

# MEDICINES AND THE ENVIRONMENT

## What Do We Know Today?

A Brief State of the Art Analysis

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## FOREWORD

This report is published by Swedish Association of Physicians for the Environment<sup>a</sup>.

The topic is a natural outcome of earlier projects which have been presented as exhibitions (*The Green Surgery* and *Green Health Care*) at the annual *Medical Assembly and Fair* in Stockholm.

This booklet addresses those physicians, public authorities, journalists and pharmaceutical companies which are interested in the effects of pharmaceutical drugs on the environment.

The purpose of this work is to contribute to a process where others will carry out more profound scientific studies in this specific area. In a questionnaire to pharmaceutical companies, the items were formulated in order to stimulate an interest in how the production and consumption of drugs affect the environment.

We have tried to find answers to the following questions:

- What do public authorities, the health sector and doctors' professional organisations know about the impact of pharmaceutical drugs on the environment?
- How much knowledge do we have today about the environmental effects of the drugs which are excreted by humans and animals?
- What environmental efforts are being made by the pharmaceutical industry, the authorities that handle drugs issues and doctors' professional organisations?
- How much awareness does the pharmaceutical industry have regarding the impact of their own production on the environment at all levels?

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<sup>a</sup> Svenska Läkare för Miljön (SLFM).

# SUMMARY

Pharmaceutical drugs are chemical substances, which we use to “prevent, indicate, relieve and cure symptoms and disease”. They have to be studied thoroughly before they can be approved, according to Swedish and EU legislation. Since they are produced in large quantities and are widely distributed, it is important to study how pharmaceutical production and consumption affect the environment. Many substances are stable and can therefore accumulate in eco-systems. As doctors, we contribute to this diffusion, but it is not easy to obtain information about the environmental effects of drugs and packaging.

## OBJECTIVES

- To make doctors, public authorities and companies interested in the topic of pharmaceutical drugs–environment.
- To investigate the current state of knowledge of how pharmaceutical drugs affect the environment.
- To investigate the environmental policies of the pharmaceutical companies.
- To suggest measures and further research within this area.

## METHODS

- A review of the literature concerning the ecological effects of pharmaceutical drugs.
- A questionnaire to the Swedish authorities concerning their view and knowledge about the ecological influences of pharmaceutical drugs.
- A questionnaire to pharmaceutical companies concerning their knowledge and policy on raw materials, production and manufacturing of drugs, managing of residue products and transport. The questionnaire deals with drugs, drug packages and advertising.
- A questionnaire to different divisions of a Swedish university hospital (Uppsala).

## RESULTS

- We have more extensive knowledge only about the environmental effects of certain antibiotics.
- Existing laws and regulations seem inadequate regarding producers’ responsibility for packaging as well as environmental assessments.
- Most pharmaceutical companies have little knowledge of the environmental impact of transport.
- The effects of metabolites excreted by humans and animals are insufficiently studied.
- It is unclear which authority has the main responsibility for dealing with the effects of pharmaceutical drugs on the environment.
- No good way has been found to present information on drugs–environment to doctors.
- The National Board of Health and the Medical Products Agency have no environmental programme. Doctors’ professional organisations seem to have environment policies, but no programmes.

## SUGGESTIONS FOR FURTHER ACTION

- All companies should use an established method for environmental quality assessment.
- The environmental quality assessment should include the effects of the transport that is needed in the production chain, as well as the effects of the excretion of drug metabolites by humans and animals.
- The area/s of responsibility of each of the different authorities must be clearly defined.
- The authorities must work internationally for restrictions on the use of antibiotics for humans and animals.
- In FASS (a compilation of registered pharmaceutical drugs in Sweden) it should be possible to insert a headline on “Ecological effects” under which new information could be added.
- More research on the effects of the excretion of drug metabolites from humans and animals is needed.

# BACKGROUND

## THE FOUR SYSTEM CONDITIONS

The current non-sustainable society with its linear handling of resources must gradually be replaced by a sustainable society, the cyclical society, in order to remove the threats to basic living conditions on earth. Four system conditions characterise the sustainable cyclical society. These system conditions have been formulated by the *Natural Step Foundation* in Sweden.

*1. Substances from the Earth's crust must not systematically increase in nature.*

Currently consumption has a definite limit — accessibility. Matter does not disappear; thus the dispersion and accumulation of waste, which causes environmental destruction and damages health, will put an end to consumption first — not accessibility.

*2. Substances from society's production must not systematically increase in nature.*

Concentrations of so-called molecular waste in nature will increase all the time, as long as we continue to spread these substances. Every substance and every residue molecular product has its own threshold value which, due to nature's complexity, cannot be predicted and must not be exceeded, if we want to maintain good health.

*3. The physical prerequisites for nature's production and biodiversity must not deteriorate systematically.*

A certain physical space is required for the function of the cyclical systems in nature and to maintain its biodiversity. Because of the current depletion of green areas, our potential for retaining a sustainable economy in society to satisfy human needs is continuously decreasing. In the long run this saps our capacity to survive, since in future, in a more energy saving society, we will become dependent on the green production of food and bio-fuel.

*4. A just and effective distribution of resources is required to satisfy human needs.*

The capacity of nature to supply us with new resources and to process our waste must not be exceeded. When the day comes when we have consumed our stock of resources, life will become a struggle for raw materials, space, clean water and air and this might lead to violence and conflicts with unforeseeable effects on health as a consequence.

