitation started immediately after the intensive care of myocardial infarction, and its influence on the physical, psychological and social rehabilitation of young coronary patients (45 years or younger) has been investigated. The main problem is the interaction of somatic and psychic factors in the physical training program. Depressive, phobic and anxiety reactions, often reported in coronary patients, will be treated by behavioral therapy. The relevance and effects of this treatment are especially studied. The medical

examinations include, among other things, comparison of the results of various working tolerance tests, and their validity in predicting work capacity. Assessment and testing of medical, psychological and social factors are made at the beginning and at the end of the rehabilitation period which ranges from four to seven weeks. The sample consists of 92 patients, 36 of whom belong to the psychotherapy group. Follow-up data will be collected by the end of 1972. The effects of rehabilitation services are studied using a control group receiving no special rehabilitation after the intensive care in the hospital. The psychotherapy group is compared to those rehabilitated by conventional methods. Reports will be ready by the end of 1973.

PSYCHOLOGY

STRESS ON BUS AND STREETCAR DRIVERS

I. Virtanen, M.Sc.
P. Björkman, M.Sc.

This is a study on characteristic physical and mental stress factors in bus and streetcar driving and the stress symptoms in the drivers.

The problems are:

1) prevalence and quality of stress symptoms in drivers;
2) which factors in drivers' work and working environment cause stress;
3) the connections between stress and accident proneness.

The subjects of the study are the bus and streetcar drivers of the Helsinki Transit Authority, about 1 300 drivers. The measurement of stress is done on the basis of drivers' reports about the factors and conditions which they feel produce stress. The quality of stress symptoms are also studied. The collection of data is done by mail with questionnaires. In addition to the subjective evaluations, the stress symptoms and stress factors are evaluated with illness statistics and objective mapping of driving routes, traffic density, number of accidents, etc. The questionnaire can easily be applied to other driver groups.

MENTAL HEALTH STUDY

R. Raitasalo, M.Sc.
K. Tuunainen

The phenomenology of mental disorders is surveyed with the aid of a questionnaire. In order to get some information on the prevalence of mental disorders and on the need for

mental health services two different groups have been studied: the clientele of the department of rehabilitation (200 subjects) and the candidates for nursing schools in Finland in the autumn of 1972 (600 subjects). A special aim is to find out the correlation between occupational problems and the phenomenology of mental disorders.

OCCUPATIONAL ANALYSIS OF FOREST WORK

R. Raitasalo, M.Sc.
T. Brunila
K. Tuunainen

The department of rehabilitation has started a study in collaboration with the Forest Administration on forest workers who have been selected to enter schools for occupational training in forest work. The material consists of 500 men. We have studied their health, psychological and social features as well as their opinions of the suitability of the training for their work and their evaluation of the health risks in forest work. The aim of this study is to improve methods for selecting trainees and to provide recommendations for improving the training program, as well as to assess information about the relationship between work and perceived somatic and psychic illness.

DEPRESSION AND HEALTH ATTITUDES IN CHRONICALLY ILL PERSONS

R. Raitasalo, M.Sc.

This is a basic psychological study of perceived depression and health attitudes of chronically ill persons. The aim of the study is to develop a frame of reference which could be used also in other health and sick behavior studies. Scales of depression and health attitudes will be constructed. The material consists of social, psychological and medical examinations of 323 chronically ill persons.

INDUSTRIAL HYGIENE AND SAFETY

PAPER MACHINE NOISE

P. U. Lehtinen, M.Sc. (Eng.)
J. Starck, M.Sc.
P. Tikka
*J. Lauttanen, M.Sc. (Eng.)**
*H. Malmgren, M.Sc. (Eng.)***
*J. Marttinen, M.Sc. (Eng.)***
*J. Ovaska, M.Sc. (Eng.)****
*L. Lehtonen, M.Sc. (Eng.)*****

The aim of the study is to determine the noise level in paper machine halls and the characteristics of paper machines and machine halls affecting the noise level.

The study is a part of the preparatory work of the Committee on Security Regulations for Paper Machines. The results should reveal the locations in the machine halls at which the most reliable measurements of noise sources in the surroundings, and also of the echoing area, can be made. An additional problem is whether the echo sequences are a sufficient basis for evaluating the acoustical characteristics of the hall.

The airborne noises in the paper machine halls are measured and analyzed at various distances from the noise sources. The measurement locations are preliminarily chosen to be identical for all objects. Additional locations, if necessary, are indicated by the real-time analyzer. The echoing sequences of the halls are measured and analyzed in octaves. If possible, the construction vibrations will be measured and analyzed.

* A. Ahlström Company
** Wärtsilä Company
*** Valmet Company
**** Tampella Company

NOISE AND VIBRATION OF HAND-OPERATED TOOLS IN SHIPBUILDING

*E. N. Kodyskina, M.D.**
J. Starck, M.Sc.

Some workers are regularly handling vibrating tools in shipbuilding. As no international recommendations of threshold-limit values for vibration in hand-operated tools exist, the results of this study will be compared to the valid Soviet standard 626—66. For vibration affecting the hands in the direction of the wrists, the standard allows a maximum frequency of 16...2000 Herz-octaves. Occupational health limits for estimating noise are based on recommendations of the International Standardization Organization. Noise and vibration are measured in the shipbuilding industry with a real-time 1/3-octave analyzer and the results are registered by a level recorder.

The field measurements will be completed by the end of 1972. In 1973 the data will be processed, and the results will be evaluated in Leningrad.

* Institute of Industrial Hygiene and Occupational Diseases, Leningrad, USSR.

