

The impact of EXtreme weather events on MINing operations





International cooperation to support the adaptation of the mining sector and the protection of post-mining areas from extreme weather events & climate change impacts

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The TEXMIN project is implemented under the **Research Fund for Coal and Steel (RFCS)** by an international consortium of 9 partners from 6 countries::

- 1. Główny Instytut Górnictwa (GIG, PL),
- 2. University of Exeter (UNEXE, UK),
- 3. Politechnika Śląska (PL),
- 4. Centre for Research and Technology Hellas (CERTH, GR),
- 5. Subterra Ingenieria, S.L. (SUB, ES),
- 6. DMT GmbH & Co. KG (DMT, DE),
- 7. Výzkumný ústav pro Hnědé Uhlí (VUHU, CZ),
- 8. Spółka Restrukturyzacji Kopalń S.A (SRK, PL)
- 9. Tauron Wydobycie S.A. (TWD, PL).



HALF A DEGREE OF WARMING MAKES A BIG DIFFERENCE:

EXPLAINING IPCC'S 1.5°C SPECIAL REPORT



The aim of the project has been to **identify and assess the** environmental impacts caused by both short-term extreme weather events and long-term climate change.

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Źródło:

The project is aimed at assessing risks and hazards resulting from climate change and developing adaptation strategies for mining regions, especially post-mining areas.

In the region, identified remedial actions for shafts and mining waste dumps have been also tested on a pilot scale.



Instytut



TE公MIN **LOGIC OF WORK UNDERTAKEN**



Review of previous extreme Identification of environmental Projections of future impacts of extreme weather events weather events and historic climate changes climate trends on mining operations **Development of Development of** adaptation strategies integrated risk **Modelling of impacts** and monitoring management tool solutions







PREPARATORY ANALYSES

Identification and analysis of past extreme weather events affecting mining operations



Establishment of climatic baseline conditions



Identification and analysis of forecasts of future climate change in mining regions

1	8	C	D	E	F	G	н	1	J	ĸ	L	
The on M	impact o	f EXtreme weather erations	events	Databa	se of Pas	t Extreme	Weather Events Aff	ecting the Mining	Industry			
Date of Incident	Scountry	Location	Mine Name	Working or Abandoned	Mine Type	Incide	Description	Response	Lessons Learned	Extreme Weather Cause Suggested by Experts or in Media?	Weather Statistics	Reference Document(s)
21 October 19	56 UK	Aberfan, South Wales	Merthyr Vale Colliery	Working	Coal	Spoil heap slide	School and houses destroyed, 144 fatalities	Massive rescue, clean-up and rebuilding operations	New laws were introduced placing regulations on spoil heaps	Heavy rainfall in October, especialy previous week, considered main cause	Rainfall 19.39mm, 2.30, 7.59, 11.39, 13.39, 12.69 on 14th - 19th	https://en.wikipedia.org/wiki/A
03 February 20	02 UK	Redruth, Cornwall	Pednandrea Mine	Abandoned	Copper, tin	Shaft collapse	200 foot shaft opened in garden of house	New cap built over shaft		Reference to "torrential rain" in news story	Rainfall 10.55mm, 13.53mm, 6.35mm in 3 days before event	http://news.bbc.co.uk/1/hi/eng
17 October 20	02 UK	North Tyneside	Unknown	Abandoned	Coal	Shaft collapse	track near station				in past week Rainfall 7.03, 6.20mm 3 and 2 days	http://news.bbc.co.uk/1/hi/eng https://www.expressandstar.co
01 April 20	LO UK	Wednesbury	Unknown	Abandoned	Limestone	Shaft collapse	Hole in football pitch			Reference to heavy rain	earlier, 3.82mm on day	shaft-appears/
10 Neuromber 20	10 UK	Tirphil, New Tredegar,	Timbil Calliana	Abandonad	Cast	Chaft colleges	Hole opened in road next to	Filling of shaft, remedial		at 19:00 on 17-Nov in news story, MISSTER paper refers to inflow	Deinfell 13 75 8 05mm on 3 days hofe	https://www.walesonline.co.uk
14 August 20	10 UK	Crusader Ave., Knightswood, Glasgow	Unknown	Abandoned	Coal and Iron	Shaft collapse	Hole in housing area, four properties evacuated and subsequently demolished	Filling of shafts		from curvert	Rainfall 14.13, 23.58, 25.66, 7.2, 8.86mm on 6th, 9-12th	http://www.themime.org.uk/w
10 June 20	12 UK	Aberystwyth, Wales	Several mines	Abandoned	Lead, zinc	Minewater discharge	Contamination of land and killing of livestock	Response mostly related to general flooding, not	Welsh government committed to flood risk management	High rainfall, flooding, caused discharge	Local rainfall: 17.4, 30.6, 52.8, 91.4, 117.2, 120.6mm previous	https://www.bbc.co.uk/news/u
12 February 20	13 UK	Hatfield, Yorkshire	Hatfield Colliery	Working	Coal	Spoil heap slide	Railway lines severely damaged	Remedial work to reinstate railway service lasting almost 6 months		BGS report suggests probably due to heavy rain	Long term continuous rain during winter (especiall late December), 21.24mm on day after event, causing	https://www.bgs.ac.uk/researcl s/landslides/HatfieldFeb2013.ht
17 Eebruary 20		River Colne, Jackson	Unknown	Abandoned	Coal?	Minwater	Piver pollution (grappe)	No remedial work	Conclusion was that dischagres here (there have been several) are not acidic and do not note a	Hemo: rain	Rainfall 11.48, 17.00mm on 12th,	https://www.examinerlive.co.u
20 January 20	14 UK	Camborne, Cornwall	Unknown	Abandoned	Metals	Shaft collapse	House partially fell into hole	Undertaken	are not actorcand to not pose a	ineavy rom	Rainfall 8 days > 10mm (1 day 19.96mm) in month to date	https://www.aol.co.uk/2014/01
12 February 20		Gilligham Kent	Inknown	Abandoned	Chalk	Mine collanse	Hole in school sports field	Hole filled with foamed		News report refers to "the week's torrential	12.04, 21.29, 10.07mm on 4, 6, 12, period from December 2013 to January 2014 was one of, if not the most, exceptional periods of winter rainfall in the last 248 years for	https://www.kentonline.co.uk/
LE rebrairy 20		Ginghan, Kent	Coxlodge	Additioned		mine compac	Hole in carpark adjacent to	7-month capping and repair		weather	Rainfall 23.65mm on 14th, 9.93mm	https://www.dailymail.co.uk/ne
20 November 20	15 UK	Greenwich London	Linknown	Abandoned	Coal	Shaft collapse	nouses	project		Reference in news report to overnight	on 17th, 9.99mm on 18th Rainfall 4.17, 14.08, 4.19mm on 9th -	<u>SINKHOLE-opens-estate-built-o</u>
09 January 20	17 UK	Hardgate, West Dunbartonshire	Unknown	Abandoned	Limestone, iron, coal	Shaft collapse	Hole in road	6-month caping, reinstasting services and		atoms and neavy faith	Rainfall 10.02mm, 7.07, 8.97, 9.36mm on 5th, 6th, 8th, 9th	https://www.clydebankpost.co metres-deep-and-caused-by-hi





