



Reducing risks from Occupational exposure to Coal Dust (ROCD)

Deliverable D5.3

Results of dissemination activities

Research Fund for Coal and Steel

Grant Agreement number 754205

1st July, 2017 – 30th September, 2020



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



Prepared By	B. J. Williamson	UNEXE
	A. Drwięga	KOMAG
	A. Wrana	GIG
	M. Malachowski	EMAG
	T. Moreno	CSIC
	R. Reiner	DMT
	Bartłomiej Bezak	PGG
	Kamil Dębowski	JSWSA
	R. Lah	PV

Project:	Reducing risks from Occupational exposure to Coal Dust (ROCD)
Grant Agreement number:	754205
Funding Scheme:	Research Fund for Coal and Steel
Work Package:	WP5
Start date:	1 st January 2018
Due Date:	30 th September 2020
Date of Delivery:	30 th September 2020
Version:	Final
Project Website:	www.exeter.ac.uk/csm/rocd

Dissemination Level	
PU	<i>Public</i>

Reducing risks from Occupational exposure to Coal Dust (ROCD)

Contents:

1. Introduction to deliverable D5.3	4
2. Webstats - UNEXE	4
3. Catalogue of ROCD website user attributes - UNEXE	6
4. Workers' survey on E-module effectiveness.....	6
5. Stakeholder engagement.....	8
Appendices	18
Appendix 1 Magazine articles and poster presentations given at conferences	18
Appendix 2 Posters produced to display at conferences and in the foyers of ROCD project partner and other interested parties	22
Appendix 3 Communication strategy	24

List of Figures

Figure 1 ROCD web page views (all sources) per week between late 2017 and the end of August 2020.....	4
Figure 2 Twitter Analytics for ROCD for the month of August 2020.	5
Figure 3 Screenshot from the ROCD website (Educational Resources page) showing freely available educational resources including the ROCD e-learning course, information sheets, posters and a link to the ROCD Miner dust hazards game app. An industry pamphlet on 'best practice' in the selection and use of RPE in coal mining (see pamphlet in D4.2.) will be added in due course.....	9
Figure 4 Example posters (in Slovenian) designed to be placed in e.g. resting places, canteens, toilets, changing areas, to remind workers to use their personal protective equipment properly.	11
Figure 5 Leaflet or posters designed to raise awareness amongst teenagers of the risks from coal dust in mines, available in English and Slovenian.....	13
Figure 6 Leaflet or posters designed to raise awareness amongst young children of the risks from coal dust in mines, available in English and Slovenian.....	13
Figure 7 Leaflet or poster (in Slovenian) designed to raise awareness amongst young children of the risks from coal dust in mines.	14

List of Tables

Table 1 Web site pageviews and other webstats for the ROCD website.....	5
Table 2 Feedback from workers on communication strategies for dissemination activities and main priorities.....	6
Table 3 Comments on the e-training course from workers at the Velenje mine in Slovenia (21/05/2020, from Matjaz Kamenik, PV).....	8
Table 4 Description of Task 5.4: Dissemination and outreach (all partners, except UKLFR). 8	
Table 5 Communication strategy key messages, methods, aspirations and monitoring	30

1. Introduction to deliverable D5.3

The scope of D5.3 was to report on the results of dissemination activities including webstats on ROCD website views and downloads, catalogue of non-personal information from web-site registrants, numbers of mine workers given training using ROCD materials, and results of the survey of workers' views and perceptions having undertaken E- modules.

Report section authors:

- Webstats – UNEXE Task 5.2 and 5.4, linked to Task 6.2
- Catalogue of ROCD website user attributes – **UNEXE** Task 5.4, linked to Task 6.2
- Workers' survey on E-module effectiveness – **EMAG** Task 5.3
- Stakeholder engagement – **EMAG** Task 5.4

2. Webstats - UNEXE

The ROCD project website was launched at the end of 2017, within the first 3 months of the project. Since then it has attracted a highly varied number of page views per month (Figure 1), probably reflecting the intermittent publication of news stories via Twitter.



Figure 1 ROCD web page views (all sources) per week between late 2017 and the end of August 2020.

Web site pageviews and other webstats are given in Table 1. These show a good level of visits to the ROCD site over its lifetime. These figures are likely to increase rapidly over the coming months given that the Educational resources page was only added in August 2020.

Table 1 Web site pageviews and other webstats for the ROCD website.

This data was filtered with the following filter expression: /rocd

Page	Pageviews	Unique Pageviews	Avg. Time on Page	Entrances	Bounce Rate	% Exit
	3,370 % of Total: 0.00% (160,288,649)	2,066 % of Total: 0.00% (127,352,241)	00:01:29 Avg for View: 00:01:30 (-0.55%)	869 % of Total: 0.00% (61,240,882)	50.75% Avg for View: 57.24% (-11.34%)	26.23% Avg for View: 38.21% (-31.34%)
1. /emps.exeter.ac.uk/csm/rocd/	1,283 (38.07%)	841 (40.71%)	00:01:46	628 (72.27%)	48.41%	37.49%
2. /emps.exeter.ac.uk/csm/rocd/consortium/	405 (12.02%)	265 (12.83%)	00:01:14	64 (7.36%)	57.81%	21.23%
3. /emps.exeter.ac.uk/csm/rocd/about/	345 (10.24%)	209 (10.12%)	00:00:50	26 (2.99%)	73.08%	14.49%
4. /emps.exeter.ac.uk/csm/rocd/research/	345 (10.24%)	184 (8.91%)	00:01:26	12 (1.38%)	58.33%	10.72%
5. /emps.exeter.ac.uk/csm/rocd/news/	329 (9.76%)	211 (10.21%)	00:01:56	27 (3.11%)	55.56%	26.75%
6. /emps.exeter.ac.uk/csm/rocd/publications/	230 (6.82%)	110 (5.32%)	00:01:44	32 (3.68%)	53.12%	25.22%
7. /emps.exeter.ac.uk/csm/rocd_new/	116 (3.44%)	56 (2.71%)	00:02:02	37 (4.26%)	35.14%	23.28%
8. /emps.exeter.ac.uk/csm/rocd_new/consortium/	72 (2.14%)	32 (1.55%)	00:00:22	3 (0.35%)	33.33%	9.72%
9. /emps.exeter.ac.uk/csm/rocd_new/about/	60 (1.78%)	32 (1.55%)	00:00:52	0 (0.00%)	0.00%	6.67%
10. /emps.exeter.ac.uk/csm/rocd_new/research/	47 (1.39%)	28 (1.36%)	00:00:23	1 (0.12%)	100.00%	4.26%

The ROCD Twitter account has also attracted attention, in the month of August 2020 receiving 217 ‘impressions’, which is the number of times the tweet has been seen (Figure 2).



Figure 2 Twitter Analytics for ROCD for the month of August 2020.

3. Catalogue of ROCD website user attributes - UNEXE

Unfortunately it was not possible to gather user attributes due to the new Data Protection Act 2018 (UK), see: <https://www.legislation.gov.uk/ukpga/2018/12/contents/enacted>, and The General Data Protection Regulation (GDPR) Regulation (EU) 2016/679 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, see: https://ec.europa.eu/info/law/law-topic/data-protection/data-protection-eu_en

4. Workers' survey on E-module effectiveness

The main task related to this part of D5.3 is T5.3. The scope of this was to carry out a pilot survey of selected stakeholders (see Task 1.1) to solicit feedback on the usability and content of the website and E-modules, which are available from: <http://emps.exeter.ac.uk/csm/rocd/>. Participation in this was to be encouraged through advertising within companies and using films, posters and social media. The results would have been used to optimise and finalise the training resources developed under WP5 and the ROCD website.

Unfortunately, Task 5.3 was severely hampered by the coronavirus pandemic as the priorities of the coal mining companies were on keeping their workforce safe and the mines in production. Apparently, there have also been a number of strikes in certain mines. These factors have made it impossible to carry out the questionnaire survey within the contract period of the ROCD project; completing it would probably take an additional 3 months. Anecdotal feedback from the mining companies, as gathered from ROCD partners PGG, JSW SA and PV, and from outside participants in the Final Meeting of the ROCD project, has been very positive regarding the e-learning course and outreach materials.

In lieu of the questionnaire survey, comments have been gathered from Polish and Slovenian mine workers (through their mine managers), on workers' general views of the training materials and effective communication strategies for dissemination of research findings, including messaging on the use of dust masks and safe working in general, see Table 2 for responses from GIG and JSW SA and Table 3 for responses from PV.

Table 2 Feedback from workers on communication strategies for dissemination activities and main priorities.

Based on the research objective please list three key communication objectives that you want to meet.
- to extend the knowledge of underground workers in scope of the value of proper using of RPE for their own health;
- to spread the knowledge among mining managers / supervisors about BAT technologies in area of monitoring, prediction and prevention of dust hazard;
- to demonstrate on mine site or in laboratory scale the achievements of ROCD project (new monitoring strategies, dust suppression devices etc.)
Understanding our target audience - Who do you think are our target groups and what are their needs in terms of issues identified by the research? Which problems do they face? What interests them and what motivates them to take action?