ENVIRONMENT

EPIDEMIOLOGIC WATER CHEMISTRY STUDIES

M. J. Karvonen, M.D., Ph.D.
*O. Erämetsä, Ph.D. (Eng.)**
*K. Pyörälä, M.D.***
A. Laamanen, Ph.D.
S. Punsar, M.D.
E. Järvinen, M.Sc.
T. Partanen, M.Sc.
A. Ryhänen, M.Sc.
H. Vornamo, B.Sc.
S. Kontkanen

A significant difference has been observed in the morbidity and mortality due to heart disease between eastern and western Finland. This difference is not entirely due to the usual risk factors of coronary heart disease, such as serum cholesterol concentration, blood pressure and smoking. The material has laid a foundation for the study of the relationship between common minerals and trace elements in drinking water and cardiovascular morbidity. Some 30 components were analyzed from well water samples in the area. Some rare elements were included. The components were the following: Na, K, Ca, Mg, Cl, J, Br, F, SO_4, NO_3, FE, Pb, Mn, Hg, Cu, Zn, Ni, Co, Cr, V, Ti, Sn, Sr, Cd, Mo, Ag, Ce, Y, La, Rb, total-P and total-S. The interdependencies between the water contents and cardiovascular morbidity will be analyzed using a data file where the cardiovascular data of the individuals have been linked with the water data of the wells. Common manual analyses and atomic absorption spectrophotometry have been carried out in the laboratory of the department of toxicology and biochemistry of the Institute. The analyses of the trace elements were carried

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out in the Laboratory of Inorganic Chemistry, the Finland Institute of Technology. The X-ray emission spectrophotometrical preparation and analytic method developed by Prof. O. Erämetsä was used.

BIOLOGICAL INDICATORS OF ENVIRONMENTAL AIR POLLUTION

A. Laamanen, Ph.D.
A. Ryhänen, M.Sc. (Eng.)
J. Jokinen, M.Sc.
S. Tola, M.D.
V. Riihimäki, M.D.

A population group is selected from a base level area and from a heavily polluted area. The pollution loading to which these groups are exposed is illustrated by human and environmental samples. The samples are stable so that the situation can be followed in the near future. Several departments of the Institute take part in this project.

NATIONAL RURAL AND URBAN AIR PROGRAM

A. Laamanen, Ph.D.
Y. Rautanen, M.Sc.
A. Ryhänen, M.Sc. (Eng.)

This is a monitoring project of the community air of seven rural and thirty urban areas. Together with these studies, community surveys will be done at different levels. On the basis of the material obtained, the important characteristics and trends will be illustrated.

NATIONAL BASE LEVEL AIR PROGRAM

A. Laamanen, Ph.D.
A. Ryhänen, M.Sc. (Eng.)

The evaluation and control of air quality demand a base level air survey, taking into account population distribution which describes the national anthropogenic activity. The temporal and local air situation described by other air surveys concerning populated, industrial and transportation areas can easily be compared with this base level air survey area. A region suitable for this purpose has been found at Pertunmaa in central Finland. Different kinds of base level surveys have been carried out according to a time schedule drawn up in several phases.

PARTICULATES IN FINNISH URBAN AIR

A. Laamanen, Ph.D.

Samples of particulates are collected from residential, industrial, traffic, and base level urban areas. This is a continuing multicomponent monitoring project.

COMMUNITY AIR QUALITY IN INDUSTRIAL AREAS

A. Laamanen, Ph.D.
A. Ryhänen, M.Sc. (Eng.)
Y. Rautanen, M.Sc.
A-L. Riekkinen, M.Sc.
R. Kartastenpää, M.Sc.
K. Markkanen, B.Sc.

This study is an evaluation of community air quality in relation to industrial activity. Special attention is paid to pollutant components, methodological developments and control techniques. The basis for the general evaluation of community air quality is specified for various branches of industry. Case studies from the pulp and paper industry, ore processing, iron and steel production, fertilizer manufacture, production of construction and structural materials, lead-emitting industries, oil refineries, and energy production are included. An essential part of the study is an air protection system model for industrial town planning, augmented with suggestions for standards to be used in industrial planning and surveillance, and viewpoints on protection economy in industry.

INDUSTRIAL EMISSION, TRANSMISSION AND IMMISSION EVALUATIONS

R. Kartastenpää, M.Sc.
A. Laamanen, Ph.D.
K. Markkanen, B.Sc.
A. Ryhänen, M.Sc. (Eng.)
A. Riekkinen, M.Sc.

This is a study to which a survey of various pollution factors, distribution studies near typical sources and a search for more descriptive emission factors are connected. The most important projects being developed are

a) the application of a snow sampling technique for collecting various elements and
b) vertical observations at the base level area.

The multicomponent indicators of industrial pollution will be examined during this project.

Psychological picture of manifest and latent carbon disulphide poisoning

HELENA HÄNNINEN

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Psychological picture of manifest and latent carbon disulphide poisoning

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Hänninen, H. (1971). *Brit. J. industr. Med.*, **28**, 374-381. **Psychological picture of manifest and latent carbon disulphide poisoning.** A battery of psychological tests was administered to 50 viscose workers with carbon disulphide (CS_2) poisoning, 50 viscose workers exposed to CS_2 without known poisoning, and 50 workers not exposed to CS_2. There were large and statistically significant differences between the group means of the poisoned and the unexposed group in most performances involving speed, vigilance, manual dexterity, and intelligence. The exposed group also showed impairment, but the changes were less severe. CS_2 thus apparently affects the working capacity and sociability of exposed workers earlier than can be diagnosed by purely medical means.

The differences between the groups were further studied by discriminant function analysis. The poisoned group could be reliably discriminated from the unexposed group. Of the unexposed and poisoned subjects, 91% were correctly classified in the proper group. The exposed workers could not be discriminated from the poisoned subjects with the same reliability owing to the effects of latent CS_2 poisoning in the former group.

Analysis of the discriminant functions further suggests that the syndromes of latent and manifest CS_2 poisoning differ not only in intensity but also in quality. Clinically manifested poisoning is characterized by lowered vigilance, diminished intellectual activity, diminished rational control, retarded speed, and motor disturbances, whereas traits indicative of depressive mood, slight motor disturbances, and intellectual impairment are characteristic of latent poisoning. This syndrome is probably much more common than was hitherto believed.

Adverse effects of industrial poisons should be diagnosed as early as possible. This is particularly true for agents that may cause irreversible psychological and neurological changes. Among them, carbon disulphide (CS_2) is well known for its irreversible effects on the nervous system.