## PHARMACEUTICAL DRUGS AND THE ENVIRONMENT

Almost every industrial product violates the four system conditions listed above. All pharmaceutical drugs and their metabolites will sooner or later be dispersed in nature. By using well thought-out techniques one can reduce the negative effects.

The raw materials of pharmaceutical production are plants, fossil oil, coal and minerals. In the manufacture of packages, fossil oil, minerals and wood are used. To produce energy for production and transport, nuclear power, uranium, fossil fuels and hydropower are used.

Residues are the visible and invisible waste products (dispersed diffusely), which arise from the exploitation of raw materials in production, transport and consumption/use of drugs and drug packages.

The dispersion directly from chemical industries has probably decreased considerably during recent decades. The discharge caused by a fire in the Sandoz factory in Basle in 1986, which affected the Rhine river and all its outlets, became a signal to improve the safety and handling of waste<sup>1</sup>. Pharmaceutical companies are today reusing materials like plastic, metals and various compounds within their production units<sup>2</sup>.

With regard to antibiotics, ecological effects of tetracyclines and quinolones have been observed<sup>345678</sup>. Quinolones are not metabolized in the body and are therefore excreted unmodified. They hardly break down in nature. Instead they affect bacterial flora in the external environment and there is a risk that they will spread resistance to antibiotics through the food chains. Tetracyclines are also excreted unmodified and natural inactivating systems hardly exist. These substances can also be toxic to other animals, particularly fish.

When talking about antibiotics, the term “eco-shadow” has been introduced. An antibiotic that has a wide spectrum and is also stable will have a greater impact on the bacterial flora (long eco-shadow) than a substance with a narrow antibacterial spectrum which disintegrates more rapidly (short eco-shadow).

Certain deworming agents used in animals are excreted in an active form and are suspected of contributing to the decrease of many of the insects living in dung, which have become increasingly rare<sup>9</sup>. Because of this, the normal degradation of faeces is inhibited.

Reactive metabolites from cytotoxic drugs have also been found.

## REGULATION

Sweden’s National Food Administration<sup>b</sup> has no appropriate rules except the specification of limited amounts of certain substances in food.

Chemical Control<sup>c</sup> is the organisation in Sweden that supervises the flow of chemicals. The Law on Chemical Products includes handling and import of chemical substances and companies are obliged to investigate the characteristics of the chemical substances they use. According to the so-called substitution principle, companies should wherever possible exchange dangerous substances for less harmful ones. The law is general, i.e. it regulates all activities where chemicals are used, but does not include pharmaceutical drugs, since they are covered by special legislation.

According to the Law on Pharmaceutical Products (1992:859), pharmaceutical products are “goods which are designed for human beings and animals to prevent, indicate, alleviate or cure disease or symptoms of disease or be used in a similar way”. The law does not embrace animal foodstuff which contains antibiotics nor chemo-therapeutic agents.

The Law on Pharmaceutical Products and the Decree on Pharmaceutical Products regulate approval, sales, production and other pharmaceutical handling. The Medical Products Agency<sup>d</sup> can dictate that a pharmaceutical agent can only be dispensed when a prescription is shown. The Medical Products Agency is the authority that approves pharmaceutical drugs. If a drug is approved within another country in the EU, it will also be approved in Sweden, “if there are no reasons to believe that the pharmaceutical agent may involve any risks to human or animal health or the environment”. If the Medical Products Agency’s examination reveals that a pharmaceutical drug which has been approved in another EU country may be harmful according to the above, the agency shall without delay contact the applicant and certain EU organs. The Medical Products Agency can also dictate further

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<sup>b</sup> Livsmedelsverket.

<sup>c</sup> Kemikaliekontrollen.

<sup>d</sup> Läkemedelsverket.

instructions that may be needed to protect human or animal health or the environment.

With regard to the packaging of pharmaceutical products, special safety demands are made, which may clash with ecological thinking. For instance, primary packages are not to be refilled and only “virgin plastics” may be used. Combination materials like plastic and aluminium are permitted. Within home nursing, the so-called Apodos system (one package for every dose) has led to an increase of single-use plastics. The EU’s demand for enclosed information leaflets has also led to an increased use of outer packages.

Hazardous waste is not an unambiguous concept — Sweden’s National Board of Health<sup>e</sup> and the Industrial Welfare Board<sup>f</sup> have different definitions. Pharmaceutical waste includes discarded products and waste contaminated by pharmaceutical products. Hazardous waste includes explosive, oxidative and flammable agents, agents which are harmful to health in other ways, as well as eco-toxic agents.

## **PRODUCERS’ RESPONSIBILITY FOR PACKAGING**

The Medical Products Agency is the authority which approves the contents, package and marking of new products. It makes also heavy demands on the packaging of pharmaceutical drugs.

In 1994 the Decree on Producers’ Responsibility for Packaging was introduced. A number of materials companies have been established by industrial branch organisations. The collection and recycling of materials will be dealt with when companies that fill, pack and import prepacked goods sign up through the REPA register.

In 1995 a study on producers’ responsibility for packages in pharmaceutical companies was done<sup>10</sup>. In this study a total of 72 companies were interviewed by phone.

Out of 20 drug producing companies, 19 had signed up with the REPA register. The twentieth was very small. Nine companies had plans to change their packaging to facilitate recycling.