	Target Group	Needs	Problems	Interests	Motivations
1.	Underground workers including manual workers and supervisors	<ul style="list-style-type: none"> - Comfortable working conditions, - The work place not affecting their health. 	<ul style="list-style-type: none"> - Some RPE with higher protection level can affect the comfort of breathing, - The dust suppression devices should not be difficult /time consuming to install and their dimensions should not affect the mining operations. 	<ul style="list-style-type: none"> - Work environment not affecting their tiredness, - Safe work environment, - Ease of equipment usage. 	<ul style="list-style-type: none"> - Successful realization of their professional tasks, - Wellbeing and wealth of their families, - Health during and after professional careers.
2.	Higher rank mining managers	<ul style="list-style-type: none"> - ensure the wellbeing of workers by providing them effective dust protection equipment, - high efficiency of mining operations. 	<ul style="list-style-type: none"> - implementation of new technologies is associated with higher risk, - lack of legal basis for more frequent or detail dust level monitoring. 	<ul style="list-style-type: none"> - Work environment not affecting the tiredness of workers, - Safe work environment. 	<ul style="list-style-type: none"> - Health of workers during and after professional careers, - Effective mine operations.

How do we reach our target audience - messages and communication channels

	Target group	Key message	Expected Action	Channel	Format
1	Underground workers including manual workers and supervisors	Proper using of your RPE is important for your health now and in the future	Ensure that workers are using the equipment in proper way	Display poster, social media	e.g.: video or animation,
				Profiled advance training courses	e-training platform
2	Higher rank mining managers	It is important to ensure the wellbeing of workers by providing them effective dust protection equipment	Ensure that all workers have best available protection equipment	Conferences for mine operators / dedicated workshops	Presentation, papers in mining journals
				Unformalised meetings and discussions	-
				Profiled advance training courses	e-training platform

Table 3 Comments on the e-training course from workers at the Velenje mine in Slovenia (21/05/2020, from Matjaz Kamenik, PV).

- “We tested with PV ROCD team and we must say is very good and instructive”;
- “We intend to spread e-learning among our workers who are understanding English language well. Targeted group will be ROCD PV team members, versus supervision staff, technical staff, management and some miners. We want to cover and spread the e-learning (plus android game) as much as possible and that we will get some structured feedback”;
- “We are also planning to contact local mining school and introduce to them e-learning and other material”;
- “Additionally we are thinking about the posters to put them on walls. For time being everybody is now wearing a masks as intensive warnings and notes were taken as COVID measure”.

5. Stakeholder engagement

Stakeholder engagement (Task 5.4) involved the production of information packs, notes on ‘best practice’, training resources and information about available workshops. E-learning and training activities are being disseminated to stakeholders, mainly electronically, but also via leaflets distributed to mining companies and at relevant meetings and conferences. A number of articles and posters have been published (Appendix 1 and 2). A comprehensive communications plan was developed, see Appendix 3.

Unfortunately, many of the planned face-to-face stakeholder engagement activities were not possible between March and September 2020 due to coronavirus, i.e. in the period when most of the results from the ROCD had been obtained and training materials were being developed. It is therefore envisaged that stakeholder engagement will continue following the end of the ROCD project.

Table 4 Description of Task 5.4: Dissemination and outreach (all partners, except UKLFR)

Hours on Task 5.4									
UNEXE	GIG	KOMAG	PV	DMT	UKLFR	CSIC	EMAG	PGG	JSWSA
500	300	500	50	100	-	300	200	75	70

Information packs, notes on ‘best practice’, training resources and information about available workshops and E-learning and training activities will be disseminated to stakeholders, mainly electronically, but also via leaflets distributed to mining companies and at relevant meetings and conferences. See below for stakeholders.

The main vehicle for disseminating resources developed during the ROCD project was the website at <http://emps.exeter.ac.uk/csm/rocd/>, specifically through the Educational resources tab (Figure 3).

REDUCING RISKS FROM OCCUPATIONAL EXPOSURE TO COAL DUST (ROCD)

Home About Consortium Research Educational resources Publications News

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 3 Screenshot from the ROCD website (Educational Resources page) showing freely available educational resources including the ROCD e-learning course, information sheets, posters and a link to the ROCD Miner dust hazards game app. An industry pamphlet on 'best

practice' in the selection and use of RPE in coal mining (see pamphlet in D4.2.) will be added in due course.

For a description of the freely available educational resources from the ROCD website see deliverable D5.2 (e-learning course, videos, project information sheet, posters, leaflet on dust hazards, school information sheets and ROCD Miner game). For the developed industry pamphlet on 'best practice' in the selection and use of RPE in coal mining see D4.2.

List of stakeholders and how they were engaged (Task 5.4):

1) Mine managers who can deploy the results of the ROCD project to improve health protection.

Mine managers were engaged through mining industry journals (Appendix 1) and the display of ROCD posters within mines and mining company premises (Appendix 2).

Unfortunately, restrictions associated with the coronavirus pandemic limited our ability to promote the ROCD project results. Despite this, Łukasiewicz-EMAG managed to establish contact with the Mining Department at the Higher Mining Authority in Katowice. They were sent information about the results of the project as well as a presentation and posters. The materials sent met with great interest from the State Mining Authority. They informed the management of several mines about the results of the ROCD project. From the discussions, they have also helped us to organize a short research project in one of the PGG mines (taking into account restrictions and a miners' strike). The results of these studies/research will be included in the final report of the ROCD project.

For the Velenje mine in Slovenia, during a regular inspection, the PV team briefed the official on the ROCD project, which he found extremely interesting. Further discussions will be undertaken when the coronavirus pandemic is over.

2) Mine workers who need to understand the benefits and implement the approaches in a way that will work operationally. Articles will be published in Polish and Slovenian and in broader worldwide mining journals and industry pamphlets.

Mine workers were encouraged to access the Educational resources (which are mostly in English and Polish) on the ROCD website at: <http://emps.exeter.ac.uk/csm/rocd/educational/> This includes presentations, videos, interactive tasks, a glossary of coal dust hazard terms, a leaflet on dust hazards, a link to a dust hazards game (ROCD Miner) and a knowledge evaluation test. This web page has been advertised via Twitter and by the mining companies themselves, initially PGG and JSWSA. A number of articles have been published to disseminate the aims and initial results of the ROCD project (see Appendix 1). An industry pamphlet will also be disseminated via the ROCD website on 'best practice' in the selection and use of RPE in coal mining (see pamphlet in D4.2).

A number of posters have been created and have been distributed to mines, see example in Figure 4.

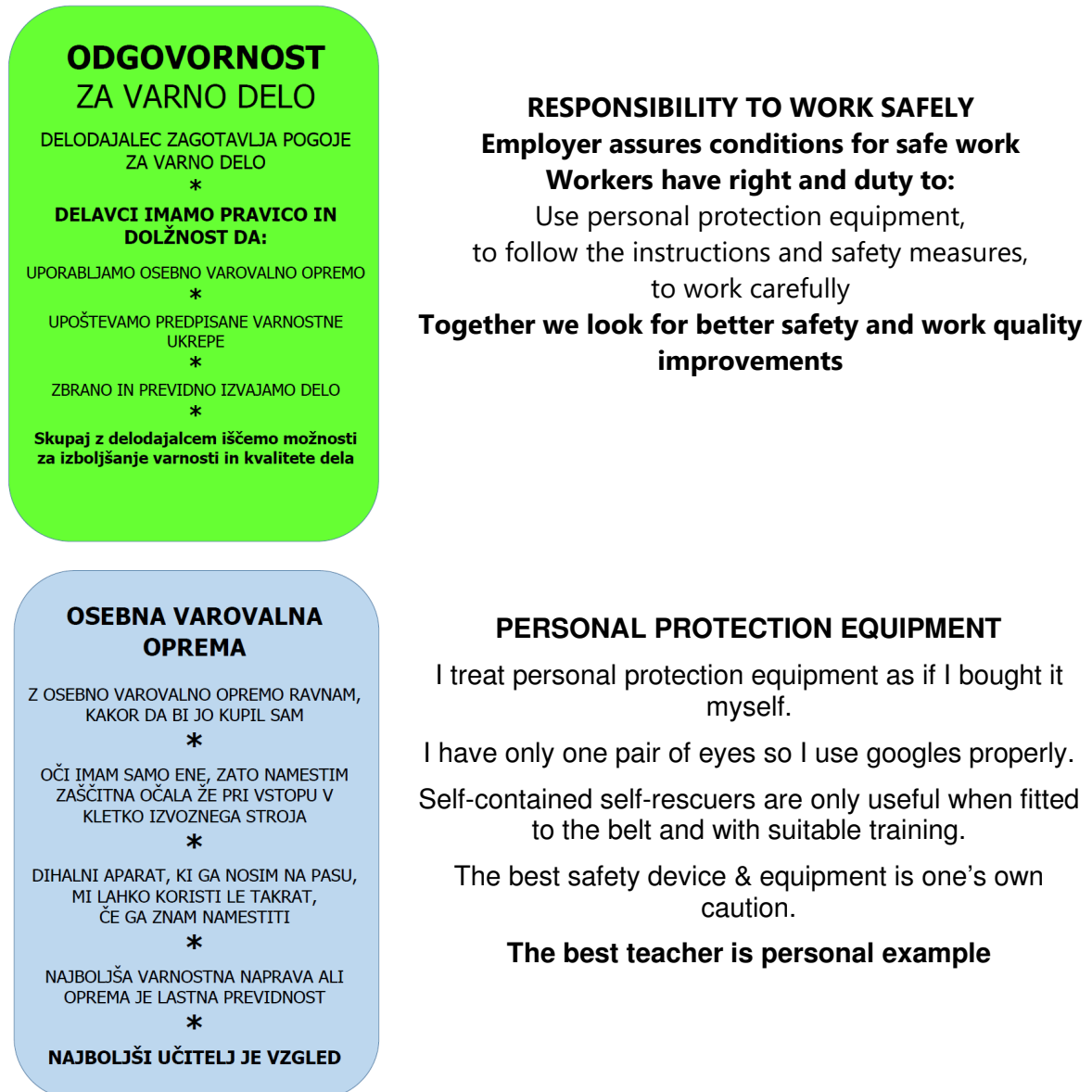


Figure 4 Example posters (in Slovenian) designed to be placed in e.g. resting places, canteens, toilets, changing areas, to remind workers to use their personal protective equipment properly.

