



Reducing risks from Occupational exposure to Coal Dust (ROCD)

Deliverable D5.2:

Report on provision of E-learning and training modules,
technical briefing notes and downloadable freeware and
games

Research Fund for Coal and Steel

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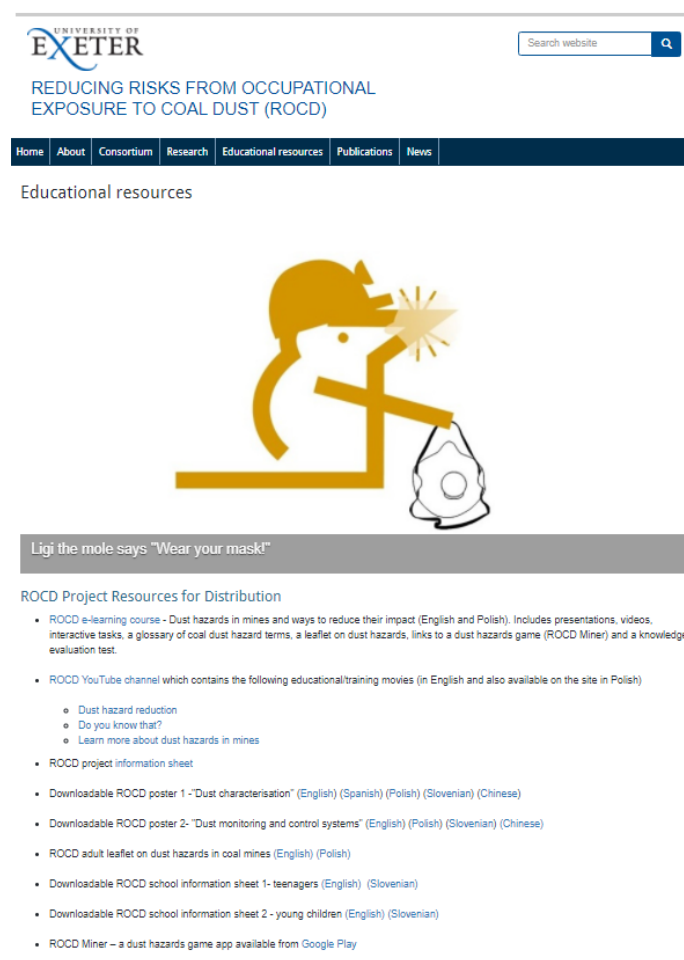
1. Aim of the deliverable

D5.2, entitled 'Report on provision of E-learning and training modules, technical briefing notes and downloadable freeware and games' is one of the main deliverables from WP5 "E-training and outreach". It specifically relates to task 5.2 "Development of E-modules" which had three main goals:

- Development of E-modules and continuous professional development (CPD) resources for operators and management to explain the technical basis and operational methods for risk reduction;
- Development of freely available E-training (training resources for workers and for wider outreach) to explain the operational implementation and benefits of the project;
- Incorporation of 'serious games' into E-training modules as gamification techniques which increase the involvement/learning outcomes of trainees, and may also engage a wider audience, to maximise the outreach of the project.

2. The ROCD e-learning course – development process

The ROCD e-learning course was developed and launched on KOMAG's Moodle platform – in two languages: English and Polish. The direct link to the ROCD course webpage (with access to each language version) is <https://elearning.komag.eu/course/index.php?categoryid=6>. There is also a link from the [ROCD Educational Resources webpage](#) (Fig. 1).



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REDUCING RISKS FROM OCCUPATIONAL EXPOSURE TO COAL DUST (ROCD)

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Educational resources

Ligi the mole says "Wear your mask!"

ROCD Project Resources for Distribution

- ROCD e-learning course - Dust hazards in mines and ways to reduce their impact (English and Polish). Includes presentations, videos, interactive tasks, a glossary of coal dust hazard terms, a leaflet on dust hazards, links to a dust hazards game (ROCD Miner) and a knowledge evaluation test.
- ROCD YouTube channel which contains the following educational/training movies (in English and also available on the site in Polish)
 - Dust hazard reduction
 - Do you know that?
 - Learn more about dust hazards in mines
- ROCD project information sheet
- Downloadable ROCD poster 1 - "Dust characterisation" (English) (Spanish) (Polish) (Slovenian) (Chinese)
- Downloadable ROCD poster 2 - "Dust monitoring and control systems" (English) (Polish) (Slovenian) (Chinese)
- ROCD adult leaflet on dust hazards in coal mines (English) (Polish)
- Downloadable ROCD school information sheet 1- teenagers (English) (Slovenian)
- Downloadable ROCD school information sheet 2 - young children (English) (Slovenian)
- ROCD Miner – a dust hazards game app available from Google Play

Figure 1 Links to e-learning resources on the [ROCD Educational Resources webpage](#).

The first step in the development of the ROCD course was to establish which content should be included in terms of topics and types of materials. This served as a basis for the next step, development of the course structure, i.e. identification of the course sections and materials to be provided within them. From an early stage it was envisaged that the following types of materials should be developed and provided within the Moodle platform: presentations (SCORM format), films, glossary (a ready-to-use Moodle resource document), software tools/applications and quizzes. The structure evolved alongside progress in developing the course content; the final version is presented in Figure 2. In particular it was decided that:

- the films should be uploaded on a YouTube channel specially launched for the ROCD project and they would be also embedded on the Moodle platform (via an embedding code), which contributes to the films' wider accessibility,
- the serious game would be run on the Android system (device: smartphone, tablet) and as regards access to it: i) it would be disseminated via the digital distribution service Google Play, ii) in the ROCD e-learning course, direct access to the relevant webpage in the Google Play service would be given.

