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Improving indoor air quality in schools

Training program

Sponsored by the Italian Ministry for Environment and Territory

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Introduction

The harmony, the good atmosphere of schools, the balanced development of the children are connected to healthy school environment. It means the good indoor air quality, good quality of drinking water, the careful management of waste, careful selection of the cleaning materials, using plants in the school environment.

The health condition of the Hungarian children, especially the respiratory diseases are increasing. From the research of the Environmental and Health Institute of Hungary (1997-1999) we know that, every third child suffers from this problem. The state of the environment and health in Hungary urged the Hungarian government to join to the European Health and Environment process to improve the situation. The 2004 is an important year from this aspect, because Budapest hosts the IV. Environment and Health Ministerial Conference on 23–25 June.

The effects of a degraded environment on children's health raise increasing concern. Every year, unhealthy environments cause the death of over 5 million children all over the world. The Budapest Conference is the European response to this situation. WHO/Europe has taken the lead in the action for children and has focused the Conference on *'The future for our children'*.

The Budapest Conference is the fourth in a series started in 1989, bringing together ministers of health and of the environment as well as major stakeholders. European ministers are expected to reach consensus and make political commitments to ensure safer environments for children, through the adoption of a Conference declaration and of a children's environment and health action plan for Europe (CEHAPE).

Environment and health process, started at the end of the 1980s, aims to build bridges between the health and environment sectors, to deal with the effects of environmental problems on human health at national and international levels.

Each conference involves two sectors and ministries, providing a political forum for the discussion and adoption of the main policies proposed for implementation at national and international levels. The deliberations of the ministerial conferences are addressed to national governments, WHO/Europe and other intergovernmental organizations, nongovernmental organizations and other stakeholders in the process.

In parallel, WHO/Europe participates in other European initiatives and global actions, to bring health

high up the agenda of other sectors and ensure that it is considered as a major component when policies are put in place. Examples include the 2002 World Summit on Sustainable Development and the Environment for Europe process.

There are several topics of the conference, one of them is the indoor air quality. The conference document want to ensure a good indoor air quality in schools, guaranteed by the political commitment.

The present publication based on the project called "Clean environment and better future for our children".

The Italian Ministry for Environment and Territory in collaboration with the Regional Environmental Center for Central and Eastern Europe, (REC) Country Office Hungary has implemented a joint project of Hungary and Italy for the Budapest Environment and Health Ministerial Conference, 23-25 June 2004.

The objective of the project is to transfer awareness raising initiatives to Hungary and for participants in the IV. European Environmental and Health Ministerial Conference in Budapest for the prevention of respiratory diseases, with particular attention to children, which have already been successful in Italy.

The project has two parts: 1. The preparation of the National Breathing Day (NBD) in Hungary based on the Italian concept. First NBD is on 24 June 2004, during the IV. Ministerial Environment and Health Ministerial Conference. 2. Indoor Air Quality in Schools, pilot training program for teachers, parents and school staff, adaptation of the Italian training initiatives for a short period pilot project in Hungary.

Indoor Air quality in schools: training for parents, teachers and school staff in Italy:

A Technical Scientific Commission, created in 1998 by the Italian Health Ministry in order to elaborate proposals of preventive and legislative actions in indoor pollution, has prepared the Guidelines for the safety and promotion of health in indoor, published on the Official Journal of November 27, 2001.

In the framework of the above-mentioned Commission, a working group 'Allergies' has been created and has prepared the criteria for the indoor air quality control, as concerns the allergic risk at home and in public places, and presented a proposal of a specific programme for school buildings.

This project agrees with the project Indoor air quality in schools, which EFA-European Federation of Allergy and Airways Diseases Patients Associations completed in 2001 with a financial contribution from the European Commission in the framework of the Community Health Programme concerning pollution-related diseases.

Following these two important scientific papers, the Rome Municipality has realized a project entitled: For a school with healthy Air: asthma and allergy: prevention and integration in the school setting, which ended with a publication of a informative leaflet which was distributed to parents and teachers of all maternal and primary schools. Moreover, in a selected number of classes, the Rome Municipality organised training for parents, teachers and school staff through meetings with doctors and representatives of the patients Associations. These lessons started in May 2003 and continued at the beginning of 2004.

After several consultation with the Hungarian and

Italian experts the pilot training program was developed and implemented at the end of April 2004 in the REC. The content of the training program focused on two aspects of the air quality in schools. The first was the present air quality in schools, actions for improvement. The second was the chemicals used in schools, learning about environmental friendly cleaning materials.

After the one day pilot training, the participants of the schools were asked to integrate the concept of the training into the school development program, which is an on-going process now. Measuring the outcome of the training, an additional part of the project has been developed with the help of the Hungarian Environment and Health Research Institute. The Institute is measuring the health indicators of the children in the selected schools. The result will be presented in the side event at the Budapest Conference. You can find further information on the www.rec.hu website.

Part 1

THE TYPES OF DAMAGES AND HARM IN THE AIR OF ENCLOSED PLACES

BACKGROUND MATERIAL

Introduction

All adults and children are exposed to a wide range of harms and damages in our everyday life which we should take account of. I am strongly convinced that if we are familiar with these hazardous and harmful substances and inform our surroundings about the methods of lessening such harms, we do our best to protect our health. It is not difficult to lessen these harms, we only need to pay attention to it.

Our teacher colleagues would like to help in the compilation. According to our experience the problems of environmental and health education can be introduced to our students with the use of the appropriate method. Thus we offer factual exercises and methods for realisation beside the background information.

When you get home after a stressful day, you close the door and think you have locked out the problems of the office, the poor quality air and the noise. The evening will be comfortable and causy with your family.

However, it is essential to know what is around us in the flat, the office or the school. What everyday objects contain, what is in the air of our room and classroom. We are going to discuss this topic in the following, but we will touch upon the ways of protection from harms and damages independent of us (how to lessen the harmful impact of substances).

Based on my experiences as a teacher we are responsible for drawing our students' attention to harms affecting them directly. Factual knowledge is vital in shaping the conscious healthcare and environmentalist attitude. And the shaping of this attitude is an essential requirement of the 21st century. We can only protect our health and environment with environmental awareness. Sustainability is workable this way only.

1. What is in the air of our flat, office and school?

We should get acquainted with this question because we spend most of our lives "enclosed". An average person spends 85-90% of his life in closed places. We face the same kind of problems in school or at the working place or at home.

Everything has changed around us: building materials, furniture materials, paints, covering materials. Flats have lower ceilings thus hazardous substances are present in a larger degree of concentration than they used to. We use gas for heating most of the times. There are more and more hazardous materials harmful to health that get released in the air of rooms and calssrooms.

Tobacco smoke

<http://www.hazipatika.hu/topics/nikotinstop/articles?aid=20040329130038#5>

(based on the article of Márta Máriáss)

Tobacco smoke contains the mixture of 80 types of alkane, alkene and alkine, approximately 100 aromatic hydrocarbons, appr. 25 different types of alcohol, carbonyl-by-products, acids, ether salts, phenols and phenolethers, further alkaloids and nitrogenous compounds, peroxides, sterines and terpenes. There are a lot of cancerogenic substances among the enumerated ones. The substances to be found in the smoke drift in the air as solid corpuscles or fluid drops of various sizes. Larger corpuscles stay affixed on the nasal mucous membrane, smaller ones reach deeper areas to the air sacs of the lungs. The ciliated cylindrical epithelium of respiratory tracts attempts to clear away the intruder substances from the respiratory organ by uninterrupted motion, however, due to the impact of toxic substances the epithelial cells perish at the same time. The corpuscles that managed to get deeper stay affixed on the mucous membrane where phagocytes gobble them up. The majority of tobacco smoke consists of corpuscles of 0,1-1 micrometer which get to the depth of the lungs without stopping and exert their effect there. You can calculate now that a smoker collects 6 kg of dirt in his lungs if (s)he smokes 20 cigarettes every day for 20 years.