The neuropsychiatric syndrome of CS_2 poisoning has been described by Lewey (1938) and Vigliani (1961), among others. Vigliani (1961) states that the picture of CS_2 poisoning has changed due to improved hygienic conditions in industry and decreasing levels of CS_2 exposure. Dramatic manic-depressive psychoses are nowadays rare; what we find is a slowly developing syndrome of poisoning with intellectual decline, stereotype behaviour, and a neurasthenic syndrome accompanied by depression.

Münchinger (1963) and Chalupa (1966) have demonstrated the value of psychological methods in industrial toxicology. At the Institute of Occupational Health in Helsinki, a study of the effects of CS_2 has been in progress since 1963 (Hänninen, 1963, 1966, 1967). This study attempts to answer the following questions: What is the quality and the degree of mental changes in clinical CS_2 poisoning? What is the functional significance of these disturbances, i.e., what are the practical effects, for example, on the working capacity? Do these changes occur among CS_2 workers who feel healthy and have no

clinical symptoms; if so, to what extent? How do the symptoms of 'latent' poisoning differ from those of diagnosed poisoning?

Material and methods

The subjects

The subjects were all workers at a viscose rayon factory. The sample consisted of three groups, each of 50 subjects. Group I included all those with clinical CS_2 poisoning. Group II comprised men without clinical symptoms but who had been exposed to CS_2 for five years or more. Group III comprised men not exposed to CS_2.

The groups were similar in age, educational background, type of work, and length of employment time at the factory. They differed in exposure/non-exposure (groups I and II/group III) and in illness/health (group I/groups II and III). Table 1 shows the age and the employment time of the three groups.

In order to control the independent variables, only subjects working in the same factory were included in the study. Nevertheless it turned out to be impossible to find groups completely without overlapping as far as exposure/non-exposure and illness/health were concerned.

TABLE 1

SOME BACKGROUND DATA OF THE SUBJECTS

Group	*No.*	*Age (yr)*		*Employment time (yr)*	
		Mean	*(Range)*	*Mean*	*(Range)*
I (poisoned)	50	40·5	(23–52)	9	(0·5–20)[1]
II (exposed)	50	38·3	(25–50)	11	(5–20)
III (unexposed)	50	37·9	(25–50)	13	(5–20)

[1]Years at work before occurrence of poisoning.

Exposure to CS_2 The average monthly CS_2 values recorded in the contaminated parts of the factory varied from 60 to 132 mg/m³ during the years 1950 and 1959. From 1960, the values were between 30 and 90 mg/m³. Several subjects were employed before 1950. According to sporadic measurements the CS_2 levels were considerably higher at that time. All the subjects in group I had been exposed to CS_2 before the onset of illness, but not after it. The exposure time in group I ranged from six months to 20 years with a mean of nine years (Table 1).

The subjects in group II had been exposed to CS_2 for 5 to 20 years (Table 1). The exposure had been continuous with the exception of holidays; some jobs also involved regular changes to out-door work. Half of the workers in group III had occasionally been exposed to CS_2, but the exposure had been neither intense nor continuous.

Symptoms of poisoning in various groups In group I the poisoning was diagnosed on the basis of a thorough clinical, neurological, otoneurological, and neuro-ophthalmological examination, including electroencephalography and electromyography. In four cases the diagnosis was uncertain. Both acute and chronic cases were included. In 20 cases poisoning had been diagnosed less than a year before psychological testing, 15 cases had been known for one to four years, and another 15 had been diagnosed five or more years earlier.

The effects of poisoning showed a large variation. Thirty-eight patients were capable of regular work. Of them, 33 were still working in the same factory. Some could manage only in sheltered work.

All the men in group II considered themselves healthy, and the regular biannual physical check-up had not revealed a single case of poisoning among them. Twelve men could, however, report occasional mild symptoms, such as headache, pain in the limbs, tremor, and insomnia. A suspicion of mild poisoning had arisen in three cases. These men had, however, recovered completely.

Of the men in group III, four had shown transient symptoms of CS_2 effect, several years before, in connexion with casual work in the contaminated areas.

Methods

Development of a battery of tests To start with, an extensive battery of tests was constructed. It covered clinical tests, known for their validity as indicators of psychological disturbances, and aptitude tests with a prognostic validity as to job success, established in previous investigations at the Psychological Department of the Institute of Occupational Health (Blanz, 1965). The battery was administered to groups II and III, and to 22 with CS_2 poisoning. The results of a comparison between the groups, and a factor analysis (Hänninen, 1966, 1967), made possible the construction of a reduced battery of tests, valid enough to discriminate between the groups and short enough to be applied at outpatient clinics. This battery was administered to the subjects in group I at the outpatient clinic of the Institute of Occupational Health.

The battery of tests included the following variables (the variable numbers and the abbreviations are the same as in Tables 2, 3, and 4):

Intelligence test

Five subtests from Wechsler adult intelligence scale (Wechsler, 1955):

Digit span
  Variable (1, D Sp): raw score
Similarities
  Variable (2, Sim): raw score
Block design
  Variable (3, BD): raw score
Picture completion
  Variable (4, PC): raw score
Digit symbol
  Variable (5, D Sy): raw score

Other abilities test

Bourdon-Wiersma vigilance test (time limit 8 min)
  Variables (6, BW speed): number of rows
  (7, BW errors): number of errors
  (8, BW fluctuation): time variation in completing a row

Santa Ana dexterity test (Fleishman, 1954).
Variables (9, SA right): right-hand performance
(10, SA left): left-hand performance
(11, SA coo): coordination of both hands
Symmetry drawing
Variable (12, Sym): number of reversions
Benton visual retention test (Benton, 1961)
Variable (13, Benton): number of correct items

Personality test
Rorschach inkblot test (Rorschach, 1946; Klopfer, Ainsworth, Klopfer, and Holt, 1954)
Variables (14, Ro Ada): adaptability
(15, Ro Emo): emotionality
(16, Ro Spon): spontaneity
(17, Ro Rat): rational self control
(18, Ro Orig): original intellectual activity

Psychomotor behaviour test
Mira test (Mira y López, 1965; Takala, 1953) Variables of extension and motor disturbances were included in the present study.
Variables (19, Mi I): length of lines
(20, Mi II): distance of lines
(21, Mi III): size of angles
(22, Mi IV): left-hand deviation
(23, Mi V): right-hand deviation
(24, Mi VI): form level of straight lines
(25, Mi VII): form level of broken lines
(26, Mi VIII): performance time
Detailed information of the tests and variables can be obtained from the author

Statistical methods The group differences were analysed using Student's *t* test and multiple discriminant analysis (Cooley and Lohnes, 1962).