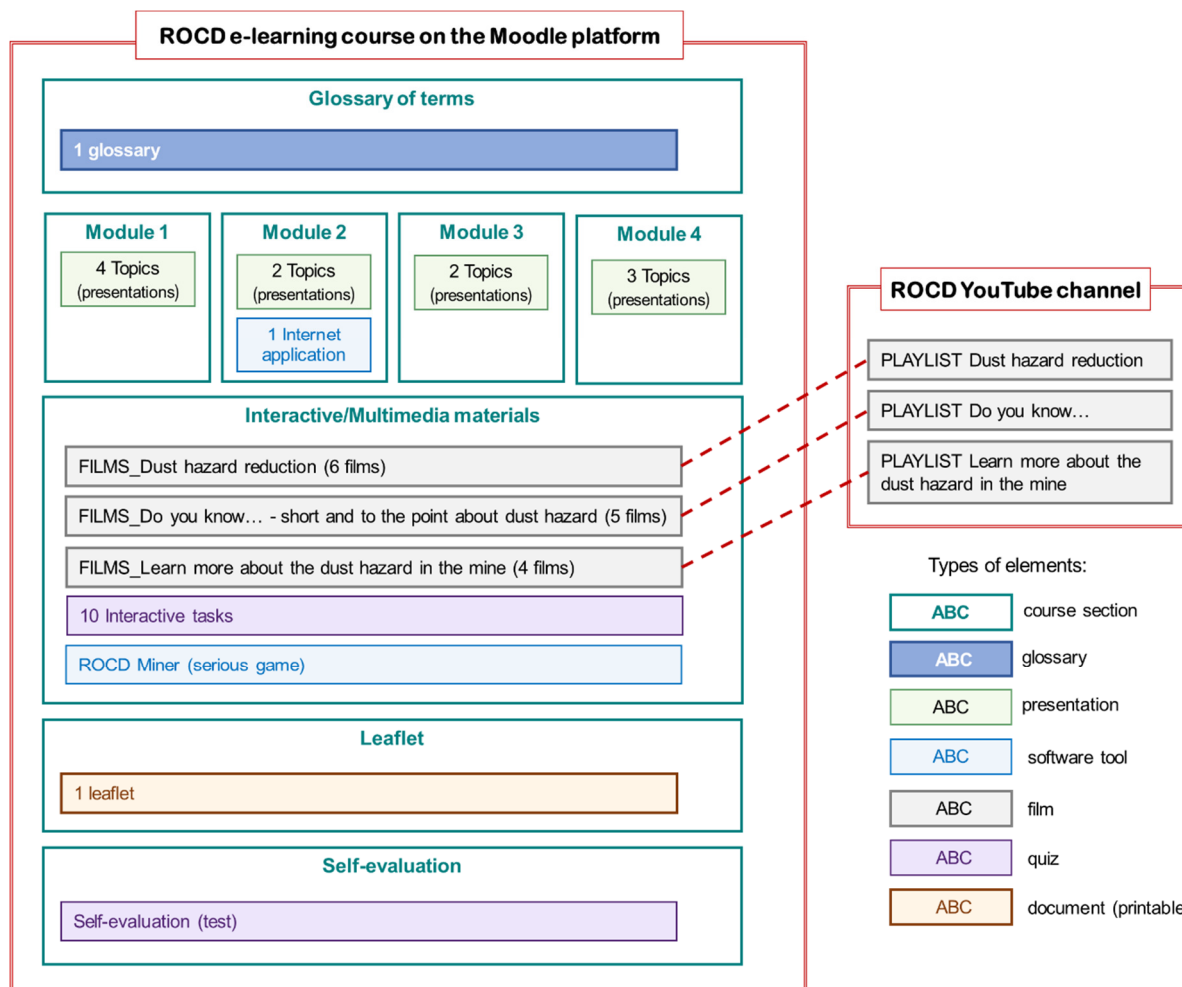


Figure 2 Structure of the ROCD training materials (corresponds to the final version of the course).

The whole course and resources – except for the serious game and the leaflet (developed by UNEXE) – were developed by KOMAG. Cooperation with other project partners also took place.

The following were the main phases of ROCD e-learning course development:

- development of the course framework on the Moodle platform – creation of the main sections.
- development of training materials and adding them to the course or giving access to them.

The development of course materials was in two-phases:

- all materials were verified internally in KOMAG by staff other than the creator to give independent viewpoints. The feedback was used to optimise the course content and visuals.
- all materials – Polish version - were assessed by workers and management from the PGG and JSW mining companies, and improvements were made based on their feedback, e.g. in Topic 4.2., example half-masks were replaced by the exact half-masks used in JSW coal mines, which are known to the trainees; this contributed to better knowledge assimilation.

The course sections labelled “module” were composed of topics that were assembled in the form of a SCORM presentation. The source files were PowerPoint presentations that were converted into SCORM format using the iSpring tool. A template (pptx file) was prepared to keep all the presentations consistent and in accordance with the visual identity of the project.

For the films, a convention for the visuals and content was established and followed. Consistency with the project visual identity was maintained.

The presentations and films provide input information and resources for the development of interactive tasks. The ‘interactive tasks’ were developed using Moodle ‘quiz’ options.

The Internet application (in Module 2) was developed in KOMAG by a team composed of an IT specialist and experts in coal dust reduction who provided the necessary input data.

As regards the ‘Glossary of terms’, KOMAG based this mainly on relevant standards and regulations but also on other sources like documents published by recognized institutes, authorities etc. As regards the English-language glossary, UNEXE contributed by providing definitions from the standards and other resources they have access to. Therefore, the final version of the glossary was developed based on resources identified by KOMAG and UNEXE.

3. The ROCD e-learning course - description

3.1. Scope

The course provides knowledge about a number of topics related to coal dust and reduction of the associated risks: background knowledge regarding dust and coal dust, how dust affects the human body, what measures and methods can be applied to predict and prevent dust hazards and to protect miners.

The order of the provided materials is as follows:

- **Glossary of terms.** There is a terminology regarding dust hazards and knowing and understanding this is necessary to effectively use the training materials in the course. The glossary can be accessed at any time from within the Moodle platform.
- **Introduction to dust hazards.** This section provides fundamental knowledge regarding dust (not only coal dust): where and how coal mine dust is “produced”, how coal dust enters and affects the human respiratory system, and the main diseases associate with it.
- **Dust hazards prediction.** A trainee gets acquainted with example devices used for measuring dust concentrations. There is also an online interactive application (and instructions how to use it) which describes/models the distribution of dust in mines which depends on: i) the distance from the source and ii) type of spraying systems used. The user can enter/select input data that affects

the resulting/modelled levels of dust – e.g. the location of the area where dust concentrations are measured, actual values from a dust meter etc. Using this application and the analysis of the results obtained contributes to building knowledge and awareness regarding concentration of coal dust in coal mines and how it can be reduced by spraying systems. The tool is an Internet application – after clicking the access link, the application opens and runs in the same Internet browser as the course – i.e. no downloading and installation is necessary.