Children growing up at places reeking of tobacco smoke contract respiratory, conjunctiva and accessory cavity diseases more often.

Thus it is essentila to prohibit smoking in the schools and at working places.

Nitrogen-dioxide

It gets into the air of the house by cooking, baking and heating. The quantity depends on the quality of the gas used. In case of the combustion of natural gas with high

heating quality more nitrogen-oxide is released. Gas-convectors produce more hazardous substances than the more modern forms of gas-heating. This composition increases especially the respiratory morbidity rate of children under 2. If we cook in a kitchen with appropriate ventilation, it will be of great help. Let in fresh air very often if you use the gas-cooker. Heating with convector is not to be recommended in schools.

Formaldehyde

It is released from the formaldehyde-resin that is used as an adhesive for furniture and furnishings compressed of sawdust. This composition provides beneficial results as it protects the floor and the wall-paper from moulding, yet it does our health harm. Its cancerogenic effect was proved in the 80's, its allergen impact causes respiratory diseases particularly.

The formaldehyde gets into the air from fresh timber. In olden times only well and thoroughly seasoned wood was used for building, therefore it provided much less pernicious effect. Consequently one should forebear to use such furnishings at home and at school.

Organic dissolvents evolving from synthetic materials

They might cause allergic reaction, when in a larger degree of concentration they are cancerogenic.

Radon

Radon is a radioactive gas present in nature. Radioactivity is the characteristic feature of certain substances. They dissolve without any peculiar effect and transform into another substance. The decomposition is accompanied by radioactive radiation. By the formation of the Earth these substances were already existing, but many of them has dissolved since then. Their rate of decay is defined by half-period. At the decomposition of the uranium occurring in the soil radon is created which gets into the atmosphere. Its half-period is only 3,8 days. The radon content of the air depends on the location and the weather.

They get on to the dust corpuscles drifting in the air and thus become integrated into the air inhaled. They stay affixed on the walls of the air sacs in the lungs, exert their destroying effect thus increasing the risk of lung cancer. The radon load is the greatest at floor level as most of it originates from the soil. Most of the substances created at the decomposition of radon are radio-active therefore they produce harmful effect on our health, as well.

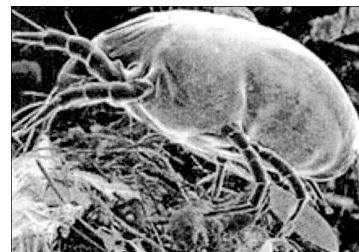
Biological contamination

Mildew and acarus are the two most important pollutants. Mildew proliferates in premises with wet air. Its substances often generate respiratory diseases. We can protect ourselves by cleaning with acetous or hypo water.

Both creatures may bring on allergic reactions. A lot of the people staying at premises without appropriate cleaning suffer from chronic respiratory illnesses.

The acarus-allergen is an aggressive substance that provokes an allergic reaction from the immune system (the production of IgE).

This Articulata species of microscopical size feed on scarfskin from humans and animals. Its droppings contain a highly irritative protein type. This animal proliferates the best at 20-26 degrees Celsius, and at 60-80 vapor percentage.



The acarus is to be found everywhere in the house, in overlay mattresses, cushions, carpets, cuddly toys. Every gram of domestic dust contains 10-20000 pieces of acarus, thus all dust-traps should be removed. Dustin should be done frequently. Airing in the sun will help a lot as it decreases the amount of acarus.

Solution, alternative methods for lessening harmful effects

- Use natural materials when building a house.
- Select paints, coloured varnishes, adhesives carefully.
- Let in fresh air frequently and consistently.
- Provide for legal background (see Appendix No.1).
- Use plants (see Appendix No.2).

We spend most our lives at school or the working place thus it is absolutely essential to create a healthy environment. Printers and xerox machines release chemical substances as well, so carefully chosen plants may prove very useful at these spots. It is recommended to place the following plants to such locations: azalea, rubber palm, tulipe, poinsettia, bamboo. These plants fix the harmful formaldehyde, the toluol etc. from the air. Cactus should be placed next to the computer. If there is central heating in the room, put several ferns into it.

You can read more about the plants in Appendix No.2 which help in keeping the air of classrooms and rooms clean.

2. Noise

We do not always consider noise as a source of environmental contamination. We live surrounded by noise in the streets, in school or in our homes. That is why it makes a difference what kind of materials are used for building and covering in the schools or at home. 60-70 % of the Hungarian population is affected with the noise of traffic.

Therefore bushes and trees should be planted around the school wherever it is possible. They damp the noise because the small leaves and branchlets disperse the sound waves and the susurration of the leaves damps the disturbing noises.

3. Scents and smells

There is an olfactory epithelium of 5cm² in the upper part of the nasal cavity of humans which consists of millions of olfactory cells. They are irritated by the various smell molecules. The result of smelling may trigger pleasant or unpleasant feelings. Favorite smells and scents influence the operation of the organism to advantageously.

Part of the basic smells is determined by the shape, composition and construction of molecules. They are for example: camphor, mint, ether and flower-scent. Other smells are created by the electric charge of the molecule, eg. pungent or rotting materials.

The sensitivity of smelling is nanogram ($\text{ng} = 10^{-9}\text{g}$). 10 ng of smell is discernible in 1 dm^3 of air. Depending on the quality of the substance they provoke smelling to different degree. Acetone of 4 ng, camphor of 0,016 ng, vanilla of 0,0005 ng stimulates the olfactory epithelium.

Several substances of different concentration provoke different smell. If we enter an unventilated classroom we are exposed to unpleasant smells sometimes. But only a short time after we do not smell them any more. The reason for this phenomenon is the exhaustion of olfactory cells, and only increasing smell intensity or intensive smells can be perceived constantly.

Nowadays essential oils celebrate their revival. They are used in different parts of our lives. A couple of interesting data will show their effectiveness. We can use the following oils not only in school but at home, as well.

Essential oils are the by-products of the operation of the vegetable organism. They are compositions of scents characteristic of species, they evaporate strongly. They are stored in various part of the plant. The quality and composition of essential oils is strongly influenced by the soil, the climate, the age of the plant and the time of harvesting. The high price of essential oils derives from the huge amount of plants used up for their production. For example 1 kg of lemongrass oil necessitates 10 tons of plant to be processed. 1 liter of orangeblossom-oil can be extracted from 1 ton of hand-picked flower. 1 drop of rose oil comes from 30 full-blown flowers (50 drops = 1 gram). We are going to write about a kind of oil that can be used in classrooms, as well.

Lemon: native in East India, the oil is extracted from the pericarp of the fruit by compression. It is a remarkable and outstanding germ-killer:

- The vapor of the lemon oil killed the pathogen of epidemic meningitis in 15 minutes,
- the pathogen of typhus in one hour,
- the pathogen of pneumonia in 2–3 hours,
- the pyogenic bacteria in 2 hours,
- the bacteria causing tonsillitis in 3–12 hours.

Thus we can sterilize the air of rooms to a large extent by evaporating lemon oil in aromatizing lamps. This is necessary because there are 20 000 pathogens in 1 m^3 of air in a central flat and 5 000 000 pathogens in 1 m^3 air of an office. Moreover, lemon-oil frightens flies away, as well.

METHODOLOGY

The transmission of everyday knowledge is getting more and more emphasized in our education. Healthcare is included into the requirements of the new final examination system and gets a stressed role. Thus the issue is

to be dealt with everywhere. We can get close to children only with interactive methods. In the following we offer some methods to supplement the background material above which help teachers in transmitting and conveying such „dry“ subjects while having fun.

Suggested methods:

1. Groupwork: The types of harm in the air of schools and houses and the alternative methods to lessen these harmful effects

- Task of group 1: How can you make the air in your house more healthy? (1st exercise sheet)
- Task of group 2: The air of our home. (2nd exercise sheet)
- Task of group 3: Double-faced problems, or else professional ventilation. (3rd exercise sheet)
- Task of group 4: The built environment around us and health. (4th exercise sheet)

The exercise sheets contain loads of ideas. The teacher can choose as (s)he wishes according to the composition, age and erudition of the target group. The exercise sheets are to be found in Appendix No.1.