Fifty-two companies were involved in the wholesale trade with medical equipment, mostly as importers. Thirty-nine were REPA register associates. Half of them thought they did not have any possibility of influencing suppliers to change their packaging. Five companies said they had tried to influence the suppliers. A few of them had changed their packages and some of them had begun to change.

The other 14 companies were very small, and four of them were thinking of signing up with REPA. Many did not seem to realize how the producers’ responsibility affected them.

The companies had very different attitudes to the possibilities/difficulties regarding the demands on packages and producers’ responsibility in the future.

The conclusions of the report were that producers’ responsibility in its current form does not seem to be an adequate means of control in order to persuade producers to change and eco-adapt their packaging. No central authority is in charge of supervising producers’ responsibility.

## **WHAT INFLUENCES BUSINESSES?**

Companies’ attitude to environmental issues is of course affected by economic aspects.

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<sup>e</sup> Socialstyrelsen.

<sup>f</sup> Arbetarskyddsstyrelsen.

Laws and regulations regulate the way companies exercise responsibility. Strong legislation with possibilities of imposing sentences or fines can make it economically more profitable to be “eco-friendly” instead of being “careless”.

For instance, in their seminars, the *Natural Step Foundation* uses the term: the precautionary principle. This means that as soon as there is a suspicion that a substance, in production or in consumption, may be harmful to humans or nature, it should be taken out of the production process. One cannot wait to get unambiguous evidence of the substance’s harmfulness.

Many companies have adopted this principle, since it has been realized that a bad reputation and impaired confidence rapidly lead to economic damage<sup>11</sup>. On the other hand, an active environmental interest can be positive in marketing promotion.

The cost of purchasing pharmaceuticals will become even more important when Sweden’s county councils begin to handle this budget in 1998. So-called parallel imports could lower prices but also extend transport. For instance, Omeprazol (Losec), which is produced in Sweden, is transported to Italy, where it is sold at a considerably lower price, and it is then transported back to Sweden.

In Sweden, two distribution companies (Kronan and ADA) have contracts with pharmaceutical firms to transport pharmaceutical products to pharmacies (which in Sweden are run by a state-owned company). In the advertising supplement, “Medical Products on Their Way”, environmental aspects are not even mentioned<sup>12</sup>. We do not know if the distribution companies look upon environmental awareness as a positive competitive factor.

## **INCREASED INTEREST IN THE ENVIRONMENTAL EFFECTS OF PHARMACEUTICALS**

In the environmental debate, attention has thus far not been paid to the impact on the external environment of pharmaceutical production and consumption.

At the Physicians’ Assembly in 1996, the Swedish Association of Physicians for the Environment presented two posters in their exhibition. One was on the ecology of antibiotics<sup>13</sup> and the other on producers’ responsibility for packaging in the pharmaceutical industry<sup>14</sup>. This led to discussion among the visitors, who included physicians and representatives from pharmaceutical companies.

The county councillor for environment within the Stockholm County Council was one of those who visited the SLFM exhibition and later wrote about the subject in the county council magazine *Fakta*<sup>15</sup>.

The Natural Environment Protection Board has done an investigation about future water and sewage systems, which led to the publication of two reports on pharmaceutical drugs and the environment in 1996<sup>16,17</sup>. The board has also held a few meetings, most recently on January 10, 1997, to discuss the dispersion and impact of pharmaceutical residues on the environment, together with the National Food Administration, the National Agriculture Administration<sup>g</sup>, the Swedish Institute of Contagion Protection<sup>h</sup>, the Medical Products Agency, the Swedish Institute of Veterinary Medicine<sup>i</sup>, the National Chemicals Inspectorate<sup>j</sup>, The National Board of Health and The Industrial Welfare Board. In April 1997 the Pharmacists Society<sup>k</sup> arranged a conference on “Environmental Aspects of Pharmaceutical Drugs and Drug Packages”.

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<sup>g</sup> Jordbruksverket.

<sup>h</sup> Smittskyddsinstitutet.

<sup>i</sup> Statens veterinärmedicinska anstalt.

<sup>j</sup> Kemikalieinspektionen.

<sup>k</sup> Apotekarsocieteten.

## OBJECTIVES

- To arouse the interest of doctors, authorities and companies in the subject of pharmaceutical drugs–environment.
- To investigate the current state of knowledge about how pharmaceutical drugs affect the environment.
- To investigate the environmental attitudes and policies of pharmaceutical companies and public authorities.
- To suggest measures and further research within this area.

## METHODS

- Review of the literature concerning the external ecological effects of pharmaceutical drugs.
- Questionnaire to Swedish authorities and organisations on their attitudes and knowledge about the ecological impact of pharmaceutical drugs.
- Questionnaire to pharmaceutical companies to investigate their knowledge and policies regarding raw materials, production, manufacturing of drugs, management of residue products and transport. The questionnaire includes pharmaceutical drugs, drug packaging and advertising.
- A questionnaire about handling drugs to different sections of a Swedish university hospital (Uppsala).

## RESULTS OF THE REVIEW OF THE LITERATURE

### **ENVIRONMENTAL IMPACT ASSESSMENT**

When a new pharmaceutical substance is registered, the Swedish authorities make extensive formal demands on documentation regarding its environmental effects. Since 1995 an assessment of the environmental consequences has to be presented with any application for the registration of new pharmaceutical drugs in Sweden.