- **Dust hazards prevention.** General information about types of solutions that can be used to reduce dust concentrations in different areas of a coal mine are presented.
- **Dust hazards protection.** Includes comprehensive information about half-masks and their correct use.
- **Interactive/Multimedia Materials:**
 - **FILMS.** There are 3 sub-repositories of films. The first one includes 6 films about technical solutions and behaviour that contribute to dust hazard reduction. The second includes 5 films covering topics such as: what coal dust is composed of, how common pneumoconiosis is, size of coal dust particles compared to other objects, what respirable dust is and how it affects the human respiratory system, and an experiment showing the effectiveness of an example dust reduction system. In the third sub-repository there are 4 films that include a re-evaluation of learning provided in the presentations but which also provide other supplementary information. Topics covered include coal dust – its characteristics and explosiveness; fitting of a half-mask; pneumoconiosis – types, statistics, diagnosing the disease; coal dust particles – size, effect on the human body.
 - **INTERACTIVE TASKS.** There are 10 quizzes that enable the user to verify their level of acquired knowledge from the presentations and films.
 - **SERIOUS GAME –** This is a specific type of interactive task. In the e-learning course, introductory information is given regarding the game along with a link to download the game from Google Play.
- **Leaflet.** This is a downloadable and printable document for persons who are exposed to dusts in coal mines. It explains the main important facts regarding coal dust and associated lung diseases, and methods that can be applied to reduce them, with particular attention on the use of half-masks. The importance of wearing half-masks is supported by testimonials from persons who have suffered from lung diseases after many years of being exposed to coal dust.
- **Self-evaluation.** The test enables a trainee to check their level of knowledge against what was provided in the course.

SEE a detailed description of the course in **APPENDIX A**

SEE example slides from the presentations in **APPENDIX C**

SEE example screenshots from interactive tasks in **APPENDIX D**

3.2. Use of the course

Access. In the Moodle platform, browsing of presentations and films can be done by any user – including users who enter the course as “guests”. But access to interactive tasks and the final test requires creation of a user account on the platform and enrolment on the course. The account creation form is shown in Fig. 3. This is a standard Moodle form. An email is sent to confirm the creation of the account.

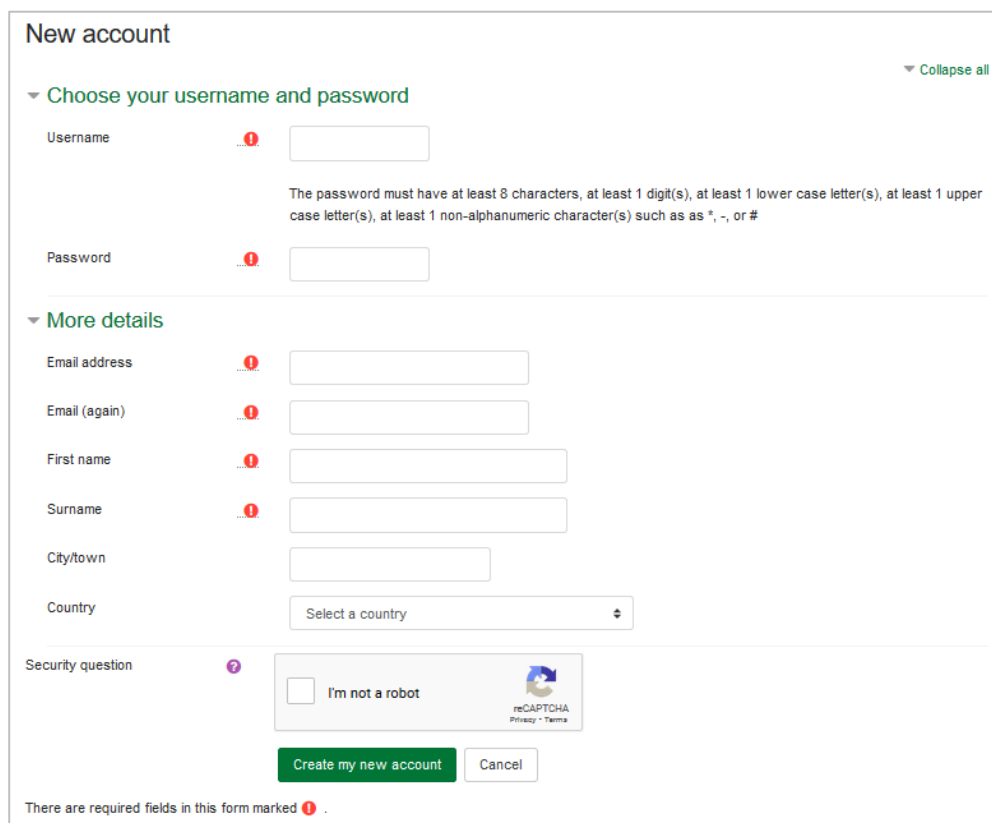


Figure 3 Setup of account to access the ROCD e-training course.

Learning path. There is no obligatory order in which to follow the course. A trainee can select and browse/use any material they wish, which is in accordance with what is recommended for e-learning courses for adults.

The objective is to provide training materials both for all who work in a coal mine underground, and thus are exposed to coal dust, and for those who are responsible for planning, implementation, governance and use of technical solutions for the reduction of dusts. Some of the materials – mainly some films – may also be of interest to audiences outside the mining industry, e.g. workers from other industries where half-masks are necessary or for persons who wear half-masks in private activities.










The materials can be also used as complementary content for the training of employees or in awareness-raising campaigns regarding dusts and their harmful impacts on health.