The discriminant analysis yields a variable combination with maximal group differences between means taking simultaneously into consideration standard deviations and intercorrelations. Discriminant analysis allows for a simple description of group differences and an allocation of weights to the variables included in the analysis. It is also a tool for a maximum likelihood classification of new subjects into groups on which the discrimination has been based. Discriminant function values can be calculated for each subject in the original sample as well as for new subjects. This makes it possible to decide to which group an individual is most likely to belong.

In the present study discriminant analysis was used in order to get a simple description of group differences and for obtaining diagnostic weights for the various tests; the discriminant function was not applied to new subjects.

Two analyses were made, one with the poisoned (group I) and the controls (group II), and another with all three groups. In both cases all the subjects of this study were classified according to their discriminant function values. In the first classification the subjects were classified as either 'healthy' or 'poisoned', and in the second the computer had to decide whether the subject was a healthy man, an exposed worker lacking in clinical symptoms, or a poisoned case.

The statistical analysis was carried out at Helsinki University Computing Centre according to the technique reported by Cooley and Lohnes (1962; pp. 116-145). The classification was based on Bayes' probabilities.

Results

Differences in performance level

The group means and standard deviations can be seen in Table 2. This also shows the probability of such results occurring by chance. We find clear differences between group I and group III in performances involving speed, vigilance, dexterity, and intelligence.

It might be somewhat unexpected to find that in certain respects group II was more like group I, the poisoned, than group III. This was, in particular, true of psychomotor and visual performance. The results indicate the presence of severe effects of CS_2 exposure in clinically symptomless workers.

Psychological characteristics of manifest and latent CS_2 poisoning

Differences between group I and group III Table 3 shows the discriminant function that gives the optimal differentiation between group I and group III. What seems to be typical of manifest CS_2 poisoning is retarded speech, low vigilance, clumsiness and inaccuracy of motor functions, diminished intellectual activity, low level of spontaneous behaviour, and impoverished capacity of visualization.

Differences between the three groups In Table 4 we see the discriminant functions and the group means for the discriminant scores. The first function yields an optimal differentiation between group I and the other two. The function is similar in content to the one obtained for group I and group III. This can be interpreted as a confirmation of the profile typical of manifest CS_2 poisoning, described above.

The second function discriminates between group II and the others. Workers exposed to CS_2 but lacking in clinical symptoms show poor visual performance, normal verbal behaviour, impaired dexterity, disturbances in manual coordination, and low form level in the Mira test. Their Rorschach results can be interpreted to reflect good adjustment and rational control, on the one hand, but also diminished originality and spontaneity, on the other. Accurate and careful working style in the Bourdon-Wiersma and Mira tests is also a characteristic of group II. This type of behaviour might be interpreted here as an indicator of depressive mood.

Classification based on discriminant functions

Classification into group I or group III According to the first discriminant analysis each subject was categorized as a member of either group I or group III on the basis of probability of membership. Table 5 shows the results: 94% of group III, the unexposed, were classified correctly, and 88% of group I. Nineteen of group II turned out to have a higher prob-

TABLE 2

MEANS, STANDARD DEVIATIONS, AND SIGNIFICANCES BETWEEN THE GROUP MEANS

Test			*Means and standard deviations*			*Significances of differences (t tests)*		
			Group I	*Group II*	*Group III*	*I/II*	*III/II*	*I/III*
Intelligence	1	D Sp	9·4 ± 2·3	9·3 ± 1·4	9·9 ± 1·4		+	
	2	Sim	14·8 ± 5·2	16·0 ± 4·8	15·5 ± 4·4			
	3	PC	13·7 ± 4·1	14·1 ± 2·5	15·5 ± 2·3		++	++
	4	BD	32·5 ± 9·4	31·5 ± 7·9	35·7 ± 7·2		++	
	5	D Sy	27·7 ± 10·1	33·3 ± 9·5	37·7 ± 9·7	++	+	+++
Other abilities	6	BW speed	27·3 ± 5·9	33·1 ± 5·5	34·9 ± 5·9	+++		+++
	7	BW errors	22·2 ± 16·8	17·8 ± 15·6	20·1 ± 17·6			
	8	BW fluctuation	84·8 ± 46·2	60·8 ± 20 0	58·0 ± 18·2	++		+++
	9	SA right	39·1 ± 9·2	44·7 ± 7·1	49·4 ± 6·8	+++	+++	+++
	10	SA left	37·3 ± 9·2	43·6 ± 5·8	48·2 ± 6·4	+++	+++	+++
	11	SA coo	23·5 ± 7·6	26·0 ± 6·0	30·5 ± 6·2		+++	+++
	12	Sym	4·8 ± 3·8	5·8 ± 6·9	3·6 ± 5·0			
	13	Benton	19·7 ± 3·0	20·9 ± 2·9	21·4 ± 3·5			+
Personality	14	Ro Ada	8·7 ± 3·6	10·7 ± 3·8	10·5 ± 3·6	++		+
	15	Ro Emo	9·8 ± 4·2	10·4 ± 3·7	11·5 ± 3·5			+
	16	Ro Spon	9·3 ± 2·5	10·0 ± 3·6	10·4 ± 2·9			
	17	Ro Rat	8·5 ± 2·6	10·0 ± 2·9	9·6 ± 2·8	++		+
	18	Ro Orig	2·1 ± 1·4	3·0 ± 2·3	3·7 ± 2·8	+		+++
Psychomotor behaviour	19	Mi I	3·5 ± 1·1	3·1 ± 1·2	3·0 ± 1·0			+
	20	Mi II	2·2 ± 1·2	2·9 ± 1·2	3·2 ± 1·2	++		+++
	21	Mi III	2·5 ± 1·1	3·3 ± 0·9	3·0 ± 1·0	+++		+
	22	Mi IV	2·3 ± 1·1	2·7 ± 0·9	3·4 ± 1·0		+++	+++
	23	Mi V	2·2 ± 1·0	2·8 ± 1·2	3·3 ± 1·1	+	++	+++
	24	Mi VI	2·6 ± 1·1	2·7 ± 1·2	3·2 ± 1·0		+	++
	25	Mi VII	2·5 ± 1·2	2·5 ± 0·8	3·2 ± 1·2		++	++
	26	Mi VIII	2·9 ± 1·0	3·1 ± 1·1	2·9 ± 1·0			