2. Legal background

Are there any legal measures concerning the protection of human health and decrees defending the people working in enclosed places?

It is essential to know the law and measures. Our students get acquainted with legal measures outlining the design and construction of school building. Of course they are not supposed to know the whole provision. Students become familiar with its details through a „playful investigation“ when trying to find answers from the text of the provision to the questions of the exercise sheet. The text of the decree No. 19/2002 OM is included in Appendix No.3. Appendix No.2 introduces the exercise sheet recommended for getting familiar with the provision.

3. Rhetoric contest: Compare traditional and modern buildings and the composition of their air.

Our students learn the rules of sophisticated discussion and debate this way. They acquire the dodges of persuasion based on arguments. The game is presented in details in Appendix No.4.

4. Preparation of graphs, analysis : The features of air in enclosed spaces (composition in percentage, extent of exposure to radon in flats of different countries) are determined by the students through the analysis of graphs. They use their creative power at the preparation of graphs. They can use the computer if necessary (they can practice the operation of computers this way). (Appendix No.5)

5. Literature work: Students try to collect information in connection with the significant relations of scents and essential therapy. They realise that substances occurring in nature may be used for curing everyday diseases and problems. We teach the children how to substitute medicaments and remedies with simple and natural substances and materials. But we do not forget to mention the dangers, either..

They collect material about various essential oils, their effects, where they can be applied. It is worth introducing several essential oils and discuss their composition and effect.

6. Preparation of a plan: We familiarize our students with facts like to what extent are we able to put up with noise or how we can decrease the load of noise in our immediate vicinity. (Appendix No.6)

TEACHER TRAINING MATERIAL DRAFT, OUTLINE

It introduces the outline of a teacher training material we have already tested. The compilation was prepared from materials you can read in the appendices. This material can be processed and finished in 90 minutes.

Appendix 1

Exercise sheets for groupwork

1st group-task: How to make the air in your flat more healthy? Read the article you received and answer the questions! Source: *Clean your lungs with plants*

NSZ • 5th December 2001 • Author: Mrs.Károlyné György dr.

- What kind of plants would you use to clean the air? List them here!
- Introduce these plants! Select the appropriate one from the pictures.
- Calculate the base area of the room/classroom! How many square meters green area is necessary to achieve clean air?
- If there are smokers around you how many plants would you keep in their rooms? Why?

Try to find interesting details about this plant! Summarize in a circle diagram what this plant causes to cohere and in how many percentage! (You can use the computer too.)

- Prepare a comparative analysis of the ability of different plants to fix hazardous materials!

You will find an answer to all questions in the article. The pictures of plants can be loaded down from the following website:

<http://www.kertpont.hu/disznoveny.htm>

The pictures and descriptions of plants can be found in **Lelkes L. (editor): Indoor plants** Agricultural Publisher, Bp.1990 book or any other book on the same or similar topic.

1st group-task: The air of our home. Read the article handed to you then answer the questions!

Source: *Professional ventilation*

- Would you like to live in a healthy flat? Design the following but try to remain realistic! Take economical view points into consideration as well!
 - What substances would you use for building you own house?
 - What room sizes would you design?
 - What type of heating would you employ?
 - What kind of furniture and objects would you put in your flat?
- Collect solutions which make it possible to significantly lessen the concentration of hazardous substances in the air of the room!
- Fill in the following chart! Which would you be able to alter? Which emission source could you terminate?

Emmission source	Name of contaminating substance	Effect of contaminating substance to health	Alternatives for prevention
cigarette			
gas-cooker	1. 2.		
gas-convector	1. 2.		
gas cirkó	1. 2.		
furniture			
covering materials			
plastic			
Biological organisms	1. 2.		

2nd group-task: The two-foldedness of problems or else professional ventilation. Read the article given to you then answer the questions!

Source: *The air in our home* <http://www.lelegzet.hu/archivum/1998/01/0569.hpp>

- Do you think that draught of air is always harmful?
- Compare the insulation of old and newly built houses! Fill in the following chart!

Type of flat	Positive references	Negative references
Old flats		
Newly built flats		
Air-conditioning equipment		

- Give a summary of the problems emerging in wet flats! Is there a connection between this situation and the ventilation?
- Give a summary of the problems emerging in dry flats! Is there a connection between this situation and the ventilation?
- The air gets used up in any kind of room if the windows are closed. Calculate how the composition of air in the classroom changes during a lesson. You will find all necessary data in the text. You have to be aware of the fact that with every inhalation $0,5 \text{ dm}^3$ air gets into our lungs and when relaxed we breathe 16 times a minute. Other data is included in the text.

3rd group - task: Our built environment and our health. Read the text handed to you then answer the questions!

Source: *Our built environment and our health* <http://www.lelegzet.hu/archivum/2003/04/2755.hpp>

- Ask your classmates how much time in average they spend in enclosed spaces on weekdays and weekends.
Calculate the mean from the results!
 - a) time spent in enclosed spaces weekdays: hrs
 - b) time spent in enclosed spaces weekends: hrs
 - c) combined mean: hrs
- List the modifications in building a house which cause the air to have more hazardous and harmful substances today than it used to..
- Which are the most hazardous substances in the air of rooms?
- Draw a schematic contour of a human being! Draw in the organs that are exposed to the hazardous substances present in the air of the room. Indicate these organs with arrows and write the name of the hazardous and harmful substance there! Choose a different colour to each substance!
- What are the hazards in vacuum-cleaning? Follow the route of a tiny grain of dust to the air sac of the lungs. Compile a process graph based on your answer.
- How can we protect ourselves from harmful effects? Word 10 suggestions which might help us in lessening the harms of the air in rooms.
- Prepare small drawings that demonstrate the „Ill building syndrome“

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Appendix 2

Exercise sheet to get acquainted with Ministry of Education Decree Nr.19/2002

PROVISIONS OF LAW

TASKS:

- What is the number of the decree?
- Based on which law was this decree created?
- What size should the building ground be where it is allowed to build a school? Where can they build a school?
- What should be the floor covering be like? What should be the natural lighting like?
- What kind of regulations concern the acoustics?
- What size should a classroom have?
- What size should various rooms have?
- What size should collections have according to design?
- What size should the teachers' room have?

Appendix 3

Ministry of Education Decree Nr. 19/2002 (V. 8.)

On the Architectural and Technical Requirements for the Location and Design of Public Education Institutions

Appendix 4

RHETORIC CONTEST

Duration of the game: 50 min

Recommended to age-group: 15-18 year-old

Aim: developing the culture of discussion, establishing reasoning skills (the new final exam requirements involve reasoning as a method)

Applicable: in classes, forest schools, camps

Preparations (1 min)

- Form four groups (A, B, C and D)! all the groups receive the copy of the article about air-quality in flats which should be elaborated by the groups.

The exercise (15 min for preparation)

The players collect arguments for the topic and they can make notes of it.

Topics:

- You move to an old house. You have to persuade your partner with arguments that you struck a better bargain than he did with his newly built home! (A team)
- You move to a newly built home. You have to persuade your partner that you struck a better bargain than he did with his old house! (B team)
- Persuade your partner to invest into an air-conditioner as it has a lot of advantages and creates a healthy micro-environment at home! (C team)
- Persuade your partner not to invest into an air-conditioner as natural ventilation is much healthier than the artificial one. (D team)
- Select the flat located in the wetter environment! (One of the winning teams)
- Select the flat located in the dryer environment! (The other winning team)

The course of the game: (11 min/pairs game)

- One pupil should be appointed from each group who has to argue based on reasons listed. The rhetor has three minutes during which(s)he tries to convince his/her partner and the audience about his/her right. First listen to the rhetors of team A and B. then questions can be directed to the rhetors in 2-2 minutes. This is followed by a voting. The audience votes about the more persuasive rhetor. They can vote with yes, no or abstain. All the members of the four teams take part in the voting.
- Repeat the same with team C and D.
- The two winners compete in the final as stated above.