SEE Applicability of training materials for particular target audiences - **APPENDIX B.**

4. Appendices

APPENDIX A – ROCD e-learning course – screenshots and description of content

SCREENSHOTS

 <p>Dust hazards in mines and ways to reduce their impact</p> <p>This course is a result of ROCD project.</p>	
<h3>About the course</h3> <p>The course contains materials on dust hazards in mines and ways to reduce them. It includes presentations, videos and interactive tasks.</p> <p>The last element of the course is: KNOWLEDGE EVALUATION TEST. The tests allows you to assess the degree of assimilation of material. It is not mandatory. It has been made available to those Students who want to verify how much they have learned during the course.</p> <p>NOTE: to browse/use interactive tasks and test, you must be logged in as a specific - not "guest" - user. You have to create an account on the platform and then enrol for the course. This is an easy procedure. We encourage you to do it!</p>	
<h3>Glossary of terms</h3>  <p>Glossary of terms</p>	
<h3>Module 1: Introduction to dust hazards</h3> <p>Main topics of Module 1:</p> <p>Topic 1.1: Dust – definition and classification</p> <p>Topic 1.2: The main sources of dust emission in hard coal mines</p> <p>Topic 1.3: Deposition of dust in the respiratory system</p> <p>Topic 1.4: Pneumoconiosis - definition, division, accompanying symptoms</p> <ul style="list-style-type: none">  Topic 1.1: Dust – definition and classification  Topic 1.2: The main sources of dust emission in hard coal mines  Topic 1.3: Deposition of dust in the respiratory system  Topic 1.4: Pneumoconiosis - definition, division, accompanying symptoms 	
<h3>Module 2: Dust hazards prediction</h3> <ul style="list-style-type: none">  Topic 2.1: Equipment for measuring the amount of dust  Topic 2.2: Internet application for calculation of the distribution of dust concentration - introduction  Internet Application - Distribution of dust concentration depending on the distance 	

Module 3: Dust hazards prevention

Topic 3.1: Introduction

Topic 3.2: Examples of dust reduction techniques



Topic 3.1: Introduction



Topic 3.2: Examples of dust reduction techniques

Module 4: Dust hazards protection

Topic 4.1: Introduction

Topic 4.2: Types of RPE applicable for miners

Topic 4.3: Use of RPE



Topic 4.1: Introduction



Topic 4.2: Types of RPE applicable for miners



Topic 4.3: Use of RPE

Interactive/Multimedia Materials



FILMS_Dust hazard reduction



FILMS_Do you know... - short and to the point about dust hazard



FILMS_Learn more about the dust hazard in the mine



Interactive task_Respiratory track



Interactive task_Dust controls



Interactive task_Face fit tests



Interactive task_Coal dust neutralization - methods



Interactive task_Surfactants



Interactive task_Spraying systems



Interactive task_Spraying - water vs. air-water



Interactive task_User seal check



Interactive task_Comparison of water and air-water spraying systems



Interactive task_Locations of dust generation



ROCD Miner - a mining game: help your miners work safely.



Screenshot from the ROCD Miner game

Leaflet

Coal dust and lung disease

The aim of this leaflet is to clearly describe and emphasise the dangers of coal dust for underground coal miners, and to promote good practice in terms of dust control and the wearing of dust masks.

A preview of the leaflet is shown below.



COAL DUST AND LUNG DISEASE

Author: Alexandra Sweeney
 Camborne School of Mines, University of Exeter, UK

March 2020

This booklet is an output of the ROCD project (Reducing Risks from Occupational Exposure to Coal Dust) which was funded by the EU Research Fund for Coal and Steel, Contract: 754205.

For more information, including online learning/training and children's materials, please visit our website: exeter.ac.uk/csm/ROCD

Search ROCD Miner on your app store to play our mining game!



The aim of this leaflet is to clearly describe and emphasise the dangers of coal dust for underground coal miners, and to promote good practice in terms of dust control and the wearing of dust masks.

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 WHY WORRY ABOUT COAL DUST?3
 RESPIRATORY PROTECTIVE EQUIPMENT4
 DUST CONTROL SYSTEMS5

BACKGROUND

Over the last 15 to 20 years there has been a resurgence in coal mine dust lung diseases in the USA [1] and Australia [2], which is likely to be the same in Europe. This is despite huge efforts and legislation during the previous few decades to manage levels of potentially toxic dust in mines and worker exposure. Worryingly, it is not just long-career and retired miners who are suffering adverse health effects, but also younger workers who have spent their whole working lives under modern dust control regulations [3]. The reasons for the resurgence in disease are not fully understood, but may, in part, be due to the general downturn in the coal industry with, in at least some mines, there being less attention and spending on protecting respiratory health. One aspect which is clear from recent visits to European coal mines is that miners are not always wearing their dust masks underground.

The following information is for underground coal mines but dust may be also dangerous in open pit operations and coal processing facilities.



TESTIMONIALS

Greg Kelly – 54 years old, 30 years underground

"There's a lot of scarring and stuff in my lungs. That's something you don't want nobody to face, it's having to struggle to breathe. That's scary."[4]

Charles Shortridge –

"I can't plan for tomorrow because I never know if I'm going to live to see tomorrow. There's no cure for me. It's black lung. It's a death sentence."[4]

Rodney Sexton – 30 years underground

"I wake up smothered. And [I] run and run through the house ... trying to get breath ... [because] I think I'm dying."[4]

Bernard Carlson Jr – 40 years underground

"Things that used to take me an hour or two to do, take me five to six hours now because I stop more frequently. And in the mornings you get up hacking, spitting black and blood."[4]

Ray Anthony Bartley – 47 years old, 25 years in the mines.

"I used to play sports, big time hunter, fisherman. But now if I have to do anything I have to wear oxygen."[4]

Mackie Braman Jr – 39 years old, 18 years underground.

"For the miners out there that are going underground... just remember, take care of yourself, because right now I've got two nine year olds that I can't even play basketball with... You can't do what you used to. And as far as providing, I'm sitting at home, getting a check that is nowhere half of what you used to bring home. It's rough."[4]

Peyton Michael Mitchell – 42 years old

"All the activity that I could do outside, I can't do no more. I'm pretty well on oxygen 24/7 in the house... I just can't do anything no more."

Peyton died at 43, leaving behind his wife and child [5].



WHAT IS COAL DUST?

Dust can be classified by size into two different types: inhalable and respirable.