In September 2019, the results of the ROCD project were presented at a course on the management and supervision of mines organized by the Education Centre "GAWOS". The subject of the training course was ventilation and combating the risks of coal dust explosion, communication and geophysics services. During the course, a presentation was given under the title - New optical dust meter for monitoring dust concentrations in high dust zones "EMIDUST" – Results from the ROCD Project.

On 28th September, 2020, a paper 'Hazard of harmful dusts in mechanized preparatory works' will be presented at the 6th Scientific and Technical Conference on "Energy and Mining - Prospects for Sustainable Development". The article contains partial results of EMIDUST dust meter tests carried out in the ROCD project.

3) Regulators to start a dialogue at a national and EU level on dust hazards and implications for mine health and safety legislation?

At the end of September, a meeting with the management of the State Mining Authority in Katowice will be organized to present the EMIDUST optical dust meter developed under the ROCD project and to present the entire ROCD project results.

The following important (non-ROCD) members of the mining industry and related academia took part in the ROCD Open Meeting on the 29th September 2020:

Tomasz Sołtysiak	State Mining Authority (WUG)
Witold Osiński	State Mining Authority (WUG)
Tomasz Krzykawski	University of Silesia
Rifat Wiśniowski	University of Occupational Safety Management, Katowice
Zbigniew Lubosik	GIG
Agnieszka Klupa	GIG
Angelika Więckol-Ryk	GIG


Związek Zawodowy Ratowników Górniczych - The Labour Union of Mine rescue Teams from Mine Ruda Part "Bielszowice"

NSZZ Solidarność KWK Ruda Ruch Bielszowice (Gość)

4) The general public to understand that coal mining is a vital part of the economy in many countries and that there is work underway to make it safer and more sustainable. Talks will be given in schools and to community groups in mining areas.

Leaflets have been designed for teenagers (Figure 5) and young children (Figure 6 and 7) to educate them regarding the potential hazards from coal dust and the importance of wearing a mask. The intension is to provoke discussion between children and their parents, who may work in mines, to reinforce messages about the importance of wearing masks and also to deeply engrain the necessity of wearing masks from an early age. The posters were sent to high schools and primary schools in Velenje.

Coal Mining and Disease




What is coal?
Coal is a type of sedimentary rock. Most of the coal in Europe was formed over 300 million years ago - that's ~55 million years before the first dinosaurs!


The world was warm and humid and there were lots of swamps. Plants would fall into the swamps and get covered by mud and more plants, eventually becoming peat. The peat then got buried in sediment. Eventually, it was buried so deep that, due to higher temperatures and pressures, it turned into coal.

Why do we mine coal?
Coal can be used in power stations to produce energy, be burnt in peoples' homes for heat, or a certain type of coal is used to make steel. It is a non-renewable resource.


Why is coal dust bad for miners' health?
Breathing in coal dust over long periods of time can cause a dangerous type of lung disease. This is because some of the dust will travel deep into the lungs. The body's immune system tries to remove or break down the dust but this process, and remaining dust, can damage the lungs. This can give miners very bad coughs and cause difficulty breathing even when sitting still. It can also lead to heart problems. In the severest cases miners can die earlier than normal.




A healthy lung



This lung has dust nodules and scarring developing.



Severely diseased lung, reduced air space.



RFCS Project # 754205

Coal Mining and Disease

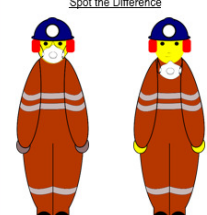
How can we stop coal dust making miners sick?
The **only way** is to stop miners breathing in the dust. The amount of dust in the air of a mine should be reduced as much as possible. Water can be sprayed around dust-producing machinery, such as the machines that cut or transport coal. Water can also be sprayed to form a barrier to stop dust travelling around the mine. The ventilation systems, which transport fresh air through the mines, can also be fitted with dust control systems.

Miners should all be wearing masks.
Modern dust masks are very good at keeping out dust to protect miners, however the masks must **fit well** and be **worn at all times**.

Some miners do not wear their masks because they do not think the dust will make them sick, or because they think they are uncomfortable – **THIS IS VERY DANGEROUS.**

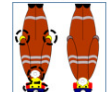
In other cases, miners only wear their masks if they can see the dust but the smallest dust particles, which are the most dangerous, are impossible to see with the human eye.

Spot the Difference




Answers

- specialist jobs.
- there are specialist types for
- Work gloves protect miners hands,
- type of eye protection in mines,
- Safety spectacles are a common
- dust is there if they cannot tell the
- masks even if they cannot tell the
- It's important that miners wear their



Search ROCD Miner on app store to play our mining game!
For more information visit our website: exeter.ac.uk/csm/ROCD




RFCS Project # 754205

Figure 5 Leaflet or posters designed to raise awareness amongst teenagers of the risks from coal dust in mines, available in English and Slovenian.

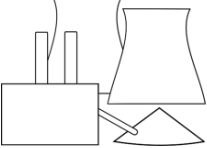
Coal Mining and Disease

Why don't you colour the drawings in?

Coal is a rock




We use coal to produce energy




POWER STATION

Mining coal produces a lot of dust




COAL MINE ENTRANCE




RFCS Project # 754205

Coal Mining and Disease

Dust is dangerous and can make miners sick.
BUT miners can be protected by **always wearing a mask!**



Search ROCD Miner on app store to play our mining game!
For more information visit our website:
exeter.ac.uk/csm/ROCD



RFCS Project # 754205

Figure 6 Leaflet or posters designed to raise awareness amongst young children of the risks from coal dust in mines, available in English and Slovenian.



Figure 7 Leaflet or poster (in Slovenian) designed to raise awareness amongst young children of the risks from coal dust in mines.

5) The scientific community to encourage further technical advances and technical solutions.

This was achieved through the publication of research papers in international and regional academic journals.

Balaga, D., 2019. Intelligent spraying installation for dust control in mine workings. IOP Conf. Series: Materials Science and Engineering 679. doi:10.1088/1757-899X/679/1/012019.

Bezak, B., 2017. Redukcja ryzyka zwiazanego z oddziaływaniem pyłu węglowego na gorników. Poster (in Polish) presented at the Polski Kongres Gorniczy November 2017.

Burger, J., 2018. Zellulärer H₂DCF-DA-assay und Interleukin-8-Nachweis zur Erfassung von reaktiven Sauerstoffradikalen als Maß für die Gruppierung der Toxizität von Bergwerksstäuben und mögliche Vorrausage von gesundheitlichen Auswirkungen auf den Menschen [in english: Cellular H₂DCF-DA assay and interleukin-8 release to detect reactive oxygen species as a measure for grouping the toxicity of coal mine dusts and possible predictions of health effects in humans]. Master of Science, Universitätsklinikum Freiburg, Germany.

Furtwängler, E. T., 2018. Oxidatives Potential als Maß für die Gruppierung der Toxizität von feinen und ultrafeinen Stäuben und mögliche Voraussage von gesundheitlichen Auswirkungen auf den Menschen [in english: Oxidative potential as a measure for grouping toxicity of fine and ultrafine dusts and possible prediction of human health effects]. Master of Science, Universitätsklinikum, Freiburg, Germany.

Gminski, R., Burger, J., Furtwangler, E., Arif, A., Mersch-Sundermann, V., Williamson, B., Johnson, D., Lah, R., Wrana, A., Trechera, P. and Moreno, T., 2018. Screening of cytotoxicity, oxidant generating capacity and inflammatory potential of two selected coal mine dusts as a contribution to the European ROCD project. *J. Environ. Anal. Toxicol.*, 8. DOI: 10.4172/2161-0525-C2-015.

Johnson, D., ROCD partners, 2019. Developing outreach and training resources to reduce the occupational risk of coal dust. Goldschmidt 2019 conference.

Johnson, D., Williamson, B. J., Rollinson, G. K., Moreno, T., Trechera, P., Lah, R. and Wrana, A., 2019. Automated mineralogical analysis of coal dust PM_{2.5} and PM₁₀, Goldschmidt 2019 conference.

Moreno, T., Trechera, P., Querol, X., Lah, R., Johnson, D., Wrana, A. and Williamson, B., 2019. Trace element fractionation between PM₁₀ and PM_{2.5} in coal mine dust: implications for occupational respiratory health. *Int. J. Coal Geol.*, 203: 52–59.

Trechera, P., Moreno, T., Querol, X., Lah, R., Williamson, B., Johnson, D., Wrana, A., 2018. Separation and chemical analysis of underground coal mine PM₁₀ and PM_{2.5}: a contribution to the new ROCD project. 5th Working & Indoor Aerosols Conference (Abs.) April 18th-20th, Cassino, Italy. Conference programme available at: http://www.aerosols2018.eu/pluginAppObj_60_58/final_program_web_16_04.pdf

Trechera, P., Moreno, T., Querol, X., Lah, R., Williamson, B., Johnson, D., Wrana, A., 2018. Chemistry of inhalable coal dust in underground mines. 6th Reunión Ibérica de Ciencia y Tecnología de Aerosoles (RICTA) Conference in Bilbao 20-22 June 2018. Poster presentation. "Chemistry of inhalable coal dust in underground mines." <https://www.dfmf.uned.es/RICTA2018/index.php?page=program>.