The US medical products agency, the Food and Drug Administration, FDA, has very detailed specifications for a compulsory Environment Assessment (EA) which is to be included with the documents submitted when applying to register new drugs. Among other things, the pharmaceutical company has to explain how waste will be handled, from production to use of the drug, which substances will be discharged into the environment from production, use and waste products and how this will be controlled. The company also has to ensure that the handling of waste complies with current environmental regulations, show what happens to the effluent in the environment and the expected environmental impact. It must complete a detailed schedule for testing for toxic effects of the actual substances and list the measures to be taken if the tests are positive. Energy consumption during production has to be estimated. The source of the raw materials has to be specified, for instance, with regard to where plants come from, manufacturing processes, permission to harvest and an analysis of

whether approval of the new drug will affect endangered species directly or indirectly.

There are also guidelines regarding documentation for registration of drugs within the framework of the EU with requirements for environmental documentation which has to be sent to the supervising authority as a separate part of the application. The regulations do not embrace all the details. The significance of the environmental part of the application is at the moment uncertain. Within European co-operation between the authorities in the pharmaceutical sector, people expect the commission to take the initiative to further investigate and define the environmental aspects of regulating medicines.

One can say that the formal requirements in the US for the specification of the effects on the environment of new pharmaceutical substances are much stiffer than comparable demands on the majority of products. The practical consequences of the documentation demands have, however, been limited, because of the conclusions drawn by the majority of the environmental consequence assessments, namely that a wide variety of new drugs have an insignificant impact on the environment. Because of this, the FDA is considering reducing the requirements for when an environment assessment has to be included in submitted documentation.

## THE NATURAL ENVIRONMENT PROTECTION BOARD<sup>1</sup>

In the report 4660:1996<sup>18</sup> by the Natural Environment Protection Board (NEPB) it is said that approximately 95 tons of antibiotics for human use were sold during 1994. The amount of sexual hormones sold was just under one ton (Table 1).

Because of illegal trade, the quantity of anabolic steroids which is distributed in society is uncertain.

Table 1: Quantities of drugs for human use sold in pharmacies in 1994

PREPARATION	QUANTITY IN TONS
Laxatives	504
Paracetamol	232
Acetylsalicylic acid	131
Penicillin V	39
Other penicillins	15
Other antibacterial drugs	40
• tetracycline	4
• fluoroquinolones	4
Active oestrogens	0,25
Other sexual hormones	0,68

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<sup>1</sup> Naturvårdsverket.

The natural excretion of sexual hormones from humans is about 94 tons a year. In addition to this, natural hormones from animal breeding are excreted. In all, these quantities are negligible compared to the chemical compounds that have hormonelike effects and are concentrated in food chains, i.e. dioxins, PCB, phthalates and nonylphenoles.

There are also indications that synthetic sexual hormones are more stable than natural ones and that their metabolites can be activated by micro-organisms<sup>19</sup>. Thus they may have other effects after excretion.

The sale of penicillin to animals in Sweden is only one third of penicillin sales for human use, while the sale of tetracycline for animal use is 2,5 times higher. Anti-microbial substances with or without antibacterial and/or toxic activities might be spread through sludge or composts and may possibly affect the micro-flora of the ground.

The Natural Board notes that the question of the spread of drug-related substances is essential, and that there is a series of questions that need to be illuminated.

## ANTIBIOTICS

We had 83 hits when searching Medline using “environment” plus “antibiotic” as keywords and they printed and studied 43 abstracts. Nineteen of these <sup>20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38</sup> and seven other articles <sup>39,40,41,42,43,44,45</sup> were read. Articles were selected on the basis of their contents: that the abstract indicated that the article was on the impact of antibiotics on the external environment. Three articles that were ordered never arrived.

Out of the 26 articles, 17 had a connection with water and/or fish (Table 2).

Table 2. Principal subjects in abstracts and articles studied

	ABSTRACTS	ARTICLES
Water	11	7
Soil	2	2
Precipitate (marine)	5	4
Sewage	2	2
Fish breeding	6	2
Domestic animals	4	3
Degradation	3	1
Transfer of bacterial resistance	3	–
Other	7	5

Summary of contents in abstracts and articles:

- Treatment with one antibiotic can cause bacterial resistance to several other antibiotics.
- Resistance can be transferred in different ways between bacteria which are not related to each other.
- Plasmide mediated transfer is the most common.
- Resistant bacteria existed before the use of antibiotics began and can also be found in water (small

quantities) that has not been exposed to antibiotics.

- Mono- and multi-resistant bacteria are not rare in groundwater and drinking water catchment areas. As much as 80% of the examined bacteria have been reported to be resistant.
- Scientists and others agree on that it is the excessive use of antibiotics in animal and fish breeding and human use that cause the high frequency of resistant bacteria.
- The worst “sinners” of the substances examined are tetracyclines and quinolones. Tetracyclines have been found in the sediment in fish breeding areas years after treatment. Resistant bacteria have been found in both wild fish and precipitates. Quinolones can be stored for a very long time in various fish tissues and may be present even after cooking. The oxytetracyclines cause deformations in the larva stage of fish, possibly due to bonding to bone structures.

## **OESTROGENS**

When searching Medline, we did not get many hits, thus a search of other data bases was also done. When using the English keywords “oestrogen” or “hormone” plus “environment” we got 203 replies. 27 abstracts were printed and studied.