Inhalable dust is visible to the naked eye, nominally less than 0.1 mm in diameter, known as PM₁₀. It can be breathed in, but dust of this size will be caught in the nose, mouth and upper respiratory tract.

Respirable dust is nominally smaller than 0.004 mm (PM₄) and therefore invisible. This dust can be breathed into the lungs. This is particularly true for the fine fraction, dust approximately smaller than 0.0025 mm (PM_{2.5}), which can reach the deepest parts of the lungs, potentially entering the tiny alveoli where oxygen is exchanged between the breathed-in air and the blood.

You probably won't realise you are breathing in this toxic fine dust underground... Always wear the correct type of mask - make sure it is properly fitted!

Coal dust is made of:

- Coal particles
- Minerals and metallic particles
- Rock particles

Dust from a lignite mine in Europe was found to contain 7 metallic elements concentrated in the respirable dust fraction, copper, antimony, tin, lead, zinc, arsenic and nickel [6]. All of these could have negative health effects, depending on how much you breathe in and whether they are in a chemical form which could harm the human body. Minerals and rock particles could also include quartz which is a known human carcinogen.

Dust components do not have to be breathed in to enter your body. They can also enter by absorption through the skin, hair follicles and sebaceous glands, as well as the digestive tract.

WHY WORRY ABOUT COAL DUST?

There are several coal mine dust lung diseases, including coal workers pneumoconiosis (CWP) and silica dust silicosis, **neither of which can be cured**.

These are usually caused by long term exposure to dust, particularly the respirable (PM₁₀) and fine fraction (PM_{2.5}).

The body reacts to particles in the lungs by sending white blood cells to break down and remove them. If the concentration of dust particles is too high then scar tissue may develop around them, which can eventually lead to the formation of nodules. A build-up of scar tissue in the alveoli reduces the ability of oxygen to transfer to the blood. It also reduces the air volume of the lungs, making it difficult to breathe [7].

<p>Coal workers' pneumoconiosis (Fig. 1) takes several years to develop, silicosis is often faster. Both diseases may begin with only mild symptoms, such as a cough and shortness of breath, however this can progress to cause death as a result of respiratory failure.</p> <p>Other symptoms include: chronic cough, chronic chest infection, shortness of breath even at rest, black mucus, emphysema, and heart problems.</p> <p>There is no cure, although a lung transplant can sometimes add a few years of life.</p> <p>Further information can be found at: https://www.lung.org/lung-health-diseases/lung-disease-lookup/black-lung/symptoms-diagnosis</p> <p>RESPIRATORY PROTECTIVE EQUIPMENT</p> <p>Coal mine dust lung diseases are entirely preventable through the use of respiratory protective equipment (RPE) and dust control measures (next section).</p> <p>RPE is equipment designed to protect the wearer's respiratory health. In general, the type and specifications of RPE required may vary depending on the:</p> <ul style="list-style-type: none"> Type of mine and coal Working conditions Dust monitoring results – including both particle size and concentration <p>Masks can either be disposable or re-useable. The re-useable masks have filters which can be replaced to allow repeated use.</p> <p>It is important that masks are properly fitted to the wearer's face. If the mask does not have a good seal, air will enter around the edges, rather than through the filter. This will result in the wearer breathing in dusty- rather than filtered air.</p> <p>Every worker should have face-fit testing to check that there is a good mask-face seal before they enter the mine or other dusty working environment. It is also important that masks are comfortable, can be worn in conjunction with other protective equipment, such as eye protection, and do not overly hinder the wearer in their work. If the RPE is uncomfortable or irritating the wearer is unlikely to use it properly, or at all.</p> <p style="text-align: right;">4 Page</p>	<p>DUST CONTROL SYSTEMS</p> <p>There are numerous sources of dust in underground coal mines, including:</p> <ul style="list-style-type: none"> Mechanical coal cutting processes, in the longwalls and roadways Conveyor belts Maintenance or development operations, e.g. installing electrical infrastructure or moving roof supports (mainly involving resuspension of dusts) <p>Dusts should be suppressed as close to the source as possible in order to protect human health, as well as to reduce the risk of explosions. Dedusting and spraying can prevent and remove airborne dust. Spraying can be made more efficient by adding surfactants to the water, lowering the water's surface tension.</p> <p>Dedusting devices and spraying installations are commonly positioned in the areas of:</p> <ul style="list-style-type: none"> Coal cutting machinery (cutting drums and heads) Canopies of powered roof supports On conveyor transfer points In roadways to form barriers As part of the ventilation system <p>It is important that the size and concentration of droplets produced by spraying installations is correct for the size and concentration of dust particles in the air.</p> <div style="border: 1px solid black; padding: 5px; text-align: center;"> <p>ALWAYS ENSURE THAT DUST CONTROL SYSTEMS ARE WORKING ADEQUATELY – ASSESSED USING CONTINUOUS DUST CONCENTRATION MONITORING SYSTEMS</p> <p>ALWAYS WEAR YOUR DUST MASK - CORRECTLY FITTED!</p> </div> <p>References</p> <p>¹ Graber, J.M., Harris, G., Almborg, K.S., Ross, C.S., Penson, E.L., Cohen, R.A., 2017. Increasing severity of pneumoconiosis among younger former US coal miners working exclusively under modern dust-control regulations. <i>J. Occup. Environ. Med.</i>, 59, 105–111.</p> <p>² Perret, J., Pluth, B., Lachapelle, P., Hinks, T.S.C., Walter, C., Clarke, P., Irving, L., Brady, P., Dharmage, S.C., Stewart, A., 2017. Coal mine dust lung disease in the modern era. <i>Respirology</i> 22, 662–670.</p> <p>³ Schuknecht, C., 2019. 'I Figured It Was Going To Be A Horrible Death, And It Probably Will Be'. NPR. [online] Available at: https://www.npr.org/2019/01/23/686000456/i-figured-it-was-going-to-be-a-horrible-death-and-it-probably-will-be [Accessed 23 March 2020].</p> <p>⁴ Berkes, H. and Ingham, H., 2019. Coal Miners To Demand Congress Restore Full Black Lung Benefits Tax. NPR. [online] Available at: https://www.npr.org/2019/07/23/743152782/coal-miners-to-demand-congress-restore-full-black-lung-benefits-tax [Accessed 23 March 2020].</p> <p>⁵ NIOSH, 2020. Faces of Black Lung II. By Wolfe, A., Yanchewski, M., Haldin, C., Morganti, W. U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication No. 2020–1090. https://doi.org/10.26616/NIOSH.PUB20201090external</p> <p>⁶ Moreno, T., Trezona, P., Quarrell, K., Liah, R., Johnson, D., Wansa, A. and Williamson, B., 2019. Trace element fractionation between PM10 and PM2.5 in coal mine dust: implications for occupational respiratory health. <i>Int. J. Coal Geol.</i>, 203, 32–50.</p> <p>⁷ Collier, J., Rider, J., Lissak, J., Organick, J. and Wolfe, A., 2010. <i>Best Practices For Dust Control in Coal Mining</i>. Information Circular 9517. [online] Pittsburgh: Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health. Available at: https://www.cdc.gov/niosh/mining/workshop/lovesheet051.html [Accessed 23 March 2020].</p> <p style="text-align: right;">5 Page</p>
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Self-evaluation