Trechera, P., Moreno, T., Córdoba, P., Moreno, N., Zhuang, X., Li, B., Li, J., Shangguan, Y., Kandler, K., Oliete Dominguez, A., Kelly, F. and Querol, X., 2020. Mineralogy, geochemistry and toxicity of size-segregated respirable deposited dust in underground coal mines. *J. Hazard. Mater.*, 399: 122935 <https://doi.org/10.1016/j.jhazmat.2020.122935>

Williamson, B., 2019. Reducing occupational exposure to coal dust. Mining Institute, February 2019. Available at: <https://mininginstitute.org.uk/transactions/featured-articles/february-2019-reducing-occupational-exposure-to-coal-dust/> [published online February, 2019].

Manuscripts in preparation

Arif, A. T., Burger, J., Furtwängler, E., Williamson, B., Johnson, D., Trechera, P., Moreno, T., Lah, R., Wrana, A., Mersch-Sundermann, V. and Gminski, R., in prep. Cytotoxicity, oxidant generating capacity and inflammatory potential in human lung cells exposed to coal mine dust particles and predictions of possible human health effects.

Arif, A. T., Burger, J., Furtwängler, E., Williamson, B., Johnson, D., Trechera, P., Moreno, T., Lah, R., Wrana, A., Mersch-Sundermann, V. and Gminski, R., in prep. Acellular oxidative potential as a predictor of toxicity from airborne coal mine dust particles.

Johnson, D., Rollinson, G.K., Arif, A.T., Moreno, T., Trechera Ruiz, P., Lah, R., Lubosik, Z., Pindel, T., Gminski, R., Williamson, B. J., in prep. Automated mineralogical analysis of potentially toxic PM2.5 and PM4 in underground coal mine dust PM2.5 and PM4: implications for occupational respiratory health.

Sweeney, A., Williamson, B., Johnson, D., Wrana, A., Pindel, T., Drwięga, A., Bałaga, D., Michalak, D., Rozmus, M., Moreno, T., Trechera, P., Arif, A. T., Gminski, R., Rellecke, R., Gomolla, N., Lah, R., Uranjek, G., Kamenik, M., Małachowski, M., Felka, D. and Turek, A., in prep. Reducing worker exposure to coal dust in European underground mines. To be submitted to Mining Science.

6) Mining communities who have seen the impact of coal mine dust related diseases to show that there are initiatives underway to improve the situation.

A number of articles have been published in company and local magazines, see Appendix 1.

7) Mining equipment and RPE manufacturers to ascertain the feasibility of deploying ROCD devices and recommendations into their next generation of dust monitoring and suppression equipment.

The company "EMAG-SERWIS" SP. z o.o. is interested in buying a license for the production of EMIDUST dust meters and then selling them to eastern markets. A possible sale of the license will take place after the completion of the ROCD project.

8) Mining associations and other professional bodies who can help promote the outcomes of ROCD to their memberships.

A number of articles have been published in company and local magazines, see Appendix 1.

GIG are planning to share information about the outcomes of the ROCD project with members of the Polish Academy of Science. There is a special group for Mining Technologies that gather experts from industry, universities and other institutions. Andrzej Walentek is leading this group; he attended the Open Meeting of the ROCD project on the 29th September 2020. We plan to solicit their opinion on the training program, ROCD game and other content.

Mining associations presentation given: Małachowski, M., 2019. Education Centre "GAWOS", IX Conference-Training of Communication and Geophysics Services - New optical dust meter for monitoring concentration in a high dust zones "EMIDUST" – The ROCD Project.

9) Students at the University of Exeter, and other universities (largely in coal mining areas) have been given case study lectures based on the results of the ROCD project.

The following two presentations have been given at the University of Exeter and Open University, UK:

Johnson, D., 2019. University of Exeter, Camborne School of Mines Seminar Series, October 2019 – Reducing Risks from Occupational Exposure to Coal Dusts – The ROCD Project.

Johnson, D., 2019. Open University, Faculty of Science, October 2019 – Automated Mineralogical Analysis of Fine Grained Carbon-rich Particles – The ROCD Project.

Appendices

Appendix 1 Magazine articles and poster presentations given at conferences



A1.1 Article in PGG's in-house magazine (in Polish), March 2018.

REDUKCJA RYZYKA ZWIĄZANEGO Z ODDZIAŁYWANIEM PYŁU WĘGLOWEGO NA GÓRNIKÓW

Bartłomiej Bezak
Polska Grupa Górnicza sp. z o.o., Centrala
b.bezak@pgg.pl

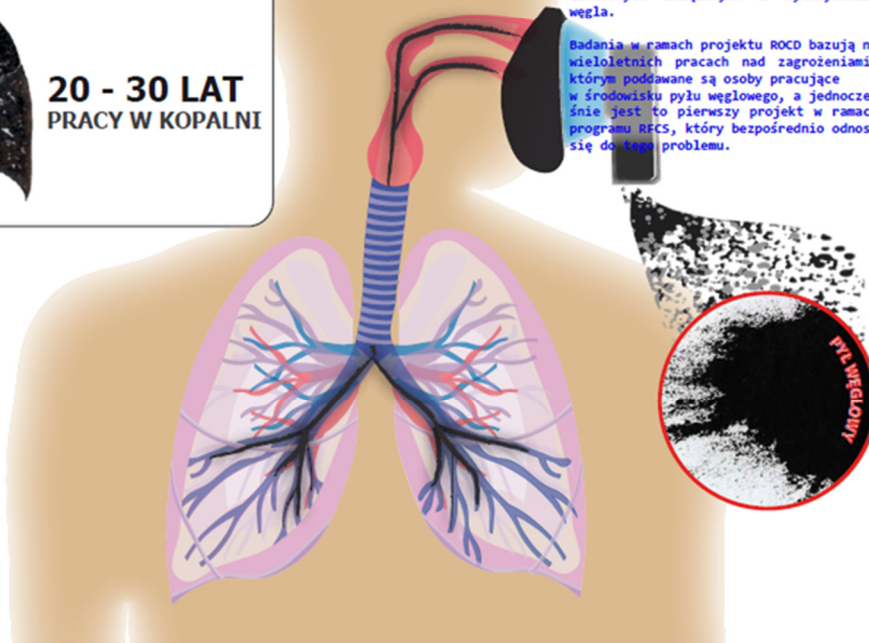


Projekt ROCD dofinansowany ze środków Europejskiego Funduszu Badawczego Węgla i Stali (RFCS) wspiera międzynarodowe wysiłki mające na celu ograniczenie szkodliwego wpływu pyłów węglowych na zdrowie tysięcy pracowników górnictwa w całej Europie. Celem projektu jest stworzenie nowoczesnych, praktycznych narzędzi oceny i ochrony służących poprawie metod zwalczania emisji pyłów, szczególnie z drobnej frakcji (PM2.5), która coraz bardziej powoduje choroby zawodowe wśród pracowników. Projekt ROCD obejmuje pięć zintegrowanych pakietów roboczych realizowanych przez międzybranżowe konsorcjum złożone z 10 wiodących instytucji z 5 krajów europejskich, obejmujących takie zagadnienia jak:

- Redukcja ryzyka związanego z oddziaływaniem pyłu węglowego na górników.
- Opracowanie zintegrowanych narzędzi do oceny ryzyka związanego z oddziaływaniem pyłu węglowego na pracowników (metody prognozowania stężenia i parametrów pyłu węglowego, ciągły monitoring parametrów pyłu węglowego).
- Opracowanie i testowanie nowych urządzeń odpylających.
- Opracowanie zasad przewidywania zagrożenia pyłem węglowym oraz jego ograniczania.

Oczekuje się, że efektem będzie rozpowszechnianie materiałów szkoleniowych oraz produkcja nowych urządzeń do monitorowania i tłumienia czynników związanych z narażeniem na pył węglowy, co znacząco zmniejszy częstotliwość występowania chorób zawodowych związanych z wydobywaniem węgla.

Badania w ramach projektu ROCD bazują na wieloletnich pracach nad zagrożeniami, którym poddawane są osoby pracujące w środowisku pyłu węglowego, a jednocześnie jest to pierwszy projekt w ramach programu RFCS, który bezpośrednio odnosi się do tego problemu.



ROCD - Reducing risks from Occupational exposure to Coal Dust,
RFCS Project # 754205



A1.2 Poster given at the Polski Kongres Gorniczny (in Polish), November 2017.



Investiramo v visoko tehnološko opremo/stran 4

65-letne sledi naših stopinj/stran 11

V PV gostili Združenje svetov delavcev Slovenije/stran 16

Zapiranje Rudnika Trbovlje-Hrastnik/stran 24

Z DELOM SE VSE DOSEŽE

Razvojno-raziskovalni projekt Premogovnika Velenje/
Raziskovalni sklad EU za premog in jeklo
MEDNARODNI PROJEKT ROCD

ROCD
RFCS Project # 754205



Slika 1: Srečanje projektnega sklopa ROCD (foto: Slobodan Mikajlović)

V Premogovniku Velenje organizirali srečanje partnerjev mednarodnega raziskovalnega projekta ROCD

Na začetku marca 2018 je Premogovnik Velenje gostil projektno skupino, ki sodeluje pri izvajanju raziskovalno-razvojnega projekta ROCD, povezanega s problematiko premenskega prašja v premogovnikih. Ta tematika bo obravnavana s petimi integriranimi delovnimi paketi s strani interdisciplinarnega konzorcija 10 institucij iz petih evropskih držav. Glavni cilj raziskave je razvijanje novih naprav za spreminjanje in zatiranje prašja, posledično pa v čim večji možni meri zmanjšanje zaprtašenosti oziroma v premogovnikih.