All the abstracts were about oestrogen-like chemicals, for instance, pesticides. None of them was about oestrogen excreted from animals and humans, natural or artificial.

## **CYTOTOXIC DRUGS**

When searching the Medline using “cytotoxic drug” plus “environment” there were 10 hits. While the main body of articles focused on industrial protection, one was about cytotoxic drugs and the external environment<sup>46</sup>.

The article describes how radio immunoassay in Southern England was used to measure the levels of bleomycin in sewage water, river water and drinking water in a treatment centre. The sewage water contained 11–19 ng/l while the river and drinking water contained a maximum of 5–17 ng/l. The risks of consuming this water were regarded as minimal.

When searching on the wider concept “pharmaceuticals and environment” there were 70 hits, of which six dealt in some way with the external environmental impact from pharmaceuticals, including veterinary substances.

## **RESULTS FROM THE QUESTIONNAIRE TO AUTHORITIES AND ORGANISATIONS**

### **THE MEDICAL PRODUCTS AGENCY**

The Medical Products Agency does not have any particular environmental programme nor does it have a general environmental course for the staff.

Since Sweden became a member of the European Union, an environmental trial of all new active substances which are meant to be in pharmaceuticals is undertaken. The Medical Products Agency takes into account possible permanent harmful effects on the environment when judging the benefits before approving the marketing of the substance.

The Medical Products Agency can only suggest suitable expressions to the compilers of FASS (a list of all the pharmaceuticals available in Sweden). Information regarding the environmental impact from drugs is not of current interest, since environmental evaluations are only required for new substances.

The Medical Products Agency is responsible for approving pharmaceutical drugs. Apart from this, the responsible authority is the Natural Environment Protection Board.

In a letter<sup>47</sup>, further information is presented. The Medical Products Agency is at present trying to clarify its own responsibilities regarding pharmaceuticals and the environment and is also trying to formulate guidelines for how it can look after the environmental aspects to a greater extent than today. The government has set up a committee with the mission to revise Sweden's chemical policies. In its final report (SOU 1997:84), the committee has suggested that the Medical Products Agency in consultation with the National Chemicals Inspectorate and the Natural Environment Protection Board should propose measures to reduce the impact of pharmaceutical drugs on the environment after consumption, and that the pharmaceutical industry should submit environmental consequence assessments for the use of pharmaceuticals which impact on hormone systems.

The Medical Products Agency is in principle in favour of introducing information of the possible environmental effects (if they can be demonstrated) for the products listed in FASS.

## **THE NATIONAL BOARD OF HEALTH AND WELFARE**

The National Board of Health and Welfare does not have any environmental programme. No general environmental course for the personnel has been conducted.

The opinion of the National Board of Health and Welfare is put forward through STRAMA (the Strategy Group for Rational Use of Antibiotics and Reduced Resistance of Antibiotics) and the Medical Products Agency.

## **THE COMPANY OF SWEDISH PHARMACIES<sup>m</sup>**

The Company of Swedish Pharmacies has an environmental policy and an environmental programme which were worked out during 1996/1997. During 1997 all personnel should have participated in an environmental course. Every manager will have a defined environmental responsibility within his/her section. In each of the 23 pharmacy groups there has to be a driving force on environmental issues. The company also has an environment council.

It is the Medical Products Agency which has the responsibility of evaluating the contents and packaging of pharmaceuticals with regard to their environmental effects. In 1996 the Company of Swedish Pharmacies invited representatives from the pharmaceutical industry to discuss the producers' responsibility for packages. A leaflet was also produced for the customers.

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<sup>m</sup> Apoteksbolaget.

The attitude of the Company of Swedish Pharmacies is that most pharmaceutical drugs with the probable exception of antibiotics and cytotoxic drugs, have no negative environmental effects. Reference is also made to the Natural Environment Protection Board and the meeting on January 10th, 1997.

## **THE ASSOCIATION OF PHARMACEUTICAL COMPANIES<sup>n</sup> (LIF)**

LIF does not have any environmental policy and has not done an environment assessment (or equivalent), since the associated companies take care of this task. LIF, LINFO AB, Pharmaceutical Statistics Inc<sup>o</sup> and the Institute of Medical Marketing<sup>p</sup> sort their office waste.

LIF has submitted a reply to the commission which published the report “A Sustainable Chemical Policy” (SOU 1997:84) in October 1997. Regarding the issue of whether the environmental effects of pharmaceuticals will be included in FASS, LIF says that the texts are based on the resumé of every product, which is a requirement for approval according to pharmaceutical legislation in the European Union.

The request for information about all packaging material was discussed in late 1996 by the editorial committee and within the Medical Expert Group of FASS. The request was viewed positively, but such information has not been included on the grounds that it could be deceptive, as changes to materials are not regularly followed up. Further, a package consists of different materials which would make the information very extensive and therefore increase the dimensions of FASS. It has instead been suggested that the companies could submit such information to the Company of Swedish Pharmacies which could collect it in a data base in their computer system.

## **THE SWEDISH MEDICAL SOCIETY<sup>q</sup>**

The Swedish Medical Society does not have an environment programme. When purchasing goods and services, however, consideration of the environment is taken and the society is eager to receive advice.

Except for prohibitions on smoking in the congress area, no environmental demands are made, but constructive suggestions are gratefully received.

