Organisation and equipment of German mine rescue brigades

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The RAG Group

Four core business areas

- **Energy:** fifth-largest energy company in Germany
- **Chemicals:** Number 1 worldwide in the area of special chemicals, third-largest chemical company in Germany
- **Property:** One of the largest residential property companies
- **Mining:** Production of German hard coal; leading position within the coal value creation chain worldwide

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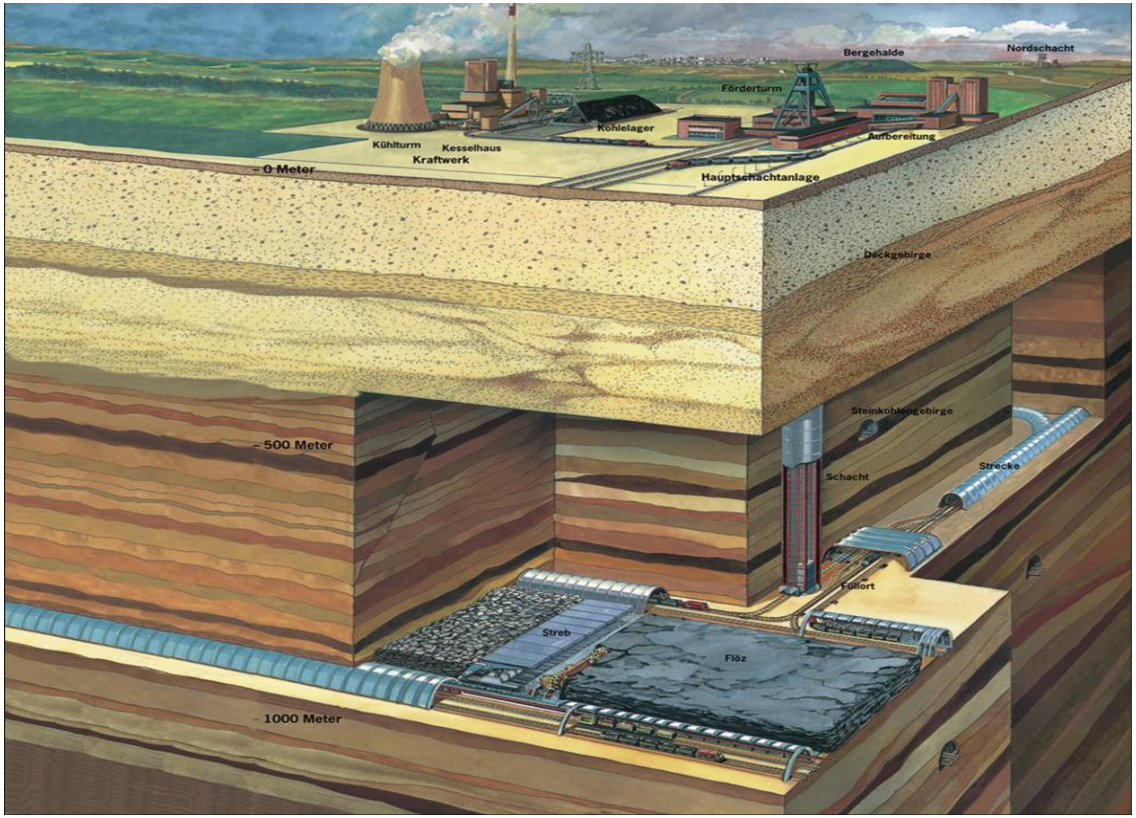
RAG Headquarters in Essen

DSK – more than just coal

DSK - the German coal company

- **employs a workforce of around 32,000** and also secures many thousands of jobs in associated areas,
- **produced 21 million tonnes** of hard coal in 2006,
- is recognised for its education and training work, with more than **3,000 young people in training,**
- **operates eight mines** and a cokery.

Section through the mineworkings



Average figures per mine

Workforce:

- **3,500 employees**

- Annual output:
  3 million t

Depth:

- **800 m to1500 m**

- MIneworkings:
  6 shafts of which 3 are exhaust ventilation shafts (600 m³/s).