Projekt ROCD združuje multidisciplinarno ekipo iz 10 institucij v 5 evropskih državah, vključno z univerzami (UNITEK) iz Velike Britanije, tremi poljskimi rudarskimi ustanovami (GGK, KOMAG, EMAG), neodvisnim

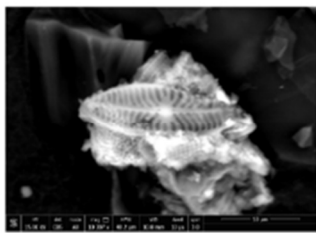
nemškam rudarsko-tehničkim podjetjem (DMT), tremi premogovniškimi podjetji – JSW SA in PGG iz Poljske in PV, Univerzitetno kliniko Freiburg (UKLFR) in Španskim nacionalnim raziskovalnim svetom

(CSIC). Začetek projekta ROCD je bil v juliju 2017. Projekt je trileten in se konča v juliju 2020. Koordinator projekta je Univerza Exeter v Veliki Britaniji (Camberne School of Mines). Srečanja se je

8

Z DELOM SE VSE DOSEŽE

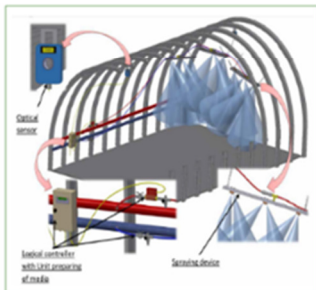
sodelujo kar 24 partnerjev iz celne. Med sodelujoce je bil tudi predstavnik Evropske komisije Lucas Lassen in podpredsednik Uprave za preprečevanje Poljske Grupa Górnicza (PGG), Piotr Bisiński. PGG je holding z 9 podjetij s kar 15 premogovniških črtno premoga, z letno proizvodnjo 32 milijard ton in 43.000 zaposlenimi. Na sestanku smo sodelovali projekt ta predstavili aktivnosti, ki so bile izvedene v prvih letih mesecih, in načrt aktivnosti, ki bodo potekale v prihodnjem letnem obdobju. V okviru aktivnosti projekta ROCD je predviden več faz. V prvi fazi je dolžnost lastnosti prašja – mineralogija, kemijska sestava in drugih lastnosti premenskega prašja, koncentracije ledbečnega premenskega prašja z morfološkimi. V nadaljevanju bodo izvedena merjenja s navedenimi napravami za merjenje zaprtašenosti, ovredniti za napoved zaprtašenosti (model) – za celotno jamo za vse pogoje in različne premogovniške ter aktivnosti za zmanjšanje zaprtašenosti oziroma v premogovnikih predom na delovnih v jami. Ena izmed aktivnosti projekta so tudi vprašalniki, ki so jih v februarju izpolnili rudarji s pripravskih delavcih in odlopih.



Rezultat prvih analiz - skladnost frakcij v vzorcih iz jame UNITEK

skupine v tem času je pomoč pri delovnih paketih v izvajanju. Glavna naloga naše projektno skupine ROCD PV je v okviru tretjega delovnega paketa, čigar naloga je razvoj avtomatiziranega sistema prah na odlopih, ob upoštevanju narave in koncentracije prašja, iz katerih bo nastali algoritmi in računalniško vodeni sistemi za zaznavanje sistema vodnih prah (vodni zavese).

Različne simulacije in in-situ testi bodo izvedeni s pripadajočimi predhodno izvedenimi merjenji in analizi. Optimizacija in testiranje avtomatiziranih sistemov se bosta izvajala v različnih situacijah in lokacijah v jami Premogovnika Velenje in poljskih premogovnikih. Ta delovni paket aktivnosti se začne z intenzivnejim delom v drugi polovici leta 2019.



Prilozena naprava za zatiranje prašja, namenjena prečiščanju senzorja za merjenje ledbečnega prašja v jarnih prostorih, ki bo deloval na principu odlopih prašja, za optimizirano prilagojeno glede na koncentracijo prašja v zraku (KOMAG)

9

Z DELOM SE VSE DOSEŽE

Projekt ROCD sofinancira Razvijni sklad za raziskave v premogovništvu in jeklarstvu pri Evropski komisiji (RFCS) v vrednosti 2,2 milijona EUR, s delom za PV 168.000 EUR. Pri projektih v večini sodelujemo z raziskovalno-razvojnimi delci, ki so opravljajo tudi strokovnjaki in zaposleni. V projektu primarno vključujemo material in opremo, ki je v vsakem primeru potrebna. Na takšen način se trajno doseže maksimalno dodano vrednost projekta, ki ni samo finančna. Pomemben je tudi dejanski razvoj, ki ima lahko velike finančne in predstavnostne učinke.



Projektne partnerje s sodelovalci iz Premogovnika Velenje po ekskurziji v jami (foto: Slobodan Mikajlović)

Partnerji projektno skupine so obiskali Muzej premogovništva Slovenije, nekateri pa tudi jamo in razume oblike. Navedeni so bili tudi visoko razvito, moderno opremo in tehnologijo.

Koordinator projekta dr. Ben Williams in drugi partnerji so se zabavali na odlično izpoljen konferenčni sestanek projektno skupine ROCD in zlasti, po njihovih besedah, fascinanti ogled jame, za kar se zahvaljujejo tako področje PV in ekipa, ki je organizirala in izvedla srečanje projektno skupine ROCD.



Robert Lah, vodja projekta ROCD PV, partnerji projekta ROCD s sodelovalci iz Premogovnika Velenje na obisku Muzeja premogovništva Slovenije (foto: Janja Šušter)

Proizvodnja v marcu 2018

indij	nacionalno	dometno	v.f.	%	ton na dan
E. K. -95/E	34.000	42.000	4.000	116,08	1.750
S. K. -95/A	208.800	149.921	-58.879	71,80	6.247
C135/G	24.000	13.547	-10.453	56,45	864
Proizvodnja	266.800	205.478	-61.322	76,44	8.544
Prepave	12.000	7.868	-4.132	65,57	338
skupaj PV	280.800	213.341	-67.459	75,98	8.889

Proizvodnja januar-marec 2018

indij	nacionalno	dometno	v.f.	%	ton na dan
Proizvodnja	884.752	677.428	-207.324	88,23	30.270
Prepave	28.014	24.880	-3.134	85,96	377
skupaj PV	912.766	702.308	-210.458	84,29	30.647

A1.3 Article in PV's in-house magazine Rudar (in Polish), April 2018.

ENERGIJA

časopis skupine HSE / junij 2018



- > Dravske elektrarne Maribor z več dogodki obeležile sto let obratovanja hidroelektrarne Fala
- > ČHE Avče - stebler prehoda slovenske družbe v nizkoogljično družbo

89

Srečanje projektnih partnerjev mednarodnega raziskovalnega projekta ROCD

Na začetku marca 2018 je Premogovnik Velenje gostil projektno skupino, ki sodeluje pri trvajajočem raziskovalno-razvojnem projektu ROCD, povezanega s problematiko premožnega prahu v premogovnikih. Ta tematika bo obravnavana s petimi integriranimi delovnimi paketi s strani interdisciplinarnega konzorcija desetih institucij iz petih evropskih držav. Glavni cilj raziskave je razvijanje novih naprav za spremljanje in zatiranje prahu, posledično pa v čim večji meri zmanjšanje zaprtaosti ozračja v premogovnikih.

Projekt ROCD združuje multidisciplinarno ekipo iz desetih institucij v petih evropskih državah, vključno z univerzo (UNEXE) iz Velike Britanije, tremi poljskimi rudarskimi ustanovami (GIG, KOMAG, EMAG), neodvisnim nemškimi rudarsko-tehnološkim podjetjem (DMT), tremi premogovniškimi podjetji – ISWSA in PGG iz Poljske in PV, Univerzitetno kliniko Freiberg (UKLFR) in Španskim nacionalnim raziskovalnim svetom (CSIC). Začetek projekta ROCD je bil v juliju 2017. Projekt je trileten in se konča v juliju 2020.

Razviti in preizkušeni bodo novi sistemi za nižanje koncentracij ledbečnega prahu, ki jih bo mogoče potrditi skladno z direktivo ATEX in bodo optimizirani za vse frakcije prahu, predvsem najmanjših, za uporabo v veliko širšem obsegu različnih scenarijev zaprtaosti in preventivnih ukrepov za zmanjšanje zaprtaosti v premogovnikih.

Osnovna ideja je globalno razširjanje razvitih protokolov in modulov za usposabljanje ter proizvodnja novih naprav za spremljanje in zatiranje premožnega prahu doma in po svetu.

ROCD je eden izmed štirih projektov, ki v Premogovniku Velenje tečejo v okviru raziskovalnega sklada RFCS. Projekt je široko zastavljen, izvajajo ga na različnih področjih, zato je vanj vključenih veliko strokovnjakov iz Premogovnika Velenje. Glede na fazo projekta se vanj vključujejo različni strokovnjaki s področji rudarstva, geologije, strojništva, elektrotehnike in informatike. Glavna naloga projektnih skupine ROCD PV je v okviru tretjega delovnega paketa, katerega naloga je razvoj avtomatiziranega sistema prh na odkopih, ob upoštevanju narave in koncentracij prahu, iz katerih bodo razviti algoritmi in računalniško vodeni sistemi za uravnavanje sistema vodnih prh (vodne zaves). Različne simulacije in in-situ testi bodo izvedeni s pripadajočimi predhodno izvedenimi meritvami in analizami. Optimizacija in testiranje avtomatiziranih sistemov se bosta izvajala v različnih situacijah in lokacijah v jami Premogovnika Velenje in poljskih premogovnikih. Ta delovni paket aktivnosti se začne s intenzivnejšim delom v drugi polovici leta 2019.