Do you want to verify how much you've learnt? Take a test!

You can take the test many times, and the test is not obligatory.



Repository of questions includes single choice questions. Each time the test is run, the questions and answers within them are shuffled.

Below you can see examples of questions. They intentionally are shown partially.

Dust with diameter of μm gets into the alveoli (gas exchange area)

Select one:

Dust are particles with dimensions

Select one:

For half-masks a seal check is carried out. Indicate the correct statement:

Select one:

The cause of pneumoconiosis is dust

Select one:

In the dispersion dust collector, the dust removal is

Select one:




Figure shows

Select one:

QUALITATIVE DESCRIPTION OF CONTENT

GLOSSARY OF TERMS

This glossary lists main terms concerning dust hazards. It is developed with the Moodle activity 'Glossary'. It contains more than 50 definitions concerning dust hazards.

Browse the glossary using this index

Special | [A](#) | [B](#) | [C](#) | [D](#) | [E](#) | [F](#) | [G](#) | [H](#) | [I](#) | [J](#) | [K](#) | [L](#) | [M](#) | [N](#) | [O](#) | [P](#) | [Q](#) | [R](#) | [S](#) | [T](#) | [U](#) | [V](#) | [W](#) | [X](#) | [Y](#) | [Z](#) | [ALL](#)

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[ALL](#)

A

aerosol

Suspension in a gaseous medium of solid particles, liquid particles or solid and liquid particles having a negligible falling velocity.

Source: ISO 4225:1994(E/F); point 3.2

air pollutant

Any material emitted into the atmosphere either by human activity or natural processes and adversely affecting man or the environment.

Special | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V | W | X | Y | Z | ALL

B

breathing zone

Immediate portion of the atmosphere from which humans breathe. This consists of a hemisphere, generally accepted to be 3 dm in radius, extending in front of the human face centred on the midpoint of a line joining the ears. The base of the hemisphere is the plane through this line, the top of the head and the larynx.

Source: ISO 4225:1994(E/F); point 3.16

Example of glossary's content (definitions)

MODULE 1 – Introduction to dust hazards – Topic 1.1 – Dust: definition and classification
Descriptive slides informing what dust is, how it can be classified (based on different criteria),
MODULE 1 – Introduction to dust hazards – Topic 1.2 – The main sources of dust emission in hard coal mines
Descriptive slides informing what causes air dustiness in a coal mine and what main types of threats it causes.
MODULE 1 – Introduction to dust hazards – Topic 1.3 – Deposition of dust in the respiratory system
Descriptive slides informing about factors that affect harmfulness of dust for a human, structure of human respiratory system.
MODULE 1 – Introduction to dust hazards – Topic 1.4 – Pneumoconiosis: definition, division, accompanying symptoms
Descriptive slides informing about pneumoconiosis – what it is, what its types are and what symptoms accompany this disease and whether it is curable.

MODULE 2 – Dust hazards prediction – Topic 2.1 – Equipment for measuring the amount of dust
Descriptive slides informing about sample devices used to measure dustiness. The following equipment is described: Personal dust sampler CIP-10 Stationary optical dust meter PŁ-3 IPS analyzer version Q - IPSQ Dust Trak II meter
MODULE 2 – Dust hazards prediction – Topic 2.2 – Internet application for calculation of the distribution of dust concentration – introduction
Descriptive slides about the application – its functionality, necessary input data, obtained information
MODULE 2 – Dust hazards prediction – Topic 2.2 – Internet Application: Distribution of dust concentration depending on the distance
Link to the application (embedded within the course)

MODULE 3 – Dust hazards prevention – Topic 3.1 – Introduction
Descriptive slides with general about spraying devices used at different location of a coal mine: in longwalls