Announcement of results, brief evaluation: (1 min)

Resource: Professional ventilation

Appendix 5

GRAPH MAKING, ANALYSIS

1ST EXERCISE:

A part of György Marx: *Close to the atomic kernel* is introduced. There is data in it indicating that the radon concentration might be totally different in various places. Use the data to complete a column diagram which shows radon-concentrations depending on location. You can use a computer for the preparation of the diagram.

2ND EXERCISE:

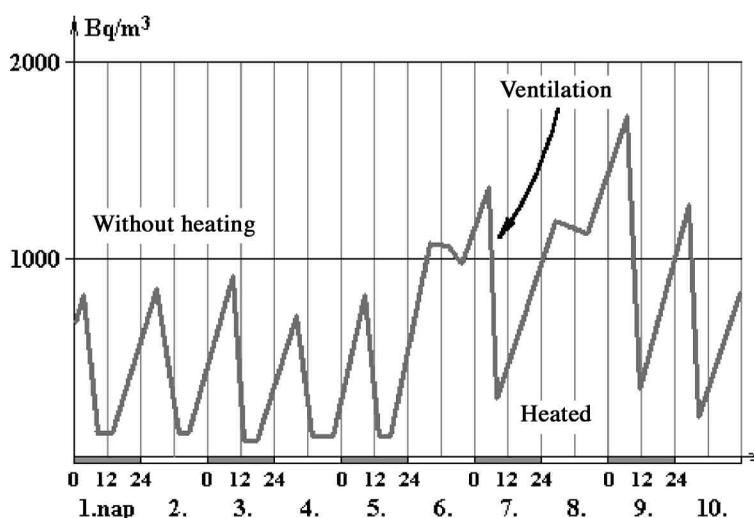
A part of György Marx: *Close to the atomic kernel* is introduced. There is data in it reporting about the alteration of the mean value of radon activity concentrate in the air of flats in certain countries. Prepare a column or circle diagram with the help of data to show the differences measured throughout the countries. You can use a computer for the preparation of the diagram.

3RD EXERCISE:

A part of György Marx: *Close to the atomic kernel* is introduced. In the handouts copied you can read data about the origin of radon to be found in our environment. Try to show the % distribution of them in a circle diagram. You can use a computer for the preparation of the diagram.

4TH DIAGRAM:

A part of György Marx: *Close to the atomic kernel* is introduced. Analyse the graph. Use the copied substance for it.



Resource: György Marx: Close to the atomic kernel

Appendix 6

THE NOISE

EXERCISE

Look at the following chart!

Let's suppose that you get commissioned to build a school. Try to design what kind of substances you would like to use, how you would want to face the walls and floor the classrooms. Explain your selection.

substance	speed (m/s)
rubber	40
air	340
cork-wood	430
water	1400
concrete	3200
brick	3600
glass	5200

EXERCISE

Observe the chart below!

It is good to know how intensive noises surround us. Which of them do you think you are exposed of in the classroom? Which would you be able to avoid? Why is it worth doing so? Explain your response.

Volume	Phenomenon	Biological impact
10–15 dB	Rustling of a leaf	Pleasant silence
20 dB	Whispering human sound	Silent noise, possible to learn or sleep meanwhile
35–40 dB	Quiet radio, TV	Silent noise, possible to learn or sleep meanwhile
45 dB	Permitted noise level of class-room	
50–55 dB 60–70 dB 75–80 dB	Medium sound intensity talk Loud talk Street crowded with vehicles	In case of durable impact irritability, tenseness, insomnia, circulation trouble, fall of body temperature, inattention may develop.
90 dB	Full orchestra forte, engine-room, motorbike, Niagara falls.	In case of durable impact auditory nerves get damaged, permanent hearing defect
100 dB	Earthquake in the distance, power plant, beat band	
120–130 dB	Thunder, airplane	Threshold of pain
140–160 dB	Explosion	May lead to deafness or death

(The resource of charts: K. Jusztn, Andrásné Orosz, Zsoltné Kapuvári J.: Naturalist and environmentalist pupils exercise book II. (The air))

Indoor air quality training program – Szentendre

1. WHAT DOES THE AIR OF ENCLOSED PREMISES (FLAT, SCHOOL, OFFICE) CONTAIN?

- **Brainstorming (5 min)** foil, marker
- **Group work, presentations**
 - Tasks of group 4 and human-drawings:
 - The impact of contamination on health
 - Provisions of law
 - 10 suggestions for self-protection
 - Tasks of group 2 and radon:
 - Composition of air in room, chart
 - Contaminations present in schools
 - How to decrease the quantity of contaminating substances?
 - Tasks of group 3:
 - Filling in the chart
 - Counting (with the data from text)
 - Wet or dry flats have better air quality?
 - Tasks of group 1:
 - Plants cleaning environment
 - What kind of plants should be kept at home or in the office or in the school
 - Plants for smokers

Report

2. DILEMMAS

- **Rhetoric contest (16 min) – two teams**
 - Collection of arguments (5 min)
 - Rhetoric (3–3 min)
 - Questions to rhetor (2–2 min)
 - Voting (1 min)

3. COMPARISONS – COMPOSITION OF AIR

- **Preparation of graphs based on data (10 min)**
- Presentation – announcing tasks (4 x 2 min)

4. THE NOISE

- **Preparation of plans (10 min)**
- Presentation of plans (2-2 min)

Part 2

CLEANING THE SCHOOL

Introductory thoughts

It is a natural demand to have clean environment around us. This is the prerequisite of hindering the spreading of all kinds of diseases in closed premises like schools. Class-rooms, staff room, laboratories, collections and first of all toilets must be cleaned every day.

We can buy highly effective disinfectants in shops in order to get rid of the spots of dirt and to kill germs. The biggest problem caused by these detergents is that their compounds mean great harm to our environment and our health. One is exposed to this harmful effect both if (s)he works with such chemicals (cleaners, wardens, or anyone at home) and if one is present at a place these detergents are being used. Therefore it is vital to get to know the sanitary safety features of such chemicals, to take them into consideration while using them and to try to purchase products that have the smallest deleterious effect.

Nowadays people think that using a great amount of concentrated and drastic cleaning chemicals and disinfectants is essential for tidiness. Of course this is partly the work of manipulative advertisements. Manufacturers put more and more new products on the market – eg. detergents that remove even „persistent stains“ without effort.

It is important to emphasize that the durability and the quality of consumer goods relies heavily on their maintenance and tending plus the features of substances used for it. One basic element of environmental awareness is when we purchase durable consumer goods and keep them fit for use as long as possible. In order to achieve this we should do the cleaning with the most appropriate and mild detergents.

The danger lying in the use of chemicals is shown by the fact that recently more laws and regulations have been dealing with the instructions how to use chemicals securely. (See Appendix No.1)

Features of detergents

In the cleaning process the stain is removed from the usually plain surface without or only with little water. Physical and chemical changes occur during this process.

Detergents are developed to remove specific types of stains most effectively. There are no detergents suitable for removing all kinds of dirt with the same effectiveness. Effect is defined by the chemical composition and physical characteristics of the stain and the detergent.

Characteristics should be indicated on the flask of the detergent. For example as follows:

- Name of detergent,
- What to use it for,
- Duration of employment,
- Dosing,
- Composition,
- Health and work safety instructions: R and S phrases, symbols of danger.

Symbols of danger: pictograms indicating the hazard of using such substances. (See Appendix No. 2!) They are used as labels in the European Union and in other countries, as well. The lack of labels does not necessarily mean that the chemical is harmless. The symbols X (irritative (Xi) and harmful (Xn) substances) and C (corrosive substances) can be found on detergents and the symbol F (flammable (F) substances and highly flammable (F+) substances) is on sprays.