Overview of contents

- Organisation of mine rescue brigades
- Equipment
- Training
- Incident statistics
- Trends within rescue brigade work
- Training und Fitness

Organization of mine rescue brigades

- 10 voluntary mine rescue brigades
- Total strength: 1,000 men
- Team = 1 Team Captain and and 4 rescuemen
- min. deployment for incidents:

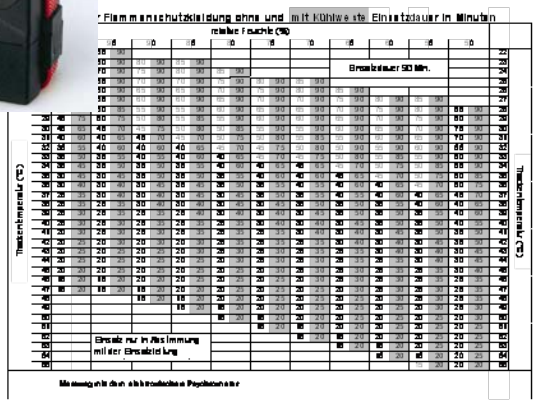
  2 teams and 1 Senior Officer, 2 further teams are sent on afterwards
- Alarm is given via rescue brigade mobile phone

Equipment

- Self-contained breathing apparatus (SCBA) - 4 hours
- Gas measuring device: Multiwarn (CO, CH4, O2, CO2)
- Climate measurement electronic psychrometer
- Mine rescue telephone
- Fire-resistant suit

Risk analysis, use of rescue brigade

- Hazardous gases in the breathing air
  CO, CO2, lack of oxygen
- Gas deflagration and explosions
  Methane gas, hydrogen, CO
- Effects of climate
- General physical fitness



Self-contained breathing apparatus

- Dräger PSS BG 4

  4 h use

  Overpressure

  Breathing air cooling

  Bodyguard

  Longer hoses

Climate table (Fire-resistant clothing)

Einsatztabelle für Flammenschutzkleidung ohne und mit Kühlweste Einsatzdauer in Minuten

Trockentemperatur (°C)	relative Feuchte (%) 100		95		90		85		80		75		70		65		60		55		50		Trockentemperatur (°C)
22	80	**90**	85	**90**																			22
23	75	**90**	80	**90**	80	**90**	85	**90**															23
24	70	**90**	70	**90**	75	**90**	80	**90**	85	**90**					Einsatzdauer 90 Min.								24
25	65	**90**	65	**90**	70	**90**	70	**90**	75	**90**	80	**90**	85	**90**									25
26	60	**90**	60	**90**	65	**90**	65	**90**	70	**90**	75	**90**	80	**90**	85	**90**							26
27	55	**90**	55	**90**	60	**90**	60	**90**	65	**90**	70	**90**	70	**90**	75	**90**	80	**90**	85	**90**			27
28	50	**80**	50	**85**	55	**90**	55	**90**	60	**90**	65	**90**	65	**90**	70	**90**	75	**90**	80	**90**	85	**90**	28
29	45	**75**	50	**75**	50	**80**	55	**85**	55	**90**	60	**90**	60	**90**	65	**90**	70	**90**	75	**90**	80	**90**	29
30	45	**65**	45	**70**	45	**75**	50	**80**	50	**85**	55	**90**	55	**90**	60	**90**	65	**90**	70	**90**	75	**90**	30
31	40	**60**	40	**65**	45	**70**	45	**70**	50	**75**	50	**80**	55	**85**	55	**90**	60	**90**	65	**90**	70	**90**	31
32	35	**55**	40	**60**	40	**60**	40	**65**	45	**70**	45	**75**	50	**80**	50	**90**	55	**90**	60	**90**	65	**90**	32
33	35	**50**	35	**55**	40	**55**	40	**60**	40	**65**	45	**70**	45	**75**	50	**80**	55	**85**	55	**90**	60	**90**	33
34	35	**45**	35	**50**	35	**50**	35	**55**	40	**60**	40	**65**	45	**65**	45	**70**	50	**75**	50	**85**	55	**90**	34
35	30	**45**	30	**45**	35	**50**	35	**50**	35	**55**	40	**60**	40	**60**	45	**65**	45	**70**	50	**75**	50	**85**	35
36	30	**40**	30	**40**	30	**45**	35	**45**	35	**50**	35	**55**	40	**55**	40	**60**	40	**65**	45	**70**	50	**75**	36
37	25	**35**	30	**40**	30	**40**	30	**45**	30	**45**	35	**50**	35	**55**	40	**55**	40	**60**	40	**65**	45	**70**	37
38	25	**35**	25	**35**	30	**40**	30	**40**	30	**45**	30	**45**	35	**50**	35	**50**	35	**55**	40	**60**	40	**65**	38
39	25	**30**	25	**35**	25	**35**	25	**40**	30	**40**	30	**40**	30	**45**	35	**50**	35	**50**	35	**55**	40	**60**	39
40	25	**30**	25	**30**	25	**35**	25	**35**	25	**35**	30	**40**	30	**40**	30	**45**	35	**50**	35	**50**	40	**55**	40
41	20	**30**	25	**30**	25	**30**	25	**35**	25	**35**	25	**35**	30	**40**	30	**40**	30	**45**	35	**50**	35	**50**	41
42	20	**25**	20	**30**	20	**30**	20	**30**	25	**35**	25	**35**	25	**35**	30	**40**	30	**40**	30	**45**	35	**50**	42
43	20	**25**	20	**25**	20	**25**	20	**30**	25	**30**	25	**30**	25	**35**	25	**35**	30	**40**	30	**40**	30	**45**	43
44	20	**25**	20	**25**	20	**25**	20	**25**	20	**30**	25	**30**	25	**30**	25	**35**	25	**35**	30	**40**	30	**45**	44
45	20	**20**	20	**25**	20	**25**	20	**25**	20	**25**	20	**30**	25	**30**	25	**30**	25	**35**	25	**35**	30	**40**	45
46	15	**20**	15	**20**	20	**20**	20	**25**	20	**25**	20	**25**	20	**30**	25	**30**	25	**30**	25	**35**	25	**35**	46
47	15	**20**	15	**20**	15	**20**	20	**20**	20	**25**	20	**25**	20	**25**	20	**30**	25	**30**	25	**30**	25	**35**	47
48					15	**20**	15	**20**	20	**20**	20	**25**	20	**25**	20	**25**	20	**30**	25	**30**	25	**35**	48
49							15	**20**	15	**20**	20	**20**	20	**25**	20	**25**	20	**25**	20	**30**	25	**30**	49
50									15	**20**	15	**20**	20	**20**	20	**25**	20	**25**	20	**25**	20	**30**	50
51											15	**20**	15	**20**	20	**20**	20	**25**	20	**25**	20	**25**	51
52			Einsatz nur in Abstimmung mit der Einsatzleitung										15	**20**	15	**20**	20	**20**	20	**25**	20	**25**	52
53															15	**20**	15	**20**	20	**25**	20	**25**	53
54																	15	**20**	15	**20**	20	**25**	54
55																			15	**20**	20	**20**	55