<p>in underground drivages</p> <p>in processing plants</p>
MODULE 3 – Dust hazards prevention – TOPIC 3.2 – Examples of dust reduction techniques
<p>Descriptive slides informing about particular solutions used to reduce dustiness:</p>
<p>in longwalls:</p> <ol style="list-style-type: none"> 1. Spraying through the spraying nozzles, mounted on the cutting drum of a longwall shearer 2. Using the zonal spraying installations mounted under the main canopies of powered roof supports
<p>in underground drivages:</p> <ol style="list-style-type: none"> 1. Spraying through the spraying nozzles, mounted on the cutting head of a roadheader 2. Spraying with use of water curtain, mounted on the cutting arm of a roadheader 3. Roadway spraying dust barriers – CZP-BRYZA 4. Smart spraying device SSD-1 5. Use of dust control devices in driven faces with the combined ventilation system 6. Wet dispersion dust collector 7. Drilling the blast holes in the face fronts with a water scrubber 8. Reducing the surface tension of water used for spraying by surfactants
<p>in processing plants</p> <ol style="list-style-type: none"> 1. Use of PASAT-W spraying system 2. Encapsulation of dust generation zones
MODULE 4 – Dust hazards protection – Topic 4.1 – Introduction
<p>Descriptive slides informing about: types of measures used for controlling of dust hazard, role of respiratory protective equipment (RPE) as a measure to control dust hazard and main requirements that have to be taken into account for using RPE.</p>
MODULE 4 – Dust hazards protection – Topic 4.2 – Types of RPE applicable for miners
<p>Descriptive slides informing about: disposable and reusable half-masks – their structure, advantages and disadvantages, protection they provide, classification,</p>
MODULE 4 – Dust hazards protection – Topic 4.3 – Use of RPE
<p>Descriptive slides informing about issues directly related with use of half-masks: on-site RPE program that should be applied, face fit testing, user seal check, rules regarding changing of a half-mask for a new one, and test stand of RPE developed in KOMAG.</p>
INTERACTIVE/MULTIMEDIA MATERIALS
<p>REPOSITORIES OF FILMS (=>3) – webpages (Moodle activity: 'Page') at which films from the ROCD YouTube channel are embedded and displayed (=> 15):</p>
<ul style="list-style-type: none"> - Films_Dust hazard reduction; corresponds to the YouTube playlist 'Dust hazards reduction' https://www.youtube.com/watch?v=NcfQM7u1RrU&list=PLkvBFeaR3ed3LR10IndFqa4Ihl3r5sFFW - Films_Do you know ... - short and to the point about dust hazard; corresponds to the YouTube playlist 'Do you know...' https://www.youtube.com/watch?v=fMgi8MbNla0&list=PLkvBFeaR3ed351SZ8jwyRLonVivrziR8g - Films_Learn more about the dust hazard in the mine; corresponds to the YouTube playlist 'Learn more about the dust hazard in the mine' https://www.youtube.com/watch?v=SYIRHJYnbHM&list=PLkvBFeaR3ed2Q8rdr6pVIFKltqA4PyP7y

INTERACTIVE TASKS (=> 10) – tasks created with the Moodle activity: 'quiz'; a variety of question types has been used

Interactive task_Respiratory track
 Interactive task_Dust controls
 Interactive taks_Face fit tests
 Interactive task_Coal dust neutralization - methods
 Interactive task_Surfactants
 Interactive task_Spraying systems
 Interactive task_Spraying - water vs. air-water
 Interactive task_User seal check
 Interactive task_Comparison of water and air-water spraying systems
 Interactive task_Locations of dust generation

ROCD Miner: A mining game, help your miners work safely – a webpage (Moodle activity: 'Page'):
 - with access to the webpage of Google Play where the SERIOUS GAME called ROCD Miner can be downloaded
 - with short description of the game.

LEAFLET

Coal dust and lung disease – a downloadable and printable short document (=> 6 pages) about coal dust as a source of danger for workers in a coal mine and methods to reduce it with particular underlining of importance of wearing of half-masks.

SELF-EVALUATION

Self-evaluation – a test created with use of the Moodle activity 'quiz'; includes 10 questions covering content of the whole course.

APPENDIX B – ROCD e-learning course – applicability for target audience

In the table it is indicated for which representatives of target audience content (even partly) of training materials is useful.

Note: interactive tasks and self-evaluation are quizzes that verify obtained knowledge and are not covered by the table


No.	Training material	Coal mines		Other industries, branches where workers are exposed to dust	Any person who is exposed to dust in private life
		personnel who works underground	management (decision makers related with coal dust control)		
x – useful directly in work, activities, taking decisions o – raises awareness, which indirectly contributes to safer behavior and/or better decisions as regards dust hazard					
Section: Glossary of terms					
	Glossary of terms	x	x	x	x
Section: Introduction to dust hazards					
	Topic 1.1: Dust – definition and classification	x	x	x	x
	Topic 1.2: The main sources of dust emission in hard coal mines	x	x		
	Topic 1.3: Deposition of dust in the respiratory system	x	x	x	x
	Topic 1.4: Pneumoconiosis - definition, division, accompanying symptoms	x	x	x	
	Topic 2.1: Equipment for measuring the amount of dust		x	x	
	Topic 2.2: Internet application for calculation of the distribution of dust concentration – introduction [and the application]	o	x		
Section: Dust hazards prevention					
	Topic 3.1: Dust hazards prevention - Introduction		x		
	Topic 3.2: Examples of dust reduction techniques		x		
Section: Dust hazards protection					
	Topic 4.1: Introduction	o	x	x	o
	Topic 4.2: Types of RPE applicable for miners	o	x	x	x
	Topic 4.3: Use of RPE	x	x	x	x

Section: Interactive/Multimedia Materials					
	Playlist: Dust hazard reduction FILM 1		x		
	Playlist: Dust hazard reduction FILM 2		x	o	
	Playlist: Dust hazard reduction FILM 3		x	o	o
	Playlist: Dust hazard reduction FILM 4		x	o	
	Playlist: Dust hazard reduction FILM 5	o	x	o	
	Playlist: Dust hazard reduction FILM 6	x	x	x	x
	Playlist: Do you know... FILM 1	o	o		
	Playlist: Do you know... FILM 2	o	x	o	o
	Playlist: Do you know... FILM 3	o	o	o	o
	Playlist: Do you know... FILM 4	o	o	o	o
	Playlist: Do you know... FILM 5	o	o	o	o
	Playlist: Learn more about the dust hazard in the mine FILM 1	o	x		
	Playlist: Learn more about the dust hazard in the mine FILM 2	x	x	x	x
	Playlist: Learn more about the dust hazard in the mine FILM 3	o	o	o	o
	Playlist: Learn more about the dust hazard in the mine FILM 4	o	x	o	o
	SERIOUS GAME: ROCD Miner	o	o		
Section: Leaflet					
	Coal dust and lung disease	o	x	o	o

APPENDIX C – ROCD e-learning course – presentations (slides)

Below are examples, randomly selected, of PowerPoint slides from the presentations.

The main sources of dust emission in hard coal mines (1)



<https://www.pexels.com/en/public-domain-photo-zhnrk>

Air dustiness in hard coal mining is one of the basic threats that may result in:

- mining disaster caused by coal dust explosion,
- occupational disease (pneumoconiosis) due to exposure of human organisms to long-term effects of dust (especially silica).

Dust in coal mines is not only coal dust, but also mine dust generated during mining operations. It is a mixture of coal dust and clay rocks, sandstones, sandy shales, silicate and aluminosilicate minerals, substances protecting against the explosion of coal dust, etc.