For explanations of abbreviations, see text.

\+ $P < 0.05$
++ $P < 0.01$
+++ $P < 0.001$

ability of being a member of group I than of group III, i.e., 38% of the exposed lacking in clinical symptoms were in their test results more like the poisoned subjects than the unafflicted ones.

Classification into group I, II or III The classification into three groups can be seen in Table 6. The number classified correctly was 113, or 75%. There were more misclassifications between groups II and III, and between II and I than between groups I and III. This can also be seen in the Figure with individuals plotted on a discriminant plane. Besides the misses, the Figure also reveals a number of borderline cases: some of the exposed are quite close to poisoned, and some of the poisoned are close to the exposed without clinical symptoms.

Misclassifications

Misclassifications can be attributed to chance, to the incomplete reliability of the discrimination scores, or to the insufficient discrimination power of the tests. Misclassified subjects, especially those with a high probability of belonging to a group other than their own, can also be individuals with a behaviour pattern atypical of that group. These subjects are also likely to be incorrectly diagnosed in clinical examinations. It is also possible that here some misclassifications can be attributed to an unsatisfactory initial categorization due to some overlapping on the criterion variable.

Next we take a closer look at the misclassified cases.

Group I subjects misclassified Three men of group I were classified into group III. Their test results were not typical of CS_2 poisoning but, on the other hand, their discrimination scores also differed considerably from the average of group III. In the Figure we find these subjects in the least dense area of the discriminant space, which means that the behaviour of these men is not typical of any of the groups. One of the men had an atypical clinical record; another,

TABLE 3

DISCRIMINATION ANALYSIS OF GROUPS I AND III

Eigenvalue	*Wilks' lambda*
1·91	0·34
	F (26,73) = 5·353

Scaled eigenvector

1	D Sp	−1·03	14	Ro Ada	−0·65
2	Sim	−3·60	15	Ro Emo	1·58
3	PC	−2·17	16	Ro Spon	2·77
4	BD	−1·09	17	Ro Rat	3·13
5	D Sy	5·06	18	Ro Orig	3·62
6	BW speed	4·92	23	Mi I	−3·34
7	BW err.	−0·75	24	Mi II	−1·33
8	BW fluct.	−0·25	25	Mi III	1·32
9	SA right	0·17	26	Mi IV	4·44
10	SA left	2·11	27	Mi V	4·07
11	SA coo.	−0·04	28	Mi VI	0·84
12	Sym	3·05	29	Mi VII	−5·45
13	Benton	2·66	30	Mi VIII	−1·56

	Group means	*Standard deviations*
I	6·16	1·09
II	8·89	0·90

showing a variety of neurotic symptoms, had been categorized as poisoned on the basis of poly-neuropathy, and the third had suffered from an acute CS_2 poisoning with exceptionally quick recovery.

Seven subjects of group I had been categorized as members of group II. In two cases the diagnosis was uncertain (two other workers with an uncertain diagnosis were classified into group I). The diagnosis of the remaining five was mild poisoning.

TABLE 5

CLASSIFICATION OF SUBJECTS INTO GROUPS I AND III (ABSOLUTE FREQUENCIES)

	Empirical group			*Total*
	I	II	III	
Predicted group				
I	44	19	3	66
III	6	31	47	84
	50	50	50	

TABLE 4

DISCRIMINATION ANALYSIS OF GROUPS I, II, AND III

Eigenvalues	*Wilks' lambda*
1 1·71	0·345
2 0·33	F (52,244) = 3·30

Scaled eigenvectors

		I	II			I	II
1	D Sp	0·57	1·22	14	Ro Ada	2·03	−4·15
2	Sim	3·43	−8·04	15	Ro Emo	−2·67	0·05
3	PC	3·05	3·53	16	Ro Spon	−1·20	1·58
4	BD	2·40	2·66	17	Ro Rat	−4·57	−2·00
5	D Sy	−4·69	3·22	18	Ro Orig	−2·57	3·45
6	BW speed	−4·37	−6·84	23	Mi I	2·47	−0·41
7	BW err.	1·40	−2·54	24	Mi II	0·65	−0·88
8	BW fluct.	−2·61	−2·24	25	Mi III	−2·58	−3·13
9	SA right	−1·38	2·26	26	Mi IV	−3·48	2·77
10	SA left	−4·09	−0·96	27	Mi V	−3·80	1·72
11	SA coo.	0·58	3·04	28	Mi VI	−1·09	1·29
12	Sym	−2·60	3·03	29	Mi VII	3·40	3·86
13	Benton	−2·78	−3·06	30	Mi VIII	1·09	1·23

	Group means		*Standard deviations*	
	I	II	I	II
I	−5·30	−0·85	1·12	1·02
II	−7·11	−1·86	0·97	0·85
III	−7·85	−0·52	0·90	1·11

TABLE 6

CLASSIFICATION OF SUBJECTS INTO GROUPS I, II, AND III (ABSOLUTE FREQUENCIES)

	Empirical group			*Total*
	I	II	III	
Predicted group				
I	40	6	2	48
II	7	36	11	54
III	3	8	37	48
	50	50	50	

Group II subjects misclassified Eight subjects of group II were classified into group III. They had been exposed to CS_2 for approximately the same time as the rest of group II.