With reference to the topic of pharmaceuticals–environment, reference is made to the sections on Occupational and Environmental Medicine, and Pharmacology respectively.

## **THE SWEDISH MEDICAL ASSOCIATION<sup>r</sup>**

The Medical Association has not adopted any specific environmental programme. The staff has no formal environmental education. The secretary’s office takes the environmental consequences into consideration when buying office products and detergents. Paper is being sorted out and one tries to minimise energy consumption.

The issue of pharmaceutical drugs–environment has not been discussed systematically within the Medical Association. EU’s permanent committee, where the Medical Association is participating, has

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<sup>n</sup> Läkemedelsindustriföreningen.

<sup>o</sup> Läkemedelsstatistik AB.

<sup>p</sup> Institutet för Medicinsk Marknadsföring.

<sup>q</sup> Svenska Läkaresällskapet.

<sup>r</sup> Sveriges Läkarförbund.

made a statement criticising CFC-driven inhalators.

## THE RESULTS OF THE QUESTIONNAIRE AT THE UNIVERSITY HOSPITAL IN UPPSALA

Five divisions regarded as having key positions in handling pharmaceutical drugs at the University Hospital of Uppsala (UAS) were requested to fill in a questionnaire (see Table 1). The divisions were the dispensary, the pharmaceutical committee of the county council in Uppsala, the pharmaceutical committee of the hospital, the division for chemistry–environment and the infectious diseases clinic.

The Company of Swedish Pharmacies in the dispensary evidenced a very ambitious environmental programme. The division for chemistry–environment also regarded themselves as having some responsibility for pharmaceuticals–environment. The two pharmaceutical committees as well as the infectious diseases clinic have so far not put this issue on the agenda. The pharmaceutical committee at the hospital was interested in the issue.

Questions and answers are presented in Table 3.

## THE RESULTS OF THE QUESTIONNAIRE TO THE PHARMACEUTICAL COMPANIES

The questionnaire was distributed in a Swedish and an English version to approximately 200 companies. We used the register of “Companies Delivering Information” in FASS 1997 and complemented it with the other pharmaceutical producing companies listed in the company register in FASS 1996. Four letters were returned since the addresses were incorrect or had ceased to function. In some cases the questionnaire was returned unanswered because the addressee did not regard it as relevant either because the company’s activities did not correspond or because the parent company answered instead of the subsidiary.

Altogether we received 63 responses. It became clear that several companies which did not have their own production had very few employees. In some cases a joint statement was made on behalf of all the companies within a group. Fifteen of the companies that replied said they produce pharmaceuticals in Sweden.

The quality of the replies varied greatly. Some questionnaires were not completely filled in. Others were circulated to different departments of a company and comprehensively filled in and copies of environmental programmes were enclosed.

Dropping out has not been analysed. Apparently there are several reasons for not replying, for instance, the company does not have any pharmaceutical production, the company has closed down or the parent company has replied instead. The answers are also difficult to evaluate. What, for instance, is the meaning of having an “environmental policy” or “environmental programme”?

The ideas underlying the question on the environmental impact of different activities (8a-g) were obviously not clearly stated. It was common for companies to reply either “Yes” or “No” to all of these questions. Some of the companies that do not engage in production did not answer the questions, while others did.

A summary of the answers is found in Table 4.

Fifty companies have an environmental policy or an environmental programme, seven plan to

establish one. Thirty-five have sent supplementary material to demonstrate this.

Thirty-six companies have some kind of environmental assessment and in addition eight are planning to conduct one. Twenty-eight have mentioned following a specific method, of which eleven have answered ISO 14001.

Fifty-one companies have a strategy for developing their environmental policy and another three companies are planning to establish a strategy. Forty-three companies have noticed an increased interest in environmental issues from their customers. Thirty companies use environmental arguments in marketing.

Out of the 50 companies which have an environmental programme, 30 have held environmental courses for both the company's board and the employees, and 46 have a development strategy for their environmental efforts. Thirty-four companies have both an environmental programme and have done an environmental assessment. Of them, 27 have held courses for the board and the staff and 29 have adopted a development strategy.

In 31 companies, both the board and the employees have attended environmental courses. Of these, 30 have an environmental policy and 28 have done an environmental assessment.

Regarding the question on whether the environmental impact of the company's activities has been investigated, the items about the production process of pharmaceuticals and waste from packages had the most "Yes" answers. The items that had most "No" answers were about transport and metabolites from excretion by humans and animals.

The question about purchasing that got more "Yes" answers was about material for printed matter and advertising, followed by the item on making demands on the production methods of raw materials for packages. Again, the question about transport had the most "No" answers.

In 37 companies, the aspect of "environmental impact" is taken into consideration in developing new medicines. The few companies that referred to their packages are not included here.

Only 16 companies can see advantages in including information about environmental effects in FASS. As motives for "Yes", competitive advantages are mentioned by several companies. One company adopted its standpoint after contacting the Medical Products Agency.

Fifty-nine companies think that consideration of environmental aspects will be important for the pharmaceutical industry in the future.

Two subgroups have been specially studied:

- One group of large companies. Forty-one of the 63 companies which answered could be found in the FASS' company register 1996. Of them, 12 companies which produced 20 or more registered substances were defined as "large" companies.
- The 15 companies that have pharmaceutical production in Sweden.