Safety instructions are defined and provided by Act XXV of 2000 about chemical safety. (See Appendix No.3!)

R phrase and R number:

„a sentence referring to the risk of hazardous substances and preparations and the number of this phrase.“

S phrase and S number:

„a sentence referring to the secure usage of hazardous substances and preparations and the number of this phrase.“

The meaning of the most common R and S numbers may be read in Appendix No.4.

Safety datasheet:

„a document listing the conditions of defining, handling, storing, transporting, and managing hazardous substances and preparations plus the requirements of healthy work.“ (See Appendix No.5!) Merchants circulating such detergents are obliged to prepare this datasheet and hand it over to the customer.

The chemical composition of detergents determines

how harmful they are to health and what kind of symbols of danger and R and S phrases get on to them.

Types of detergents and their composition

<http://www.okoszolgalat.hu/page7.php>

- **All purpose cleaners and liquid detergents** stand close to compensate the xerodermia and the solution of dermal fat caused by tensides. Appendix No.7 indicates the construction of tensides and the steps of their operation. The fundamental requisite to synthetic liquid detergents and multi-purpose cleaners is to decompose in biological way. One condition is they do not contain sulfon-acid tensides and divergent hydrocarbon chains. The hydrophilic molecule unit usually includes several hydroxyl groups. These detergents must be phosphate and decolorant free.
- Certain multi-purpose cleaners contain acetic acid or other organic acid beside or instead of tensides, as well.
- **Carpet cleaners** remove dust, grease and other dirt from the textile. They make it possible for us to clean the substance dry and quick and to brighten its colour. Such detergents contain powerful surfactant compounds and colour vitalizing additives.
 - **Stain removers** help us get rid of stain and dirt concentrated on a small spot other detergents could not remove. General stain removers are to be used in case of grease or oil spots or food types leaving stains in general. In fact they consist of the mixture of organic solvents (benzene, carbon-tetrachloride, trichloro-ethylene) and a base for impurity absorption. Specific stain removers may be used for the removal of certain stain and spot types.
 - **Furniture polishes** are sold in paste, cream or emulsion forms, their main constituents include wax, mineral and vegetable oils (aliphatic hydrocarbons) and formaldehyde and silicone. They serve for the plugging of pores in the wood and for polishing the surface. Products in flasks usually have propane or/and butane and air as propellant-gas. That is the reason why these flasks are extremely inflammable.
 - **Floor-polishes** usually contain wax: beeswax, artificial wax, paraffin by-products and their combinations. non-ionic tensides are present in them in a greater amount. Solvents like benzene, turpentine etc. help the polishers in dispersing.
 - **Body lotions** serve for skin protection and for prolonging its span of life. The main ingredients consist of polishing substances i.e. waxes and wax-like substances. Other important components in body lotions are fish-oil, solvents and reducers like turpentine and benzene. Coloring agents, emulsifiers and occasionally silicon oils can be found as additives in lotions.
 - **Windows and mirrors** can be cleaned quickly with window-cleaners. They contain a small amount of surfactant tensides that have great washing effect plus a component promoting the drying up of the glass (eg. iso-propyl-alcohol) and water.
 - **Air sprays** consist of fragrances, alcohol and deodorizers that neutralize cigarette smoke and food smell. Their powerful fragrance overdominates the source of the unpleasant smell, but it does not terminate the smell. Their additives might serve as germ-killers and antiseptic which are usually air-pollutants, moreover they contain unhealthy para-dichloro benzene or acetaldehyde.
 - **Plate-powders** serve for the removal of corrosion layers on metal wares. Their cleaning action relies on mechanical effect on one hand (polishing substances: kaolin, chalk-dust), on the other hand it relies on chemical solvent action (surfactant substances: oxalate acid, ammonia solution). It often contains ammonia which may cause harm to health when inhaled unbroken.
 - **Oven polishers** usually contain corrosive substances (eg. caustic lye, potassium hydrate), and glycol plus surfactant substances that are toxic.
 - **Germ-killers and toilet cleaners** usually contain chlorine and oxygen, thus they do not only kill germs but they bleach as well. Highly toxic formaldehydes, phenols, crezols etc. might be in these preparations. There is sodium hypochlorite and sodium hydroxide in the so-called *chlorotic germ-killers*, while the bleaching powder consists of calcium hypochlorite.
- Detergents contain sodium perborate serving as *oxidative bleaching powder*, the bleaching effect of which comes in effect best above 60 degrees Celsius. The oxygen evolved eats away the blood, wine and fruit stains therefore it disinfects at the same time. It makes no sense to use it in water below 60 degrees Celsius because its bleaching effect will not work. *Germ-killers based on oxygen* include hydrogen-peroxide at the decomposition of which bleaching and antiseptic elemental oxygen gets evolved.
- Optical bleaching detergents* are organic combinations that link to the textile fabrics like colouring agents. They absorb UV-rays and radiate blue light which extinguishes the possible yellowish shade of white substances. The substance looks bright white but it has nothing to do with its cleanness. Thus it is absolutely superficial to use such bleaching detergents.
- **Scalers** are strongly corrosive (eg. hydrochloric acid, formic acid, acetic acid). They react to the calcium- and magnesium-carbonate precipitated from water. They often contain sulphamic acid, phosphoric acid and non-ionic tensides.
 - **Outlet cleaners** contain sodium-hypochlorite and sodium hydroxide. They are highly corrosive. The chlorine gas formed by pouring warm water onto the crystal reacts aggressively to contamination.
- Important to note!** It is prohibited to mix detergents containing acid (eg. scalers, acetic detergents) with chlorotic detergents or to employ them together. In case of chemical reaction toxic chlorine gas will be released (See Appendix No.8). Indicators R31 and S50 refer to this process.

Alternatives protecting our environment

- **Washing soda** (sodium carbonate Na_2CO_3) is a general water softener, steep, and fat dissolver detergent. It has strong alkaline chemical reaction ($\text{CO}_3^{2-} + \text{H}_2\text{O} = \text{HCO}_3^- + \text{OH}^-$), dissolves in hot water, and serves as damp-absorbing white powder. When mixed with animal or vegetable fats it constitutes soap.

It is applicable for water softening: $\text{Na}_2\text{CO}_3 + \text{Ca}^{2+} = \text{CaCO}_3 + 2\text{Na}^+$ so it may replace phosphatic detergents.

When used to a great extent it may cause sodification in the soil therefore it is not suggested for use at locations lacking in drainage and having a high level of subsoil water.

Only a very small amount is enough of it.

Appr. 1-2 spoonful of washing soda is recommended to 15 liter water for steeping dirty pots and objects.

It becomes a multi-purpose cleaner when added to hot water (3 spoonfuls)

If one spoonful is dissolved in one liter hot water it may be used for cleaning strongly contaminated surfaces.

For pots burnt down use 1 spoonful washing soda dissolved in 5 liter hot water.

Washing soda can be purchased in the Green Shop: Budapest, 1054, Nádor str. 34. Tel: +36-80-269-446 (green number to be called for free)

- **Lemon** juice is a weak natural acid. It is applicable for bleaching, scaling and cleaning metal.
- **Baking soda** (sodium-hydrogen-carbonate NaHCO_3) is a white powder similar to washing soda in its impact, but is less alkaline, and dissolves easily in water. When left in the fresh air it gets carbonated slowly. Dissolves well in warm water.

It is perfect for scrubbing when mixed with little water. Rub the oven with wet cloth then sprinkle bakingsoda onto it while it is still warm and leave for one hour before rinsing off.

Baking soda sprinkled onto the carpet should be left for 15 minutes then vacuum-cleaned with great care. Carpets will get clean this way and even insects will be kept away.

You can buy baking soda in supermarkets or pharmacies in packages of 50 and 200 gramms.