Six men were classified into group I. One of them had left work after six months. He had complained of insomnia and headache, but no diagnosis of poisoning was made. Another was transferred to another job because of insomnia, fatigue, and anxiety. It might be possible that these men suffered from an undiagnosed poisoning, or that their behaviour was like that of the poisoned, though due to some other reasons.

Four subjects misclassified into group I have not shown any symptoms of illness, and they continue with their work.

Group III subjects misclassified Eleven subjects of group III were classified into group II. Four of them were repairmen who had been exposed occasionally to CS_2; three workers had earlier been exposed for a year, and the remaining four had never been exposed. One must be careful in drawing conclusions because about half of those correctly classified had been exposed occasionally to CS_2.

One of the two classified in group I had never been exposed, whereas the other one had been exposed occasionally. Both of them had always been considered healthy.

Two special cases

Two persons were tested twice, first when they were healthy and unexposed and later when they had been heavily exposed. In the first instance they belonged to the group of unexposed workers (group III). Later their working situation changed and they became exposed and were poisoned while repairing spinning machines; then they belonged to group I. The probabilities of their belonging to groups (Bayes probabilities) were as follows:

Case	*Probability*					
	First testing			*Second testing*		
	I	II	III	I	II	III
1	0·07	0·08	0·85	0·98	0·02	0·00
2	0·32	0·13	0·55	0·93	0·06	0·01

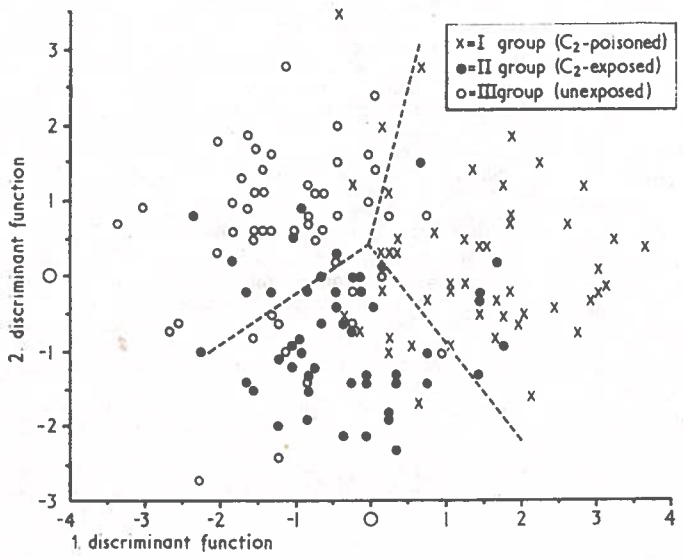

FIGURE. Location of the individuals in the two discriminant plane (second analysis).

Discussion

The psychological changes observed here in CS_2 patients are consistent with previous clinical findings. A drop in the general performance level, diminished vigilance, low productivity and originality, and a loss of spontaneity have often been interpreted as signs of depression or mental retardation. An important finding of the present study is that a motor disturbance, often quite severe, is almost a regular concomitant of poisoning.

Earlier studies have focused on the subjective psychological symptoms of poisoning. The present results reveal, however, that the psychological syndrome of CS_2 poisoning is not limited to the subjective experiences only. This syndrome also includes a disturbance of behaviour which affects working capacity, abilities in particular. We can observe a decline in intellectual performance. Even more serious disturbances occur in motor functions, in dexterity, and in alertness. As these abilities are essential for a factory worker's job success and working capacity (Blanz, 1965), it is obvious that the psychological disturbances due to CS_2 are not only a subjective burden but also a severe handicap in everyday life. CS_2 poisoning affects also human social behaviour. According to the present results, the damaging effect of CS_2 is considerable: the mental dysfunction varies, but in general the effects seem to be more severe than was previously believed.

The defects found in 'healthy' workers exposed to CS_2 are perhaps more disturbing. Disturbances and deterioration of functions essential for working capacity can be seen in them, too. What is important is that definite effects of CS_2 are also present in men who have not been diagnosed as afflicted or have not even been suspected of being poisoned. They do not show impaired health or working capacity or personality changes to the same extent as those with manifest symptoms of poisoning, but a number of these men, some of them fairly young, show a considerable loss of mental capacity and potential.

The test profiles of the two afflicted groups, the exposed and the poisoned, were different. This might show that there are not only quantitative but also qualitative differences between early and later phases of CS_2 poisoning. The discriminant function analysis provided additional information about 'latent' and 'manifest' CS_2 syndromes. It is also possible that there were differences in intrinsic proneness to poisoning or in sensitivity to exposure between these two groups. Such a difference might explain why some workers developed clinical poisoning and some did not.

When the subjects were categorized, on the basis of the test results, into the various groups, the percentage of correct placements was 75. The number of misclassifications between the poisoned and the unexposed was small. This shows that psychological tests are useful in diagnosing CS_2 poisoning. Psychological testing should be included in periodic health examinations of exposed workers, as deterioration of mental functions appears to be more frequent and more severe than was hitherto believed.

The discriminant functions obtained here can hardly be universally applicable. There are differences in the average performance between ethnic and national groups, and probably also in the compensatory mechanisms that balance mental disturbances. This makes it necessary to revalidate the methods if they are to be applied in a different cultural environment from the present one.

It is probable that similar results can be obtained with other test combinations as well. What seems to be important is to make the battery of tests heterogeneous enough to cover a variety of mental functions. According to the discriminant function analysis, it is more reliable to base conclusions on the test profiles than on some isolated symptoms.

Dr. S. Hernberg is responsible for the diagnoses; I am grateful for his supportive interest and help in preparing the manuscript.