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ESTABLISHMENT OF CLIMATIC BASELINE CONDITIONS

GIG & Politechnika Śląska

• 3 Polish mining regions









CERTH

 Western Macedonia Lignite Centre Kozani-Ptolemai and Megalopouli, Arcadia region (Greece)

VUHU

North Bohemian Coal Basin, Czechia

DMT

Ruhr area, Germany

SUBTERRA

• Teruel province, Spain

UNEXE

• UK coalfields (South Wales, Ayrshire, Nottinghamshire, Yorkshire, Durham), UK







MODELLING



Different climate variables:

- changes in precipitation
- changes in temperature
- changes in atmospheric pressure

Different aspects of mining operations & post-mining areas:

- impacts on mine water quantity & quality
- impacts on surface stability
- environmental impacts on mine gases







REGIONAL ACTIVITIES - PILOT INVESTMENTS

 DECOMMISSIONING (& BACKFILLING)
OF GŁOWACKI SHAFT



 RESEARCH OR EROSIONA & THERMAL ASPECTS + PILOT INSTALLATION FOR BETTER STABILITY OF WASTE DUMP





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RISK ANALYSIS AND ADAPTATION TO CLIMATE CHANGE



SURVEY

INSTRUKCJA

Arkusz oceny ryzyka składa się z 1 kartik Arł drukowanej jednostronnie. Prosimy wpolnich tylko szaro komórie. Prosimy zwłócić uwagę na 4 perspektywy czasowe: stan obecny (2022) oraz scenariusz klimatyczny 2030-2050.

Ocenie zostają poddane: prawdopodobieństwo i skutki wystąpienia zdarzenia niepożądanego. Dlatego prosimy wypełnić szare komórki wartościami od 1 do 5, zgodnie z Tabelą poniżej.

Prawdopódobieństwo wystąpienia zdarzenia niepożądanego jest jedyną zmienna, której wartość może być różna w różnych scenanuszach (do 2050 roku).

Skutki wystąpienia zdarzenia niepożądanego są stale. Dlatego skutki dla danego zdarzenia niepożądanego prosimy ocenić tylko raz dla wszystkich okresów.