The obstruction of outlets might be solved by placing 2 spoonfuls of baking soda there, pouring 150 ml vinegar onto it and then covering the outlet. Leave covered until you hear a fizzling sound.

- **Acetous acid** (CH_3COOH) is a medium strongacid. It serves as germ-killer, multi-purpose cleaner and scaler. The diluted vinegar used in households is innocuous to health and environment.

Synthesized vinegar of 20% must be diluted to its half-one third. Natural vinegar has a smaller degree of concentration.

- **Borax** (sodium-tetraborate $\text{Na}_2\text{B}_4\text{O}_7 \cdot 10 \text{H}_2\text{O}$) is a colourless crystal. When left out in fresh air it turns to dust. Its diluted solution has alkaline chemical reaction, it dissolves in glycerine (the glyceric solution has acidic chemical reaction). It is applicable to stain removal, window cleaning, scaling and cleaning the wall-paper.
- **Raw milk and egg white** are perfect for skin care.
- **Lemon, white vinegar, glycerine, pure alcohol and borax** are all suitable for removing stains from carpet. The fundamental rule of stain removal says that immediately after the induction of spots removal must be launched immediately.

Suggestions

- Try to use the mildest detergents with neutral chemical reaction in the least possible concentration and amount.
- Use rubber gloves and let some fresh air into the room when working with stronger chemicals as they may cause allergic reactions when touching the skin or inhaled.
- Do not purchase detergents that lack in easy to follow instructions, dosage rules and gauge.
- Do not follow the advertisements blindly.
- In fact traditional methods and cleaning substances create the same perfect result, furthermore our purse remains thick and our flat and environment becomes cleaner.

Environmental and healthy cleaning methods

Surfaces to be cleaned	Instructions for cleaning
Windows, mirrors	It is best to clean with warm acetous water. If we put a bit of methylated alcohol into the cleaning water, it forms an anti-static layer. Greasy contamination on kitchen window should be removed with lukewarm liquid detergent and water.
Cleaning tiles and faucets	Scalecrust can be removed by acetous water.
Polishing furniture	Use natural textiles eg. cotton, wool, or plastic duster that functions according to the principle of electrostatics. When selecting from furniture polishes try to prefer substances containing natural wax as they serve as the best for this purpose. A cotton cloth soaked with warm milk is an excellent furniture polish. Scratches on furniture should be scrubbed by a hazelnut cut into two halves (in case of light-coloured wood) and darker furnitures should be treated with walnut pieces. Water spots should be treated with the half-half combination of cooking-oil and alcohol of 70%.
Dusting	Try dusting with a soft cloth or mop, broom made of natural substances (eg- horsehair broom).
Swilling	Clean water is enough for dusting, only fatty contamination in kitchen should be treated with detergent. The multi-purpose cleaner contains 1 liter of hot water and 3 spoonfuls of washing soda. Scaling might be necessary in the bathroom with acetous water. Try to be sparing of water by recycling it. If there is a baby in the family his/her bath water can be used up for swilling (or the last wash-water gathered from the washing machine).
Cleaning	It is a multi-purpose cleaner, but applicable for strongly contaminated surfaces: dissolve one spoonful of washing soda in one liter hot water.
Scrubbing with brush	Used only for removing strong contamination eg. wall joints of grinders, garden pavement.
Steeping of dirty objects	Time can replace detergents, heat and powerful scrubbing! The majority of stains dissolves or softens when soaked in alkaline water (eg- washing soda). Dirty pots, object should be steeped in 15 liter water and 1–2 spoonful washing-soda.
For general washing up	Even burnt down pots can be washed by the mixture of 5 liter water plus one spoonful of washing soda.

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Appendix 1

Some important regulations for schools on chemical substances

Act XXV. of 2000 on Chemical Safety

Government Decree No. 189/2000 (XI. 8.) on Rules of Imposing Chemical Charges.

Government Decree No. 188/200. (XI.8.) on Rules of Operation of the Inter-ministerial Committee Acting in the Field of Chemical Safety.

Decree No. 44/2000. (XII.27.) of the Minister of Health on the Detailed Rules of Certain Procedures and Activities in Connection with Hazardous Substances and Hazardous Preparations.

Joint Decree No. 25/2000. (IX.30.) of the Minister of Health and the Minister of Social and Family Affairs on Chemical Safety of Workplaces.

Decree No. 26/2000. (IX.30.) of the Minister of Health on Protection Against Carcinogenic Substances of Occupational Origin and on Prevention of Health Damages Caused by Such Substances.

Information No. 8004/2000. of the Minister of Health on the List of Hazardous Materials Classified in the European Union.

Joint Decree No. 41/2000. (XII.20.) of the Minister of Health and the Minister of Environment on the Restriction of Certain Activities in Connection with Certain Hazardous Substances or Hazardous Preparations.

Decree No. 6/2001. (II.28.) of the Minister of Environment on Certain Rules of the Biodegradability of Surfactants Contained in Detergents and Cleaning Agents.

Joint Decree No. 12/2001. (V.4.) of the Minister of Environment and Minister of Health on Risk Assessment and Risk Reduction of Chemicals.

Decree No. 16/2001. (VII.18.) of the Minister of Environment on List of Waste.

Appendix 2

Symbols of danger



Toxic (T) substances
and **Highly toxic (T+)** substances



Inflammable (F) substances
and **Highly inflammable (F+)** substances



Irritative (Xi) substances
and **Harmful (Xn) substances**

Explosive (E) substances



Oxidant (O) substances



Corrosive (C) substances

http://www.fjokk.hu/kemiai_k.html

Environmental dangerous (N) substances



Appendix 3

ACT XXV. OF 2000 ON

CHEMICAL SAFETY

The Parliament – having regard to people’s constitutional right to the highest possible level of physical and mental health and healthy environment – in the interest of ensuring rights for chemical safety of natural persons in the territory of Hungary, has adopted the following act, in order to identify, avoid, reduce, prevent and introduce the damaging effects of hazardous substances and hazardous preparations.

w) **R phrases and R number** means a sentence and a serial number of the sentence referring to the risks of hazardous substances or hazardous preparations;

x) **S phrases and S number** means a sentence and a serial number of the sentence referring to the safe use of hazardous substances or hazardous preparations.

Chapter VI

RISK MANAGEMENT

Health Protection, Work Protection, Consumer Protection, Environmental Protection, Product Responsibility

20.§ (1) Before starting manufacturing, production, processing and use of hazardous substances or hazardous preparations (including the import), the less hazardous substance (preparation) should, if possible, be chosen from among the hazardous substances and hazardous preparations, which are suitable to the same purpose.

For justification of the choice, the necessary risk assessment and cost-benefit analysis should be done and submitted to the supervisory authorities, if requested.

(5) To the non-bulk hazardous substance or hazardous preparation, which is traded in packed form for the population, instruction for use in Hungarian should be provided by the trader. This instruction for use is to be prepared by the producer or importer by using the relevant data of the Safety Data Sheet.

Safety Data Sheet

22.§ (1) For the sake of health and safety on workplaces and measures necessary for environmental protection, hazardous substance or hazardous preparation can be traded for a person doing his/her work by occupation, only with Hungarian Safety Data Sheet, prepared by the producer or importer. The data sheet includes all information necessary for health and environmental protection. (www.adatlap.hu)

29.§ The notifier is responsible for all information given in connection with the notification of hazardous substances and also for the accuracy of the data.

Chapter VII.

RISK COMMUNICATION, INFORMATION EXCHANGE

Education

27.§ The National Curriculum should include the principles and most important rules of chemical safety and appropriate handling of hazardous substances and hazardous preparations, especially the knowledge of identification of hazardous substances and hazardous preparations and information about storage and utilization of generally used hazardous substances (preparations).