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Psychological performances of workers exposed to various solvents

by *Kari Lindström*, M.A.*

Lindström, K. **Work-environm.-hlth 10 (1973) 151—155.** *Psychological performances of workers exposed to various solvents.* A comparison has been drawn between the psychological test performances of a group of workers exposed to various common industrial solvents (N = 168), such as tri- and tetrachloroethylene, toluene, xylene and their mixtures, and those of an unexposed control group (N = 50), and a group of subjects with CS_2 poisoning (N = 50). The methods applied were the same as those developed earlier to assess the CNS effects of exposure to CS_2. The psychological performances of the group exposed to the common solvents were inferior to those of the control group, but the performances of the members of the group suffering from CS_2 poisoning were even more disturbed. The parameters that varied most widely between the groups were sensorimotor speed performances and psychomotor performances. Visual accuracy was as poor in the group exposed to the common solvents as in the CS_2-poisoned group. In the group of solvent workers, those with verified or suspected poisoning had psychological performances, particularly in regard to sensorimotor speed, which were slightly inferior to those of the workers who had been exposed but displayed no symptoms of poisoning. The test battery seems to be a useful instrument for the registration of disturbances within groups of workers exposed to solvents.

Notwithstanding the wide industrial utilization of solvents, relatively little is known about the effects upon psychological performances of long-term exposure. Only two researchers, Chalupa and Münchinger, (1, 2, 9) have given this subject detailed study. Münchinger (9) has found varying degrees of organic psychosyndrome (disturbances in memory, thinking, and the affective state) among workers exposed to trichloroethylene, carbon disulfide and toluene.

More is known about the short-term effects. Several investigations (11, 12, 13, 14, 16) have been made into these effects by the application of psychological methods. Disturbances have been confirmed in sensory and motor performances, and in memory functions. The extent of weakening is dependent upon both the nature of the solvent and the intensity of exposure.

At the Institute of Occupational Health, mental changes attributable to long-term exposure to carbon disulfide and lead have been studied for many years (4, 10). During the course of the study concerned with the effects of long-term exposure to carbon disulfide, psychological methods were developed for examination of the CNS effects of such industrial poisons. These methods have also been tested out for some years in the clinical-psychological examination of workers exposed to a number of industrial solvents. The results obtained in these tests are reported below.

The aims of this investigation were:

(1) comparison of the psychological performance of workers exposed to solvents with that of a control group;

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(2) comparison of the psychological performance of workers exposed to solvents with that of workers with confirmed carbon disulfide (CS_2) poisoning;
(3) evaluation of the use of psychological tests in the examination of workers exposed to solvents.

MATERIALS AND METHODS

Subjects

The group exposed to solvents comprised 168 male workers who were clinically examined at the Institute of Occupational Health between 1964 and 1971. The clinical examination was made either because of suspected occupational poisoning, or in conjunction with the periodical health examinations required by law for workers exposed to solvents. The group exposed to solvents was divided into two subgroups. One subgroup (group I) comprised 42 male workers with confirmed or strongly-suspected solvent poisoning. Most of them were engaged in active work at the time of the examination. The other subgroup (group II) comprised 126 male workers submitted to periodical health examinations by reason of solvent exposure at work. A diagnosis of poisoning was made when the findings of clinical or laboratory examination, electroencephalography, electromyography or clinical neuralogical findings were pathological.

The control group (group III) comprised 50 healthy male workers working in »clean» departments of a viscose factory. They had never been occupationally exposed to CS_2, or to any other industrial poisons affecting the central nervous system.

Group IV comprised 50 men with CS_2 poisoning. Of these, two thirds were able to work at the time of the examination. Many of those still working had been transferred to tasks with less physical and mental demands, and without exposure to CS_2.

Tables 1 and 2 illustrate the occupational distribution and the main exposing agent of the two groups of solvent. The means and ranges of age and duration of exposure in the four groups have been listed in table 3.

Table 1. Occupational distribution of the groups exposed to solvents.

Type of occupation or work	Number of workers	
	Group I	Group II
Repair work	11	2
Spray painting	11	40
Dry cleaning	5	13
Glue work	1	24
Photogravure printing work	—	22
Color work	2	9
Other	12	16
Total	42	126

Table 2. Main exposure solvent.

Solvent	Number of workers	
	Group I	Group II
Trichloroethylene	21	23
Tetrachloroethylene	2	6
Toluene	4	22
Toluene + xylene	4	21
»Thinners»	4	40
Miscellaneous	7	14
Total	42	126

Table 3. Age and duration of exposure in the different groups.

Group	N	Age (yrs)		Duration of exposure (yrs)	
		Mean	Range	Mean	Range
I (solvent poisoning)	42	35	17—53	6	0.5—30
II (solvent exposed)	126	32	16—58	6	0.1—30
III (unexposed control)	50	38	25—50	—	—
IV (CS_2-poisoned)	50	41	23—52	9	0.5—20

Table 4. Number of observations, means, standard deviations and significance levels between the means of groups I and II. (Abbreviations are explained in the »Methods» section).

Test		Solvent poisoning Group I			Solvent exposed Group II			p *
		N	Mean	SD	N	Mean	SD	I/II
Intelligence	1 Sim	35	13.2	5.5	16	17.7	5.5	< 0.05
	2 PC	34	12.7	3.6	35	14.3	3.1	NS
	3 D Sy	42	32.0	10.2	121	38.1	12.7	< 0.01
Other abilities	4 BW speed	33	29.9	5.9	125	32.6	6.8	< 0.05
	5 SA right	33	44.5	8.1	115	47.0	7.0	NS
	6 SA left	32	42.7	7.3	113	43.7	5.6	NS
	7 SA coo	32	28.0	7.0	113	30.1	6.2	NS
Psychomotor behavior	10 Mi 1	31	3.5	1.1	96	3.4	0.9	NS
	11 Mi 2	31	3.4	0.7	96	3.1	0.9	NS
	12 Mi 3	31	2.7	1.3	96	2.9	1.2	NS
	13 Mi 4	31	2.9	1.2	96	2.9	1.0	NS
	14 Mi 5	31	2.7	1.1	96	2.9	0.9	NS

* Two-tailed risk level, as assessed by Student's t test.
NS denotes risk level higher than 0.05.