The group consisting of large companies in general has a higher profile regarding environmental issues. On the other hand, there is no difference between the companies that do production in Sweden and the entire group.

Table 3. Questionnaire to Uppsala University Hospital

QUESTIONS	UAS PHARMACY	COUNTY COUNCIL'S PHARMACEUTICAL COMMITTEE	UAS PHARMACEUTICAL COMMITTEE	UAS DIVISION FOR CHEMISTRY-ENVIRONMENT	UAS INFECTIOUS DISEASES CLINIC
1) Has your unit instructions to take environmental aspects into account when handling pharmaceuticals?	Yes, the Company of Swedish Pharmacies' environmental programme	No detailed instructions, but included in overall assessments	No	Yes	Not for external but for internal environment (hospital flora)
2) If yes, how?	See the Company of Swedish Pharmacies' ambitious environmental programme	No details	—	Registering medicines in research. Recommendations for handling of pharmaceutical waste	—
3) If 'No' to 1, has your unit nevertheless discussed environmental aspects?	—	—	No, not during the past 2 years	—	In connection with lectures on animal rearing
4) Is your unit suited to take account of environmental aspects of medicines?	Yes, of course	No comment	Yes	Hitherto the mandate has only been to watch out for "dangerous substances" in the work	No, not the individual clinic
5) If 'No' to Question 4 – which body should take such responsibilities?	—	No comment	—	—	Pharmaceuticals committee
6) Do you believe that environmental aspects of pharmaceuticals will become important in the future?	Yes	No comment	Yes	Yes, perhaps above all in respect of antibiotics and hormone-like substances	Yes
7) If 'Yes', in which way?	Whole chain of dealing with pharmaceuticals	No comment	Do not know, would like information	Rules governing limited use of waste and waste management	Regulations in connection with registration of pharmaceuticals

Table 4. Summary of answers from the pharmaceutical companies

QUESTIONS	ALL		LARGE		SWEDISH	
	Yes	No	Yes	No	Yes	No
Sent material	35	28	11	1	7	8
1. Does your company have an environmental policy or program?	50	13	12	—	9	6
2. Has the company carried out an environmental analysis of its activities? (For example, an environmental audit)	36	26	12	—	8	7
3. Has the executive/board of directors/management taken part in environmental courses?	37	25	8	3	8	7
4. Have the employees taken part in environmental courses?	36	25	9	2	8	7
5. Does the company have a strategy for developing its environmental policy?	51	12	11	1	10	5
6. Have your customers shown increased environmental interest?	43	20	12	-	9	6
7. Do you use environmental arguments in your marketing?	30	32	7	5	7	8
8. Has the company documented the effects of its enterprises on the environment?						
a) production of raw materials for medicines	26	26	6	4	5	9
b) production of raw materials for packaging	24	28	6	4	5	8
c) transportation	21	34	7	4	4	10
d) manufacturing processes for medicines	<b>37</b>	<b>16</b>	9	2	11	3
e) manufacturing processes for packaging	31	23	9	2	8	6
f) waste products from packaging	<b>41</b>	<b>15</b>	9	2	12	2
g) waste products from humans or animals consuming medicines	22	30	4	7	2	10
9. In purchasing raw materials for medicine, does your company make environmental demands regarding:						
a) production methods	23	27	7	4	5	9
b) transportation	<b>12</b>	<b>39</b>	5	6	2	11
10. In purchasing raw materials for packaging, does the company make environmental demands regarding:						
a) production methods	28	24	8	3	5	9
b) transportation	<b>11</b>	<b>38</b>	4	6	3	10
11. In purchasing printed materials and advertising, does the company make environmental demands regarding:						
a) materials	<b>41</b>	<b>18</b>	10	1	9	4
b) printing methods	28	31	8	3	5	8
12. In purchasing transportation services, does the company make environmental demands regarding:						
1. method of transportation	25	34	8	3	7	7
2. fuel	<b>17</b>	<b>41</b>	4	7	4	10
13. In developing new medicines, is "environmental effect" a consideration?	37	13	10	2	9	5
14. Do you see any advantages to include the environmental effects of medicines in FASS (i.e the compilation of registered pharmaceutical drugs in Sweden)?	16	38	3	8	1	11
15. Do you believe that it will be important in the future for the pharmaceutical industry to pay attention to environmental concerns?	59	—	11	—	14	—
16. Who is responsible for environmental issues (environmental manager/official) in the company?						
17. Does your company have any production of pharmaceutical drugs in Sweden?	15	47	3	9	15	—

## EFFECTS FOLLOWING THE QUESTIONNAIRES

- ◇ One company wanted information on where to procure environmental courses.
- ◇ One company asked for contact with environmentally interested doctors to inform them about its environmental work.
- ◇ One drug committee asked for information on pharmaceuticals and environment.
- ◇ One company suggested that the questionnaire should be repeated after a few years.
- ◇ One company contacted SLFM to get information about the organisation and the project.
- ◇ The press has asked for further information.

## CONCLUSIONS

### SUMMARY OF THE RESULTS

We have more extensive knowledge about external environmental effects of pharmaceutical drugs only with regard to certain antibiotics. We do not know very much about the effects of other medicines on the external environment and therefore cannot know whether they have a negative impact.

Existing laws and regulations regarding producers' responsibility for packaging as well as demands for environmental assessments seem inadequate.