Appendix 4

R phrases referring to the hazards/risks of implementing hazardous substances

- R 8 It causes fire when touching inflammable substances
R 20/22 It is harmful when inhaled or swallowed
R 22 It is harmful when swallowed
R 36/38 It irritates eyes and skin
R 31 Mixing with acid results in formation of toxic gases
R 34 It causes burn

S phrases referring to precautionary measures in connection with hazardous substances

- S 1/2 It should be kept locked up and out of reach for children.
S 24/25 Any contact with eye or skin should be avoided and it must not get into the eyes.
S 26 If it gets in the eye one should wash it out with plenty of water immediately and then see a doctor.
S 27/28 If it gets on the skin the stained cloth must be removed and the skin must be washed down with the appropriate amount of (determined by manufacturer).
S 45 In case of accident or indisposition a doctor should be called for immediately. If possible the label of the substance should be shown to him.
S 46 When swallowed one must turn to a doctor and show the label to him.
S 50 It cannot be mixed with acid.
S 62 When swallowed one must not vomit.

Appendix 5

Safety datasheet

1. Name of product: "Cillit scaler and anti-corrosive"

2. Composition:

Phosphoric acid [7664-38-2]	5-15%	Xi	R36/38
Sulphamic acid [5329-14-6]	5-15%	Xi	R36/38
Non-ionic surfactant substance	<5%	Xn	R22, 36, 38
Colorant and fragrance			

3. Classification based on degree of danger

R 36	Irritates the eye
R 38	Irritates the skin
S 2	Must be kept away from children
S 26	If getting into the eye rinse off immediately with plenty of water
S 46	If swallowed see a doctor immediately, the flask/package must be shown to the doctor

Danger to humans: irritative effect if getting into the eye or onto the skin

4. First aid

Getting into the eye: must be cleaned with water immediately and see a doctor (rinsing off with open eyes, contact lenses if there is any should be removed beforehand)

Touching the skin: contaminated cloth must be removed immediately and spotted skin part must be rinsed off with plenty of water; see a doctor if necessary

If swallowed: rinse off mouth with water, drink water or milk, do not force vomiting, seek doctor's help immediately

5. Inflammability

Extinguishing substance: any kind of extinguisher substance and method can be used
Personal protective wear: appropriate respirator to be used

6. Safety measures in case of accident

Personal protection safety measures: avoid getting in touch with the eye or the skin
Environmental safety measures: do not let in outlet directly, collect for recycling or appropriate waste management; placement of waste should be done by point No.13; remaining substance should be rinsed off with plenty of water

7. Treatment and storing

Treatment: avoid getting in touch with the eye or the skin
Storing: in closed package in dry conditions

8. Conditions of work harmless to health

a, In case of domestic use there is no need for safety device

b, In case of industrial usage:

Eye protection: goggles are recommended
Skin protection: rubber gloves are recommended

9. Physical and chemical features

Appearance: liquid
Colour: blue
Smell: fresh
pH: 1.8 (solution of 100%)
Solubility: mixes with water without restraint
Viscosity: water-like

10. Stability and reactivity

Conditions to avoid: temperature higher than 50°C
Substances to avoid: alkaline solutions; hydrogen is released when reacting to zinc or metal; chlorine gas is released when reacting to hypo

11. Toxicological data

LD₅₀ (on rats, orally): >2000mg/kg based on the data of elementary substances
Getting into the eye: irritative due to its acidity
Touching the skin: irritative due to its acidity
Getting into the body: irritative due to its acidity

12. Oecotoxicity

Due to the modification in the pH of living waters it might be dangerous for water-life. The applied surfactant substance is biologically decomposable to 80% based on the EU directive No. 88/242 referring to non-ionic surfactant substances.

13. Waste management and cutting off the current

Waste management is regulated by decree No. 102/1996. (VII.12.) according to the quantity and the circumstances.

14. Regulations on transfer

It is not a hazardous substance in terms of transfer

15. Other

This safety datasheet was completed based on decree No. 233/1996 (XII. 26). Information included are precise and correct to the best of our knowledge. This data may not be used to quality insurance purposes

Tatabánya, 9. November 2000

*Melinda Dén
Quality manager*

Appendix 6

Decree No. 6/2001. (II.28.) of the Minister of Environment on Certain Rules of the Biodegradability of Surfactants Contained in Detergents and Cleaning Agents

Based on the authorization in Section a) (4) of Paragraph 34 of Act XXV. of 2000 on Chemical Safety (hereinafter referred to as the CS Act), I order the following:

1. § The scope of the Decree includes requirements of biodegradability of the surfactants of detergents and cleaning agents, manufactured and traded in the territory of Hungary.
2. § In the sense of this decree
 - a) **detergent** means all kinds of materials or products in physical form of powder, paste, liquid, rod, flake, ground material etc., which are traded for household, communal or industrial washing, dishwashing, soaking, rinsing, and water softening, in watery medium and the components of which after use directly or indirectly reach the environment;
 - b) **cleaning agent** means all kinds of detergents, which are used exclusively for removing impurities from non-textile firm surfaces;
 - c) **surfactant** (tenside) means an organic compound, consisting of one or more hydrophilic and hydrophobic groups, and which is suitable for forming water-soluble micelles and used as active ingredient in detergents and cleaning agents. From the point of view of chemical behavior surfactants can be anionic, cationic, non-ionic or amphoteric;
 - d) **anionic surfactant** means tenside, in which the hydrophobic group is a component of the anion;
 - e) **Non-ionic** surfactant means tenside, in which a hydrophilic group of varying length is connected to the hydrophobic group;
 - f) **biodegradability** means a structural change (or the degree of it) in course of the biodegradation process, resulting in the reduction of surface activity. Degree of reduction is measured by an adequate standard method;
 - g) **producer** means the manufacturer of the detergents and cleaning agents or, in case of foreign producer, the importer.
3. § (1) In Hungary only detergents and cleaning agents can be manufactured and traded, or to Hungary only detergents and cleaning agents can be imported, for which the degree of biodegradability of anionic and non-ionic tensides reaches or exceeds 80 % and the average level of biodegradability of the amphoteric tensides reaches or exceeds 90%.

Appendix 7

The construction of tenside molecules

The tenside molecule consists of a polar (1) – hydrophobic, dissolving in water –and an apolar (2) – hydrophilous, not dissolving in water – part.

<http://www.eucerin.de/skin>

The molecules of surfactant substances produce a mono-molecular layer on the water surface or mycelles are created in the water (picture No.1)

Tensides are connected to fat contamination by apolare end. Mycelles are created in the meantime. the fat– tenside mycella separates from the surface to be cleaned.

<http://www.theochem.uni-duisburg.de/DC/substance/silicon/versuch/versuch7.htm>

http://www.uni-siegen.de/dept/fb08/abteil/org/org1/vorlesung/kapitel10_11/sld008.htm

Appendix No.8

Appendix 8

Do not mix detergents!

Tímea Szabó, Attila Főző, Bíborka Ruzsa, Borbála Varga
www.poli.hu/oldaskotes/tisztit.htm

You can read it on the label stuck to detergents that you should not mix it with other cleaners (R31, S50).

- Szem- és bőrizgató hatású.
- Savval érintkezve mérgező gázok képződnek. Ne keverje más háztartási tisztítószerrel.
- Elzárva és gyermekek számára hozzáférhetetlen helyen tartandó.
- Ha szembe kerül, bő vízzel azonnal ki kell mosni és orvoshoz kell fordulni.

If we still do so, chlorine gas will get released, which is indicated by the characteristic pungent smell and gas development.

Development of chlorine gas

Explanation

In chlorotic detergents the chemical balance of chemical compounds looks the following.

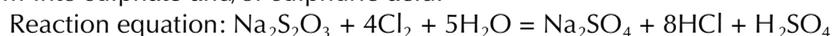


a) There is NaOH surplus in *detergent* thus chlorine is fixed in sodium hypochlorite (NaClO) and sodium-chloride (NaCl).

b) In case of *cleaning* detergent should be used in diluted solution (with excess of water). This results in the development of chlorine gas.

c) *When mixed with acid* NaOH starts to vanish because the acid neutralizes it. Moreover, water is created during the neutralization. Therefore the balance reaction is shifted to **chlorine development**.