Projekt ROCD sofinancira Razvojni sklad za raziskave v premogovništvu in jeklarstvu pri Evropski komisiji (RFCS) v vrednosti 2,2 milijona EUR, z deležem za PV 168.000 EUR. Pri projektih v večini sodelujejo z raziskovalno-razvojnimi delom, ki ga opravljajo njihovi strokovnjaki in zaposleni. V projekte primarno vključujejo material in opremo, ki ju v vsakem primeru potrebujejo v PV. Na takšen način se trudi doseči maksimalno dodano vrednost projekta, ki ni samo finančna. Pomemben je tudi dejanski razvoj, ki ima lahko velike finančne in predvsem varnostne učinke.



Srečanje partnerjev ROCD; foto: Arhiv PV

19

A1.4 Article in Energia magazine (in Polish), June 2018

JSW PARTNEREM MIĘDZYNARODOWEGO PROJEKTU

PROJEKT DOFINANSOWANY JEST ZE ŚRODKÓW EUROPEJSKIEGO FUNDUSZU BADAWCZEGO WĘGLA I STALI I PROWADZONY JEST W RAMACH PRIORYTETU BEZPIECZEŃSTWO I HIGIENA PRACY W KOPALNIACH, DĄŻĄC DO OGRANICZENIA SZKODLIWEGO WPŁYWU PYŁÓW WĘGLOWYCH NA ZDROWIE PRACOWNIKÓW GÓRNICZWA W CAŁEJ EUROPIE

Głównym założeniem projektu jest opracowanie nowoczesnych i praktycznych narzędzi oceny oraz urządzeń mających zastosowanie w zwalczaniu emisji pyłów, w szczególności drobnej frakcji PM 2,5, które mogą docierać do górnych dróg oddechowych, płuc oraz przenikać do krwi, powodując coraz częściej poważne problemy zdrowotne i choroby zawodowe pracowników.

Zgodnie z założeniami projektu ROCD, prace prowadzone są według zdefiniowanych pakietów roboczych, które obejmują: redukcję ryzyka związanego z oddziaływaniem pyłu węglowego na górników, opracowanie zintegrowanych narzędzi do oceny ryzyka związanego z oddziaływaniem pyłu węglowego na pracowników (metody prognozowania stężenia i parametrów pyłu węglowego, ciągły moni-

toring parametrów pyłu węglowego), opracowanie i testowanie nowych urządzeń odpylających, opracowanie zasad przewidywania zagrożenia pyłem węglowym oraz jego ograniczania.

Oczekiwanym efektem końcowym prowadzonych badań/prac będzie opracowanie innowacyjnego urządzenia dla ograniczenia zapylenia połączonego z systemem pomiarowym, a także zweryfikowa-



nie efektywności stosowanych obecnie środków ochrony pod kątem ochrony przed frakcją pyłu PM 2,5. Ponadto badania prowadzone w ramach projek-

tu zmierzają do opracowania nowych metod oceny i predykcji zagrożenia pyłowego. Projekt realizowany będzie przez 3 lata (do czerwca 2020r.) przez

konsercjum składające się z 10 wiodących instytucji oraz przedsiębiorców górniczych z 5 krajów europejskich.

PP

Listopad nr 14 (167)/2018

 Jastrzębski Węgiel

A1.5 Article in Jastrzębski Węgiel newspaper (in Polish), November 2018.

Appendix 2 Posters produced to display at conferences and in the foyers of ROCD project partner and other interested parties

PROTECTING COAL WORKERS FROM MINE DUST 

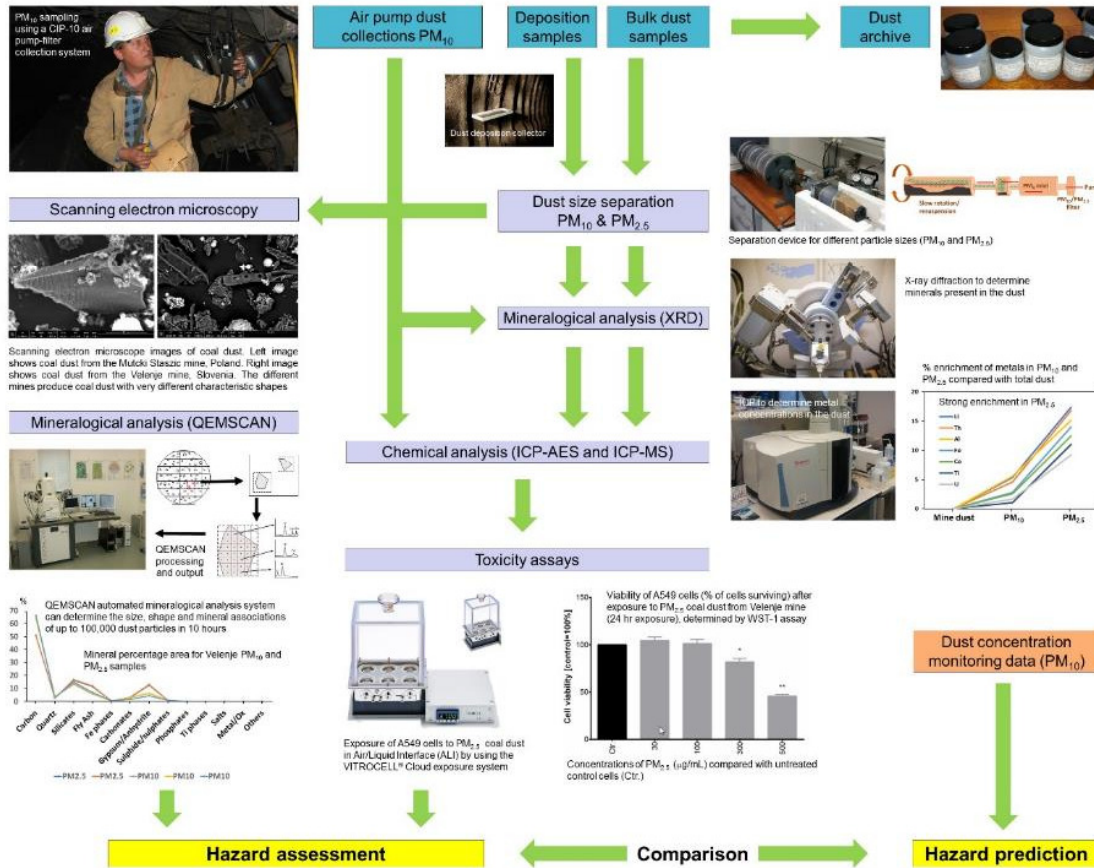
The ROCD project (Reducing Risks from Occupational Exposure to Coal Dust) is an EU-funded contract (2017 to 2020) to address current concerns about the health impacts of dust in coal mines.

- Despite international efforts, coal mine dust continues to impact the health of thousands of miners.
- Interdisciplinary project involving a world-leading consortium of 10 university and industry partners from UK, Poland, Slovenia, Germany and Spain.
- Project will develop modern assessment methods and devices to control dusts and protect workers.
- First detailed study of $PM_{2.5}$ (nominally dust with a diameter <2.5 microns), which is increasingly implicated in human, mainly cardiovascular, diseases.
- Case studies at hard coal mines in Poland and a lignite mine in Slovenia.
- Global dissemination of developed dust characterisation methods, new devices for monitoring and dust suppression and training tools for the proper use of dust masks to reduce incidences of coal mining-related disease.

<http://emps.exeter.ac.uk/csm/rocd>



Workflow for coal dust characterisation and health hazards prediction



Results will be linked to ROCD research on the efficiency and recommended use of dust masks

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



A2.1 Poster produced under WP5 on coal dust sampling and characterisation.

PROTECTING COAL WORKERS FROM MINE DUST



The ROCD project (Reducing Risks from Occupational Exposure to Coal Dust) is an EU-funded contract (2017 to 2020) to address current concerns about the health impacts of dust in coal mines.

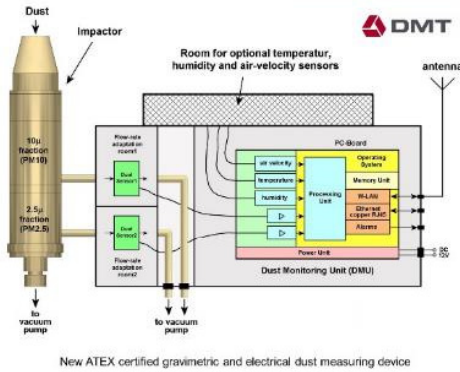
- Despite international efforts, coal mine dust continues to impact the health of thousands of miners.
- Interdisciplinary project involving a world-leading consortium of 10 university and industry partners from UK, Poland, Slovenia, Germany and Spain.
- Project will develop modern assessment methods and devices to control dusts and protect workers.
- First detailed study of PM_{2.5} (nominally dust with a diameter <2.5 microns), which is increasingly implicated in human, mainly cardiovascular, diseases.
- Case studies at hard coal mines in Poland and a lignite mine in Slovenia.
- Global dissemination of developed dust characterisation methods, new devices for monitoring and dust suppression and training tools for the proper use of dust masks to reduce incidences of coal mining-related disease.