ROCD

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Dust – definition and classification (2)



<https://www.pexels.com/en/search?q=air+pollution>

Industrial dust is an aerosol in which the dispersed phase consists of solid particles, and whose source is production processes in industry. Contains both organic and inorganic ingredients.

Depending on the type of pathogenic effect, dust can be divided into:

- irritant,
- toxic,
- sensitization,
- carcinogenic,
- fibrotic – causing pneumoconiosis.

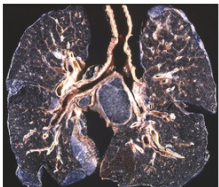
ROCD

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Pneumoconiosis – definition, division, accompanying symptoms (3)



https://commons.wikimedia.org/wiki/File:Coal_workers_pneumoconiosis_-_Anthracosis1conf15187845054.jpg

Pneumoconiosis among coal miners:

- arises from inhalation of mine dust and is characterized by focal pulmonary fibrosis,
- mine dust consists mainly of coal, however, 2-10% of the mine dust components are silica and selenium, copper, beryllium, cobalt,
- the disease appears after an average of several years of work in a mine.

The pneumoconiosis is not caused by respirable dust but by respirable fractions of crystalline silica.

This project has received funding from the Research Board for Coal and Steel under grant agreement No 754205

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Stationary optical dust meter PŁ-3




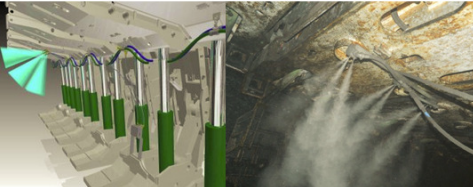
SOURCE: ATUT; www.atut.lublin.pl

This project has received funding from the Research Board for Coal and Steel under grant agreement No 754205

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Example of dust reduction techniques used in longwalls Using the zonal spraying installations mounted under the main canopies of powered roof supports (2)

The spraying pack is **installed under the powered roof supports and directed towards the longwall face**. The spraying nozzles produce air-water (misty) streams whose task is to water the dust carried with the flowing air. Spraying packs use compressed air, which reduces the water consumption needed to reduce the dust concentration.

KOMAG type air-water longwall spraying system; SOURCE: KOMAG

Air-water spraying installation of longwall shearer; SOURCE: KOMAG

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Topic 4.2. Types of RPE Disposable dust half-masks

General structure of a disposable dust half-mask is as shown in the figure

The diagram illustrates two views of a disposable dust half-mask. On the left is a white, cup-shaped mask with yellow headbands. On the right is a grey, cup-shaped mask with a white rectangular exhale valve on the front. Blue lines connect labels to the corresponding parts of both masks: 'sculped nose part' points to the top edge; 'nose clip' points to the bridge of the nose; 'headbands' points to the yellow straps on the left mask and the white straps on the right mask; 'filtering part' points to the main body of the mask; and 'exhale valve (exhalation valve)' points to the white valve on the right mask.

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Topic 4.3. Use of RPE

FACE FIT TESTING (7)

Qualitative face fit testing QLFT is suitable for both disposable and re-usable half-masks. It is not suitable for full-face masks.

The test routine goes as follows:

- The wearer dons the face mask
- A test hood is placed on the wearers head
- An test agent is then sprayed into the hood
- The wearer is asked to carry out a number of tasks/exercises mentioned before

<https://safetynetwork.3m.com>

During the exercises the wearer provides feedback whether s/he can taste the agent.

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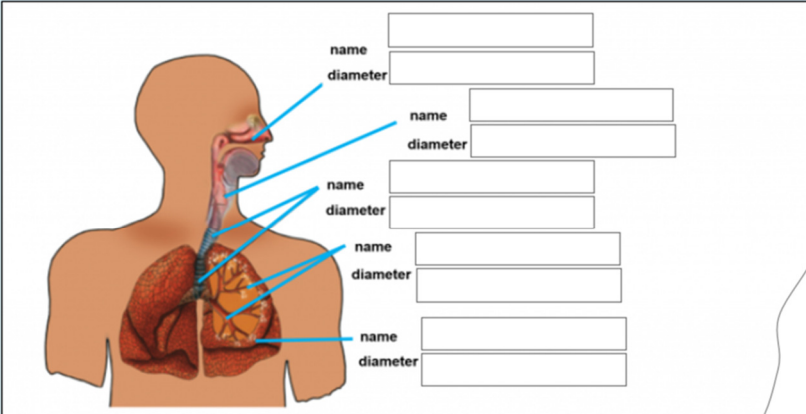
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APPENDIX D – ROCD e-learning course – Interactive tasks (screenshots)

There are 10 interactive tasks in the course. Below you can see examples of them. They are intentionally shown as partial views.

TITLE: Interactive task_ Respiratory track

Name particular parts of the respiratory track and assign diameter of dust particles that reach them.



Interactive task interface showing an anatomical diagram of the human respiratory system. The diagram is annotated with labels for 'name' and 'diameter' for various parts. Below the diagram, there are input fields for these labels. At the bottom, there are buttons for 'bronchi and bronchioles', 'trachea and bronchi', '1,1 – 3,3 µm', and '> 10'. Other partially visible buttons include 'larynx and nasal mucosa' and '1,5'.

TITLE: Interactive task_ Face fit tests

Complete the gaps in sentences regarding face fit testing.

QLFT . QNFT .

.

QLFT method , while QNFT .

.

Application of the QLFT requires



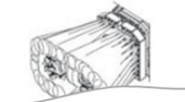
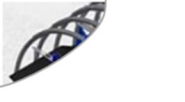
Application of the QNFT requires

provides PASS or FAIL result a special hood to be placed

TITLE: Interactive task_ Spraying systems

Drag images and photos into relevant table fields.


	image	photo
internal water spray system (sectional drift sprinkler)		
external water spray system (water curtain)		
air-water spraying systems used in corridor headings on mine haulage roads		


TITLE: Interactive task_ User seal check

Put appropriate activities in right order for each method of user seal check carried out for a half-

How to check the seal of the reusable half-mask via negative-pressure check?



How to check the seal of the reusable half-mask via positive-pressure check?



Put your hands

Verify whether the facepiece collapses slightly and no air

Breathe in and hold