Test methods

The psychological methods employed were a part of those applied by Hänninen (4, 5) in studies of the psychological effects of CS_2 exposure. The variables in this study were chosen after the preliminary study (7), and were derived by application of the following tests (the variable numbers and the abbreviations correspond to those given in tables 4 and 5):

Intelligence:
- Three subtests of the Wechsler Adult Intelligence Scale (13) were used:
  - Similarities
    - variable (1. Sim): raw score
  - Picture completion
    - variable (2. PC): raw score
  - Digit symbol
    - variable (3. D Sy): raw score

Other abilities:
- Bourdon-Wiersma vigilance test (time limit 8 min)
  - variable (4. BW speed): number of rows
- Santa Ana dexterity test (4)
  - variable (5. SA right): right hand performance
  - variable (6. SA left): left hand performance
  - variable (7. SA coo): coordination of both hands

Personality:
- Rorschach inkblot test (6)
  - variable (8. Ro R): total number of responses
  - variable (9. RO rt): average reaction time

Psychomotor behavior:
- Mira test (7). Variables of extension and motor disturbances were included.
  - variable (10. Mi 1): length of lines
  - variable (11. Mi 2): distance of lines
  - variable (12. Mi 3): left hand deviation
  - variable (13. Mi 4): right hand deviation
  - variable (14. Mi 5): form level of straight lines

Statistical methods

The means and standard deviations of the variables have been computed. Univariate comparisons of the differences between two group means were made by means of the Student's *t* test. Multivariate analysis was unnecessary.

RESULTS

Table 4 indicates the means and standard deviations for the different variables in the two solvent groups, along with the significance levels between the group means. With regard to two intelligence variables, statistically significant differences were found between the groups. The performance of group I was inferior to that of group II. The clearest differences were noted in time-limited visual speed performances. The group differences in

Table 5. Means, standard deviations and significance levels between the means for solvent exposed (I & II), unexposed (III) and CS_2 poisoned patients (IV).

Test		Solvent exposed (I & II)		Unexposed (III)		CS_2 poisoned (IV)		p*	
		Mean	SD	Mean	SD	Mean	SD	I & II/III	I & II/IV
Intelligence	1 Sim	14.6	5.8	15.5	4.4	14.8	5.2	NS	NS
	2 PC	13.5	3.4	15.5	2.3	13.7	4.1	< 0.001	NS
	3 D Sy	36.5	12.4	37.3	9.7	27.7	10.1	NS	< 0.001
Other abilities	4 BW speed	32.0	6.7	34.9	5.9	27.3	5.9	< 0.01	< 0.001
	5 SA right	45.4	7.3	49.4	6.8	39.1	9.2	< 0.01	< 0.001
	6 SA left	43.5	6.1	48.2	6.4	37.3	9.2	< 0.001	< 0.001
	7 SA coo	29.6	6.4	30.5	6.2	23.5	7.6	NS	< 0.001
Personality	8 Ro R	2.6	1.3	3.1	1.3	2.3	1.2	NS	NS
	9 Ro rt	3.0	1.3	3.1	1.3	2.4	1.1	NS	< 0.05
Psychomotor behavior	10 Mi 1	3.4	1.0	3.0	1.0	3.5	1.1	< 0.01	NS
	11 Mi 2	3.2	0.9	2.7	1.0	3.9	1.0	< 0.001	< 0.001
	12 Mi 3	2.9	1.2	3.4	1.0	2.3	1.1	< 0.01	< 0.001
	13 Mi 4	2.9	1.0	3.3	1.1	2.2	1.0	< 0.01	< 0.001
	14 Mi 5	2.9	1.0	3.2	1.0	2.6	1.1	< 0.05	< 0.05

* Two-tailed risk level as assessed by Student's t test.
NS denotes risk level higher than 0.05.

psychomotor performance were not statistically significant.

The psychological performances of groups I and II differed markedly from that of the control group (table 5). It became clear that accuracy in visual perception and left hand performance in Santa Ana were more disturbed in those groups. Moreover, the sensorimotor speed was significantly slower in the exposed group than that in the control group. The most marked differences were observed in performance of the psychomotor Mira test. Enlargement of the motor pattern, and disturbances in psychomotor control were typical of the group exposed to solvents.

The performances of the CS_2 group were greatly inferior to those of the workers exposed to other solvents. In particular, sensorimotor speed tasks were more retarded, the average reaction time in the Rorschach test was longer, and psychomotor performance, particularly voluntary movements of the hands, were more disturbed.

DISCUSSION

The workers exposed to solvents were inferior in performance to the controls in almost every variable studied. However, the performances of the patients with CS_2 poisoning were even more disturbed. Visual accuracy was as poor in the solvent groups as in the CS_2 group. Nevertheless, in this study the question of qualitative differences between the CS_2 and the solvent groups remains open.

Only relatively small differences were apparent between the subgroups exposed to solvents; the group in which solvent poisoning was diagnosed, or strongly suspected, displayed results in the performance tests demanding sensorimotor speed that were inferior to results in the group free from poisoning.

On evaluation of the suitability of the psychological methods applied in this study for the examination of workers exposed to solvents, it was demonstrable that the methods attained a moderate degree of reliability in separating the groups from each other. Although this test battery does not completely cover all the psychological functions that might be affected by solvent exposure, it is adequate for the demonstration of changes induced by exposure to solvent. A more comprehensive eludication of disturbances in the psychological functions such as the activation level, affective state and the logical memory, needs additional tests.

Interpretation of the data is rendered difficult by variation in the effects of exposure by reason of a number of circumstances, including the nature of the exposure — short and intensive as opposed to long and moderate, and the elapse of time since the last exposure. In the latter case, various abstinence symptoms may occur. Furthermore, in general it is not easy to obtain reliable exposure data, particularly in retrospect.

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