<http://emps.exeter.ac.uk/csm/rocd>

New devices for dust monitoring and control, optimised for PM₁₀ and PM_{2.5}

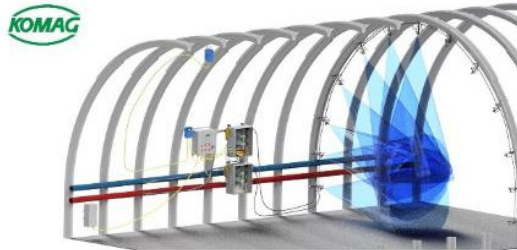
Development of new dust monitoring devices



DMT is developing a prototype of a new spectrometer-based dust-monitoring device for the continuous determination of dust concentrations in air. An impactor with a high flow rate will ensure simultaneous dust-sampling for gravimetric analysis.

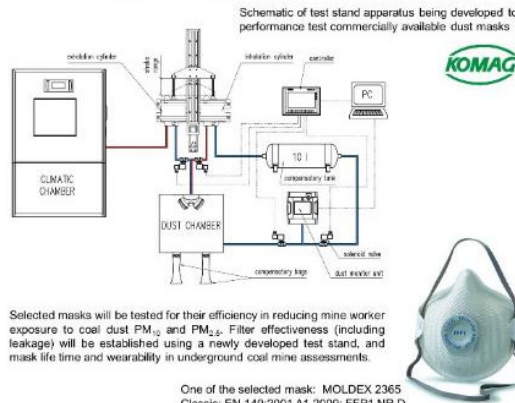
ITI EMAG is developing a new optical dust monitoring device that is a modification of the previously developed (uncertified) dust meters. The device will be used to simultaneously measure the levels of PM₁₀ and PM_{2.5} dust fractions up to a concentration of 200 mg/m³. It will be a device designed for environmental research in zones with high dust concentrations.

Development of new dust control system



Visualisation of a new intelligent spraying device being developed to reduce and prevent the spread of dust (PM_{2.5} and PM₁₀) in underground mines. The system uses compressed air to generate a high velocity spray of water droplets which have diameters close to and therefore capture dust particles. The advantage of the new device is that the intensity of the spray is adjusted depending on the level of dust measured by an EMIDUST optical dust meter.

New test methods for dust mask performance



Selected masks will be tested for their efficiency in reducing mine worker exposure to coal dust PM₁₀ and PM_{2.5}. Filter effectiveness (including leakage) will be established using a newly developed test stand, and mask life time and wearability in underground coal mine assessments.

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



A2.2 Poster produced under WP5 on new coal dust monitoring and control devices.

Appendix 3 Communication strategy

By Dr Penda Diallo (UNEXE)

Objectives of the communication strategy

The main objective of the communication strategy is to support the effective communication of research findings and outputs from the study through the most effective media and communication channels including both written, verbal and visual displays. The specific objectives for the strategy would be to achieve the following:

Goal 1: Effective dissemination of scientific knowledge

- Increase miners' knowledge on indoor air quality in coal mines and what they can do to improve it.
- Increase knowledge on reasons why coal mines are still a matter of concern regarding air quality.
- Share scientific knowledge on the subject.
- Communicate the existence of scientific projects on this subject.
- Communicate research and R&D developments made during the project, mainly to the scientific and mining communities but also to the public and equipment manufacturers.
- Offer information on dust hazards prediction based on the physicochemical properties of the coalmine dusts (chemistry, mineralogy) listing of coal properties (rank etc.), and presence of potentially toxic substance.
- Share information on toxicological assessment of coal mine dusts, mainly focussing on PM_{2.5}.
- Share data that will result from the in vitro laboratory tests.

Goal 2: Promoting and raising awareness of best practices and new technologies

- Communicate to the mining industry, and technology community the research outputs and conclusions from the ROCD project.
- Communicate best practice methods for dust impacts prediction, prevention and protection, and dust exposure risk reduction to coal mine workers (miners, management staff, and mine owners/regulators) and to other stakeholders.
- To spread the knowledge among mining managers / supervisors about BAT technologies in area of monitoring, prediction and prevention of dust hazard.
- Communicate the knowledge about the new easy to use and affordable dust monitoring systems (see D2.2).

- Build better and continuous awareness of dust-related issues, which will lead to better protection / prevention.
- To extend the knowledge of underground workers in scope of the value of proper use of RPE for their own health;

Goal 3: Raising awareness of the potential risks related to unprotected exposure to coal dust

- Communicate to the public on the nature of the coal industry and potential respiratory health impacts to workers.
- Communicate to the public (including miners' families) the potential risk to health from coal mining dust, highlighting ROCD project output.

Goal 4- Use effective communication channels to raise awareness and encourage target audiences to adopt best practice approaches

- To support the underground staff with information related to wearing RPE depending on dust measurements on their way to- and at their working places.
- To achieve higher awareness / knowledge about coal dust (e.g. that coal dust can include dangerous substances).
- Identify efficient communication channels (most important is verbal).

Goal 5-Demonstration

- To demonstrate on mine sites the achievements of the ROCD project (new monitoring strategies and dust suppression devices)
- To demonstrate on mine sites the achievements of ROCD-project (new monitoring strategies for dusts as well as new sampling and control devices).

Goal 6- Training and Education

- To develop and disseminate e-learning modules to target audiences.

Target audience

The project addresses critical issues relating to dusts in working underground mines. Therefore, to ensure that the findings from the project have an impact, the project aims to disseminate findings and information to key target audiences, including:

- Miners
- Mining companies and their employees
- Academic institutions

- Government institutions
- Intergovernmental organisations
- Private Sector companies
- European Union organisations
- Funding organisations working on mining-related issues

Primary target audience

The primary target audience constitutes a group of professionals working in the mining industry, including:

- Mine managers, senior mining company managers, mine team leaders, miners, underground workers including manual workers and supervisors, human resource departments, engineers (mine planning staff) and technicians

Secondary target audience

Any person/institutions that can have an impact on the primary audience. Such people and organisations will include

- **Professionals** - scientists, academics, students interested in mining and institutions that can benefit from the research findings.
- **Academic Institutions** - Schools, universities, concerned institutions, Scientists.
- **Stakeholders (government, industry , politicians and general public)** - Industry authorities, government, politicians, manufacturing industry (equipment manufacturers, equipment suppliers/fitters), public (any, cities, municipalities), mine regulatory authorities in Slovenia and Poland, and other coal countries, coal mining communities.

Objectives

The objective of the strategy is to successfully disseminate research findings and outputs and to ensure that the information reaches the identified target audiences. To achieve this, the communication strategy will set objectives, which are Specific, Measurable, Achievable, Realistic, Relevant, Targeted and Time Based (SMARRTT) as much as possible.

Overall aim:

A response hierarchy model adapted by Pickton and Broderick (2005) will be used in this report to show “the stages that individuals are said to progress through initial awareness to final action such as purchase and consumption” (Pickton and Broderick, 2005:421). Here, the last stage will be the adoption of adequate protection kits.

The aim is to successfully and continuously encourage miners to properly wear RPE. To achieve this, the strategy will set objectives.

Attitude objectives

Primary target audience

Awareness & Knowledge

To emphasise on the risk that is presented by unprotected exposure to coal dust

- Get the primary audience to understand the consequences and risks associated with exposure to coal dusts.

Conviction

Reassure the target audience of the importance of the use of protective equipment, preventive measures and consistent use of best practices.

Attitude

Increase the awareness of best practice approaches focusing on the benefit of RPE and learning materials.

Remove doubt that might be associated with training costs, practicality of RPE and e-learning courses by focusing on advantages related to RPE, preventive actions and the advantage of e-learning courses.

Secondary target audience

Awareness

Increase awareness of protection from coal mine dusts and benefits that it can offer once effectively implemented.

Knowledge

Inform the audience of the services available that they can benefit from and why it is important that they support the primary target audience to use best health and safety practices.

Conviction

Reassure Managers that :

- Protection and prevention will ensure that their workforce is healthy and more productive.

Reassure Organisations that:

- RPE will protect the health of workers and sustainability of their operation.
- The e-learning will be delivered with the highest standards and offer very useful information to all coal mine workers.
- Inform them that international multidisciplinary experts put the courses together.

Attitude

Remove doubt that might be associated with the costs of training, practicality of RPE and e-learning courses by focusing on advantages related to RPE, preventive actions and the advantage of e-learning courses.

Behaviour Objectives

Primary target audience

Action

Increase best practice actions amongst coal mine workers and across the industry.

Get the primary target audience to use adequate RPE, undertake the e-learning course and encourage each other to regularly think of their safety.

Secondary target audience

Action

Encourage organisations to support and encourage the promotion of best practice in coal mines.

Encourage students and community members to read and learn more about the impact of exposure to coal dust.

Communication Challenges

There are many potential dangers associated with mining and it is important to note that these are not the focus of the communication strategy. A main challenge is how to build awareness regarding the importance of protection and reduction of exposure to coal dust without creating fear vis-à-vis the economic benefits of coal mining. Admitting that risks exist without causing fear and paranoia over risks in the mine is a complex task. Fear can lead to negative reactions,

reduce public acceptance and create negative media attention. Therefore, the communication strategy will aim to focus mainly on protection and exposure rather than on “mine danger”.

Communication strategy

To achieve the above-defined objectives, the strategy will consist in using various means of communication to inform the potential audience on the research findings. The dissemination of the research findings and output should reach the potential beneficiaries (individuals as well as the institutions concerned).