It is useful to have **anti-chlorine** at home. Anti-chlorine (better know as sodium-tiosulphate; $\text{Na}_2\text{S}_2\text{O}_3 \times 10 \text{H}_2\text{O}$, hypo) is a white salt dissolving well in water. It should be used in case the two detergents were poured together by accident and this resulted in the development of chlorine gas. Anti-chlorine neutralizes chlorine. They react and form into sulphate and/or sulphuric acid.



Pairs that do not match – What should not be mixed with what?

Acidic detergents

Cillit – scaler and anti-corrosive
Domestic hydrochloric acid
Alfa – scaler

Alkaline detergents containing chlorine

Domestos
Hypo
Clorox
Flóraszept
Mr Muscle outlet cleaner

Features of chlorine (Cl₂)

The chlorine gas is a yellow-colored toxic gas of greater denseness than air, it has a suffocating smell, moreover it irritates to cough. It reacts with water: chlorine water is created which also contains dissolved chlorine molecules. Chlorine annihilates micro-organisms so it is used as **germicid**. Both chlorine gas and chlorine water bleach out and eat away colours, thus they are commonly known as decolorants. Chlorine is **toxic** for living organisms and humans. Elemental chlorine is highly reactive.

All the hypo, clorox, domestos detergents used in the household contain chlorine.

Health education training program – Szentendre

Detergents in school

Videofilm

- **Tuning in** to the topic, thought-provoking, raising the issue.
- Watching of the „household detergents“ part of the „Environmentalist decision making, life with hazardous substances“ film (Green pack) together.
- Individual work with **exercise No I.**
- Discussion
- Symbols of danger –

Examination of the composition of detergents known to the public

- **Guided groupwork** –examining the composition, the symbols of danger and the R and S phrases based on the labels on bottles.
- Filling in the chart in **exercise No II.** according to the labels from detergents

Legal background

- **Groupwork**
 - a) The meaning of R and S phrases (Appendix No3.)
 - b) The concept and construction of the Safety data sheet (Appendix No3)
 - c) Definition of substances in detergents (Appendix No6)
- Description of tensides – (Appendix No7.)

The impact of certain detergents on health and environment

- **Guided groupwork** – Filling in **exercise No III** based on the safety datasheets.
- **Discussion** – which detergent would you recommend the most and the least
- Do not mix detergents! – **chemical experiment and/or discussion about Appendix No 8.**

Alternatives

- **Text analysis** – Kuka Búvár 1999. autumn: Instead of intelligent washing powders (individual reading),
- Then filling in the exercise at the end of the text – **individual work**
- **Discussion**
- Getting acquainted with environmental friendly products, examination of them

Exercise I

You heard in the film what it meant if a substance was hazardous. List these characteristic features.

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Write under the pictures which symbolizes the features mentioned above. Use a different colour if you can write the meaning and the formula next to the pictures!

Pictograms of hazard, symbols of danger



Write here what kind of diseases detergents may cause (think back what you have just seen in the movie)!

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What kind of advice did they get about the usage of detergents in the movie?

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Exercise II: fill in the following chart!

Study the labels of the detergents placed in front of you.

Try to describe these substances by filling in the chart.

Name, field of use	Chemical composition	Number of R, S phrases	Symbols of danger	Comment

List the compounds in the order of the frequency of their occurrence in detergents!

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Exercise III: Impact of detergents on health

List the impacts of certain substances found in detergents on health by observing the safety datasheets!

Name	Chemical substances – impact on health

Exercise IV

Instead of intelligent washing powders

I am standing at the counter of a tiny household shop holding a tube of toothpaste in my hand. I like this shop. It reminds me of an old-fashioned grocery with its scent of lavender, relaxed atmosphere and wooden shelves. There stands a well-dressed woman complaining to the elderly shop assistant – she has tried several different scalers but none of them could clean the shower stall properly. What would be the best solution for this problem? The jovial lady smiled kindly at her and uttered only one word: vinegar.

It was easy to understand the perplexed expression on the face of the customer as she obviously expected something else. According to the common report of our times detergents belong to the modern households – that is to say chemicals used for cleaning our homes making it clean, scented and bright. You can choose from a wide range as costly furniture polishes, scrubbers, air sprays, germ-killers and co line up on the shelves of supermarkets. The wardrobe is loaded with them at home and every time we tidy up the house we use up heaps of flasks. We have long forgotten that there is another way to do this. We do the house-cleaning with detergents having immediate effect partly because of our rapid lifestyles, and we buy more and more of them due to ads heard and seen in TV without cease. We think we save time when using cleaning detergents and as a result we have more sterile homes. Yet we never – or rarely – think of the fact that **the more effective chemical substances cause significant damage when they get out to nature together with our waste and waste water. They cause harm to the water, the soil, the air and endanger the multitude of creatures and their living-spaces. They clean our houses, but they contaminate our environment for good.**

I inherited a real pre-war copper bed from my great-grandfather years ago. It was a beautiful piece of furniture, a masterwork, although it was stained and somewhat shabby. I did not know what to do to improve the looks of it until finally my great-granny helped me out. I polished the bed with a mixture of vinegar and salt as she suggested. The metal regained its original shine and the bed became the ornament of the room.

Our grandmothers knew the tricks of cleaning up. They did not need any artificial chemicals contaminating the environment for keeping their homes clean, they used only natural resources and some time-honoured methods. They used lemon, vinegar, salt and baking soda, and the flat glittered the same way as today at the age of domestic chemicals.

There are a lot of simple household tricks. Perhaps we are reluctant to start with them as the production and implementation of self-made detergents seem too complicated and time-consuming. But it is not. It is only more comfortable to reach out for the flask filled in the factory than to spend some time on making the appropriate substance. **Those, who are concerned about the germ-killer poured into the outlet, the usage of furniture polish with power-gas or corrosive delubricator, can change their cleaning habits.** It suffices if they get back to the old recipes.

- Tiles, tubs, wash-basins should be cleaned with vinegar as it dissolves fat and dirt and it makes the surface gloss.
- Corrosive acid-containing scalers can be replaced by vinegar. It can dissolve the thickest layer of dirt: pour vinegar on parts in question and rub it over with a scrub or wet clout. Place a clout impregnated with vinegar onto more persistent scale and leave for ten minutes. If the pot has scale, pour a little vinegar to the bottom and clean it after a few hours.
- Toilets may be cleaned with baking-soda or the mixture of vinegar and water half-and-half. It cleans and disinfects at the same time.
- The fridge can be cleaned with baking-soda or the mixture of vinegar and water half-and-half. If you want to deodorize it keep an open sachet of baking-soda inside.
- Vaporize a bowl of water with lemon in the microwave oven and wipe out with a wet clout.
- Window-glass or a mirror should be washed down with soapy water, then sprinkled with a mixture of one portion vinegar and four portions hot water. Finally, rub it over by a clean clout.
- Use the mixture of olive oil and lemon juice instead of furniture polish (or deerskin impregnated with water and vinegar).

Environmental protection is not about great things, rather smaller ones. Things in everyday life. We are able to protect the world around us by changing our habits, to a small extent at least. When it comes to our next cleaning up we may remember that **the impact of the chemical stored in that colorful flask for tap cleaning does not end when it vanishes from sight.**

Bea Lugosi

Kukabúvár 1999. autumn www.kukabuar.hu

(Réka Könczey - Andrea S. Nagy: Guide to Green Everyday – this book deals with this topic in a whole chapter, those who are interested may get a lot of useful ideas from it.) (For chemical-free cleaning baking-soda, wash soda etc. can be purchased in the Green Shop: Budapest V. Nádor str. 34.)

Questions:

Why do we use „modern“ detergents sold in flasks?

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What kind of environmentally friendly detergent is recommended in the article for cleaning certain things?

What?	With what?