Most pharmaceutical companies are today not sufficiently conscious about the environmental impact of transport.

The effects of drug metabolites excreted by humans and animals are insufficiently described and studied today.

The replies to the questionnaire put to different departments in a hospital indicate that the environmental aspects of drug use are not yet taken into account in the clinical work.

There are companies which have environmental programmes or have done environmental assessments without having trained either management or the employees. This might be regarded as remarkable and one may wonder whether any fundamental changes have been achieved. Almost all the companies which have trained both management and employees do, however, have both an environmental programme and an environmental audit.

The companies seem to know most about the environmental effects of packaging and drug production. They have less knowledge of the environmental effects of transport.

It appears that the Medical Products Agency, the Natural Development Protection Board and the National Chemicals Inspectorate together have responsibility for pharmaceuticals–environment. Yet it is uncertain which body has the main responsibility. According to verbal information from the Natural Environment Protection Board, further progress has not been made since the meeting held in January 1997. Making information about pharmaceuticals–environment available in FASS seems to be complicated, but it should be possible to include some kind of relevant information about the effects on the external environment.

Neither the National Board of Health and Welfare nor the Medical Products Agency have an environmental programme. The professional medical organisations have some kind of environmental policy, but no environmental programmes.

## PHYSICIANS' OPPORTUNITIES TO EXERT AN INFLUENCE

As physicians, we use chemical substances every day at work. When we write a prescription we can influence what kind, how many substances/pharmaceuticals and how much of each are spread and also how much packaging is spread.

The possibilities for doctors to prescribe in an “eco-friendly” way have not been discussed so far. Lack of information has limited this possibility. The largest quantities are prescribed in non-institutional care. New knowledge about the ecological effects of antibiotics has recently become available and the demand for environmentally adapted packaging and “nearby produced” pharmaceuticals has so far not been very substantial.

FASS does not provide the information doctors need to prescribe in an “eco-friendly” manner. The place of origin is given for provisions, which makes it possible for consumers to choose “nearby produced” products. It is more complicated with pharmaceuticals, since locally produced drugs may be transported long distances to be brought back again to be sold more cheaply (so-called “parallel import”). In addition, there is no information in FASS about, for instance, the ecological impact of antibiotics outside the body.

Since the 1970s, direct mail advertisements to Swedish doctors have steadily increased. Now the extravagant print is often reinforced with plastic covers, small plastic or metal items and so on. This makes it difficult for the recipient to sort the advertisements according to type of waste and a great deal is thrown unopened into the waste basket. This is surely an unnecessary cost to the company and an avoidable strain on the environment.

Is there something we as doctors can do to foster “the better options”?

- Try to prescribe in an “eco-friendly” manner, i.e. get information on and take ecological effects into consideration, including materials and transports.
- Avoid prescribing unnecessary quantities of pharmaceutical drugs.
- Ask consultants from the pharmaceutical companies about the ecological effects, environmental programmes, transport, packaging materials, etc.
- Say no to “eco-unfriendly” advertising of drugs.
- Say no to pharmaceuticals from companies that behave in an environmentally unethical manner.

To prescribe in an eco-friendly manner, considering transport distances, may result in prescribing more expensive drugs, which in Sweden leads to a corresponding reduction of resources for health care. As a doctor, you may find yourself facing an ethical dilemma. Perhaps this could be compensated for if, for instance, the county councils could negotiate a better price from companies with plants nearby.

Encompassed in the economic aspect is the “unnecessary” prescription of pharmaceutical drugs, which includes unnecessarily large packages and the ecological impact. Increased use of test packages could be positive.

Posing questions to consultants could stimulate pharmaceutical companies to become more eco-friendly and more interested in information about the environmental effects of their products.

It is also in the interest of all doctors to decrease the quantity of printed matter from advertising. It

should not be impossible to persuade the Association of Pharmaceutical Companies to find better alternatives.

In the 1970s and 1980s a boycott was organised against Ciba-Geigy because of their sale of oxyquinolone preparations, which led to the SMON catastrophe in Japan. This resulted in a withdrawal of the substance in many countries. A boycott by doctors thus might be an effective way of influencing pharmaceutical companies on ethical questions.

At present a patient in Sweden has very little opportunity to influence the choice of pharmaceuticals. If a doctor has not noted the name of the drug company on the prescription, should the patient not be allowed to choose a very similar preparation without incurring extra costs?

## **SUGGESTIONS FOR FURTHER MEASURES**

- ⇒ All pharmaceutical companies should have an established method for doing environmental quality assessments. This includes appropriate courses for the management and the employees.
- ⇒ The environmental quality assessment should also embrace the environmental impact of transport in the production chain, as well as the environmental impact of metabolites after excretion from humans and animals.
- ⇒ The borders of responsibility between different authorities for pharmaceuticals-environment have to be defined.
- ⇒ The authorities must increase their demands for documentation of pharmaceuticals' environmental effects. The subject has to be pursued within EU.
- ⇒ The authorities should pursue the issue of international limits to human and animal use of antibiotics through the WHO as well as in EU and other bodies.
- ⇒ There should be a headline "Ecological effects" in FASS which can continuously be updated.
- ⇒ Pharmaceutical companies should considerably reduce the quantity of printed advertising matter.
- ⇒ More research is needed on the subject of "Pharmaceutical metabolites excreted by humans and animals — is this a problem for the environment?".

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