MEDIA

ROCD will try to gain publicity within different media (key list of selected vehicles to be agreed with different organisations):

Media	Location	Vehicle
Newspapers	<ul style="list-style-type: none"> ▪ National ▪ Regional ▪ International 	Advert of e-learning, safety videos
Magazines	<ul style="list-style-type: none"> ▪ International and national 	Advert of e-learning course
Journals	<ul style="list-style-type: none"> ▪ Online ▪ Universities ▪ Insert in journals 	Research publication, contribution to papers, reports
Events	<ul style="list-style-type: none"> ▪ International ▪ Exhibitions ▪ Conferences ▪ Academic courses ▪ workshops 	Leaflets, , e-learning, reports, computer based discussions, branded products, website links

Testimonials and endorsement

- This will be available for people who visit the website to view in a video style
 - Include people attending training, meeting staffs or film footage with a previous coal miner affected by coal dust related health problems to show and discuss importance of the issue at hand and the everyday implications of dust related health problems.
 - Posters of current miners including faces that can be recognised.
 - Show miners underground following Health & Safety rules (photos of big machines).
 - Ask celebrities (e.g. famous footballers) to endorse H&S messages,
 - Show videos of professionals describing the benefits of using RPE, best practice measures and the added value to their current positions.
- Illustrate case studies with photos.

- Encourage people to share their stories on the benefits of the approaches that they are using.

By sharing testimonials from different stakeholders, other workers will be more motivated to use RPE and to adopt best practice measures.

Awards and Rewards

Mine owners could celebrate and reward use of RPE. e.g. an annual safety merit scheme-nominated by another workers, winner receives a financial reward.

Team approach – rewards for following best practice, fines for non-compliance

RPE-champion of the month – prize

Best ideas for H&S – monthly prize

Rewards for reducing incidents of respiratory health problems

H&S manager of the month

Best ideas for H&S – monthly prize

Prize winners communicated to population of local towns and more widely - via company web site

Other means of communications to help disseminate the research findings include website news and press releases. A website has already been built and is publicly accessible.

Implementation Plan-Communication strategy

Table 5 shows the planned communication strategy which will be used by the research team to disseminate the key research findings throughout the project, including a summary of key target audiences, the key messages, how information will be disseminated, desired outcomes of our efforts, and evaluation methods.

Table 5 Communication strategy key messages, methods, aspirations and monitoring

Target audience: <i>Who do we want to inform?</i>	Key messages: <i>What do we want to tell them?</i>	Communication methods: <i>How are we going to tell them?</i>	Desired outcome	Evaluation methods
Miners	<p>Proper using of your RPE is important for your health now and in the future</p> <p>Your health is crucial for your job-To keep your job for the longer term and to earn more money in the future you need to be healthy</p> <p>By using adequate protection equipment, you</p>	<p>Training (face to face and e-training), workshops, Internal mail, posters, leaflets, guides</p> <p>Share information notice on website, EXPO's conferences</p> <p>Posters across mining sites (toilets, exit, entrances, offices; large screen monitors</p>	<p>Increased awareness of workers regarding the potential impact of coal dust on the health and wellbeing of miners and consequently better RPE's</p> <p>Adopt best practice approaches and adequate use of protective equipment.</p>	<p>Reduction in number of accidents</p> <p>Safety records</p> <p>Number of people attending courses</p>

Target audience: Who do we want to inform?	Key messages: What do we want to tell them?	Communication methods: How are we going to tell them?	Desired outcome	Evaluation methods
	<p>will successfully realize your professional tasks; contribute to the wellbeing and wealth of your families, and be healthy both during and after your professional careers</p> <p>To help you avoid health problem you should, wear your mask; make sure your mask fits properly</p>	<p>Article in external newsletters</p> <p>Advertisement in local paper, celebrity endorsement, testimonials</p> <p>Social media-blogs, emails;</p> <p>Merchandise display</p> <p>Multimedia-video, animation and posters; radio</p>	<p>Increase use of PEE and become more safety aware of coal dust in their environment</p> <p>Ensure that all workers have best available suppression and protection equipment, and receive adequate training</p>	
<p>Mining company employers</p>	<p>Reinforcing the implementation of best practices through the use of adequate protection equipment will reduce workers sickness and safety incidences which will lead to higher production outputs</p> <p>Use prevention and ensure the use of RPE</p> <p>It is important to ensure the wellbeing of workers by providing them with effective dust protection equipment; and ensuring adequate dust suppression and worker training</p> <p>By providing employees-miners with effective dust protection equipment, you will be protecting their wellbeing and contributing to their health</p> <p>Risk associated with coal dust will be mastered</p> <p>Show investors, local and national government that your mine is a responsible employer</p> <p>The health and wellbeing of your staff is crucial for your financial stability and success in the market place</p> <p>Offer accessible information to support miner's efforts to improve protection and prevention efforts</p>	<p>Provide easily digestible best practice guidance from national and international case studies</p> <p>Send letters to manager/CEO of each mining coal mining company in specific regions</p> <p>Rewards and awards for reducing incidents of respiratory health problems and best employee and manager efforts</p> <p>Social media-blogs, emails;</p> <p>Merchandise display</p> <p>Multimedia-video, animation and posters; radio</p>	<p>Ensure that all workers have best available protection equipment</p> <p>Encourage workers to use PEE and consistency in supervision – warnings – communication to raise awareness – motivations, gives positive example</p> <p>Improved de-dusting of mine site and better employee protection when exposed to dust</p>	<p>Monthly awards and rewards</p> <p>Number of trainings delivered</p> <p>Health and Safety records</p> <p>Information leaflets</p>

Target audience: Who do we want to inform?	Key messages: What do we want to tell them?	Communication methods: How are we going to tell them?	Desired outcome	Evaluation methods
	<p>Good to show workers, public, government and, investors that your company cares about the health of its workers</p> <p>By motivating workers to wear RPEs you can protect the health of mining staff</p>			
<p>Government-Mining regulatory authorities/ Politicians/ Donors (EU), Foundations</p>	<p>It is important to regularly implement, monitor and update health and safety regulations in order to protect the well-being and health of coal miners'</p> <p>Increase funding to explore and mitigate the risks and hazards associated with coal mining</p> <p>Best practices can improve occupational health in their country</p> <p>Promote scientific projects on mining air quality and miners working environment</p>	<p>Provide easily digestible best practice guidance from national and international case studies</p>	<p>Monitor actions by mining company and health data for mine workers</p>	<p>Available best practice guidance notes</p>
		<p>Provide toolkits and materials for monitoring and evaluation of coal mining activities</p>	<p>Inspections and analysis of data from mines</p>	<p>Number of Toolkits provided and number of trainings delivered</p>
		<p>Policy briefs, Press releases</p>	<p>Include issues related to coal mining in key policy debates and legislation</p>	<p>Number of policy brief issues</p>
		<p>Research councils website</p>	<p>Open more calls for this type of projects</p>	<p>Number of calls</p>
		<p>Policy meetings</p>		<p>Number of meetings organised and points discussed</p>
		<p>Research funding programmes</p>	<p>Increase funds for research related to coal mining</p>	<p>Available funds and accessibility</p>
<p>Equipment Manufacturers/Fitters/Suppliers</p>	<p>It is important to provide easy to use, improved and comfortable range of smart monitoring and control devices for dust suppression, and better RPE</p> <p>Provide technical notes on new devices (IP protected)</p>	<p>Website, conferences, workshops, mail and articles, trade shows, face to face meeting</p>	<p>Organise meetings with different stakeholders to discuss new devices, and opportunities</p> <p>Design reliable and accurate dust detection tools</p> <p>Offer easy to use, improved and comfortable protection equipment</p>	<p>Type of equipment/tools available and accessibility for the target audiences</p>

Target audience: Who do we want to inform?	Key messages: What do we want to tell them?	Communication methods: How are we going to tell them?	Desired outcome	Evaluation methods
Scientists /Academic/ Educational institutions /Researchers	<p>It is important to understand the reasons why health is still in the XXI century a matter of concern in underground coal mining</p> <p>The ROCD project will offer you up to date and accurate information on the impacts of coal dust on the health and wellbeing of coal miners</p> <p>Follow us on social media and visit our website to be kept up to date on our activities</p>	<p>Use of social media (LinkedIn, Twitter, etc...), websites</p> <p>Articles in academic journals and conference papers</p> <p>Press releases</p> <p>E-learning material</p>	<p>Increase awareness of possible and potential impact of coal mine dusts</p> <p>Undertake further research on the impact of dusts from coal mine on miners</p> <p>Find solutions and mitigation measures to combat health issues likely to result from the impact of coal mine</p>	<p>Number of publication on the subject</p> <p>Courses delivered on the subject</p> <p>Conference papers</p>
General public and local community	<p>The potential health problems posed by coal dust exposure and associated risks can be reduced by use of specialist equipment and risk reduction methods.</p> <p>A healthy coal mining community helps to retain the working age of people fit to work at the high end, so that they are less dependent on state welfare and better quality of life overall</p> <p>The ROCD project will offer you up to date and accurate information on the impacts of coal dust on the health and wellbeing of coal miners</p> <p>Follow us on social media and visit our website to be kept up to date on our activities</p> <p>Youth-“Being a safe miner is cool”</p>	<p>Meetings and local events, science displays, posters, local TV/radio interviews, organised visits to the miners, simplified</p>	<p>Mines, industry and government (maybe local health authorities) could fund events and meetings within community venues to highlight importance of reducing risk in coalmines and their surrounding areas</p>	<p>Number of local events</p> <p>Number of attendees</p>

Evaluation and reporting

The key expected outcomes and time-lines should serve as milestones for monitoring the entire process.

References

- Pickton, D. & Broderick, A. (2005). Integrated Marketing Communications, 2nd edition, Pearson Limited Edu.