	Prawdopodobieńs	Skutki			
Wartość numeryczna	Charakterystyka opisowa	Wartość prawdopodobieństwa (%)	Wartość numeryczna	Charakterystyka opisowa	
1	Rzadkie	1-10	1	Nieistotne	
2	Mało prawdopodobne	11-40	2	Niewielkie	
3	Umiarkowane	41-60	3	Umiarkowane	
4	Prawdopodobne	61-90	4	Poważne	
5	Prawie pewne	91-99	5	Katastrofalne	

TEXMIN Prosze zapoznać się z krótka instrukcja wypełniania arkusza oceny ryzyka (dołączonej na osobnej kartce) OCENA RYZYK 2030 2040 2050 Kopalnia JEŻELI Częstetliwość ekresów suchych wzrasta TO odkrywkowa stabilność zbocza może być naruszona Region góméczy změ nom TD można zaotserwować zmiany re. JEŻEU Intensywne opady deszczu nasilają się T może wystąpić osuwisko JEZELI Częstofiwość okrestw suchych wzrasta uzcza w polączeniu ze zmniejsz TO można zaotze w wodach odbiornika, co powo knostnia erwować uysłępowanie zapadiok II ŽITLI Opady deszczu są coraz większe TO moż rystąpić zwiększona erozja wodna zboczy hałdy JEŻELI intensywne opady deszczu nasilają się TO może dojść do zalania wyrobiska JEŻELI Temperatura wzrasta TO obserwuje się zmlany w blobbnow dwalej słowo obserwuje się

JEŻELI Temperatura wzasała i opady małają TO n zrokutywowanych holdach mogą, wystąpić dzikie pażny JEŻELI Temperatura wzaszta i opady małają TO występuje wzmażane zjawisko pytenia

palkia JEŻELI Bpadak temperatury zwiększa się TO mogą wystąpić przemy w zasilaniu JEŻELI Bpadak temperatury zwiększa się TO moźny palkia i zopiserwowóć znywanie zamacnickch ini

kopalnia JEŻELI lieść opadów zmniejsza się, skutkując zmniejszorym zasilaniem wód podziemnych TO m być wymagane wdrożenia lub adiętniczja liechnologi worzazatak wode konstruktarej.

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Halds

TOOL

	An integrated risk management tool	
European Commission	TEXMIN	Research / for Coal &
Survey I	or risk assessment	ane
hasic / advanced		100
-> advanced		
Choose country:		
- Poland		+
Koppen-Geiger d	mak dissification.	102
- DB		- C-
Description	Clo - Subpolar oceanic dimate - Not (Cs) or (Cw) Not (a or b) & 14Tmon10<4	
Direct / Non-direct	t dimate variables:	
→ Direct		+
Specific type of a	bject:	
- Restorated	reclaimed) spoil heap	+
Climate factor:		
→ Dry periods		4
Hazard:		
-> Extensive d	amage to forestry reclamation	+
Risk		
-	is frequency is increasing THEN extensive damage to forestry reglamation may be observed	-
Risk description	With the invesse in the flaguency of oscimence of dry periods, there are deaths of faces on completed forest redar The dris in Splexet in titles exposed to swrlight. Mortally varies according to the accordin	nation. her in I ies.

Object-specific survey risk assessment

Pes	peorye:	
-	2040	+
-	Yes	+
->	Yes	
-	Yes	+
-	Yes	-
·		ereri -



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Reston Minister Mining Known BMPA (2016-2012) - BMP Xinf-2010 real 31, Januar 1 - 2023, pp. 75, 201

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www.texmin.gig.eu



News & Events

TEXMIN project entitled "The impact of EXtreme weather events on Miking operations" is a firre-years RECG research project carried out by a nterdisciplinary consortium of 9 institutions from 6 countries, ie the UK. Greece, Spain, Germany, Coech Republic and Poland, focused on assessing an minimising the environmental impact of extreme weather events on mining operations. The duration of project realization: 01.06.2019 - 31.06.2022.

23/05/2022

Regional Workshop in GIG

On the 26th of May 2022 the regional workshop entitled: "Impact of weather phenomena on the mining sector and post-mining areas - regional workshop" will take place in the headquaters of Central Nining Institute

The conclusions will be soon available.

12/05/2022 Drought in Number

A new report from the United Nations Convention to Combat Desertification (UNCCD) called Drought in Numbers, 2022 was released on 11 May, It was ased to mark Drought Day at UNCCD a 15th Conference of Parties See the whole report here

20/04/2022

On the 19 of April 2022 POI Format performed a dron fight to measure the geometry of the slope of the Janua mine waste deposal facility in LDigt i Poland. The measurements, using the photogrammetric method, will allow to determine the effectiveness of the old installation of slope protection



Project			Updates.	
TEXMIN - T	he impact of EXtreme weather ev	vents on MINing	Recommendations	
operations		-	Followers	
😄 Dert Brobh 🗯	Malgarzata Markowska - @ Ewa Janson - Show a	al 16 collaborators	Boods (C)	(1m) 2
Goal. The impact	Extreme weather events on Mining operations			
Load Partner OLD	MW INSTYTUT GORN OT WA			
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Project log	Faderences (0)			Follow
	Research ref	erenced in this	project	
	Past and Present Climate Conditions of I	European Coal and Lighte A	1026	
	Post and Present Climate Conditions of I Article Politest available Mar 2022	European Coal and Lignite A	raak.	

TEXMIN Handbook

A Guide to Managing the Risks Posed to Working and Abandoned Mining Facilities, and to the Surrounding Environment, **Caused by Climate Change**







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2016

2015 - 2014



ΤΕΧΜΙΝ



Thank you for you attention

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