Messung mit dem elektronischen Psychrometer

- Risk for mine rescue brigades in hard coal mining because of **hot, damp climate**
  Rock temperature up to 65 °C
- Mine rescue brigades work **above** mining temperature regulation limits (**Limit 32°C Teffective**)

Measuring equipment

Dräger Multiwarn II

Auer Exmeter IIP

Flame-resistant clothing

•Nomex – twin layer
and towelling underwear

Training

- Basic training at the Central Mine Rescue Station (5 days)
- Team captain - Training Course (3 days every 2 years)
- Rescue officer - Training Course (4 days every 2 years)
- Equipment attendant (5 days every 4 years)

Training

- 5 rescue brigage excercises per year
- 2 periods of theoretical instruction per year

Planned rescue brigade assignments

- 10 -12 assignments per year
  Reclamation of sealed roadways

Emergency assignments

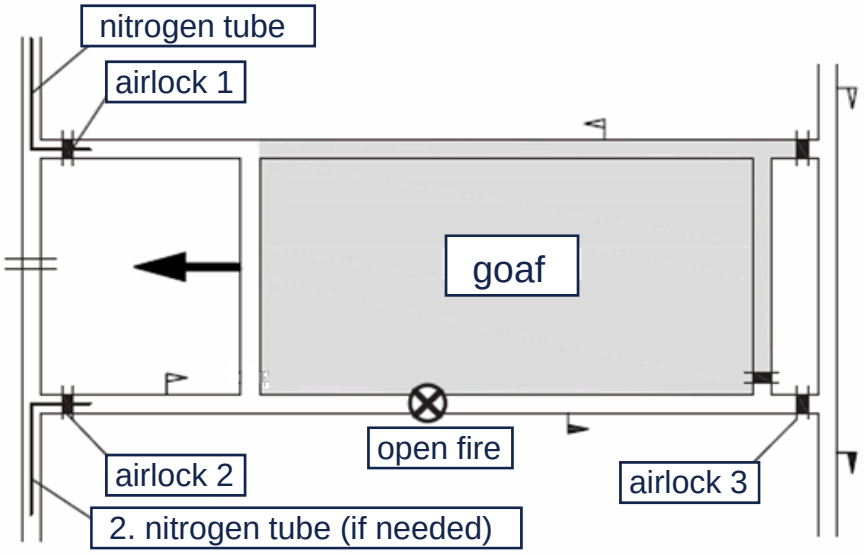
- 5 – 6 Alarms each year

In 80 % of cases, only minor incipient fires have to be extinguished, larger open mine fires only seldom occur. Assignments for fighting self-igniting fires are more common.

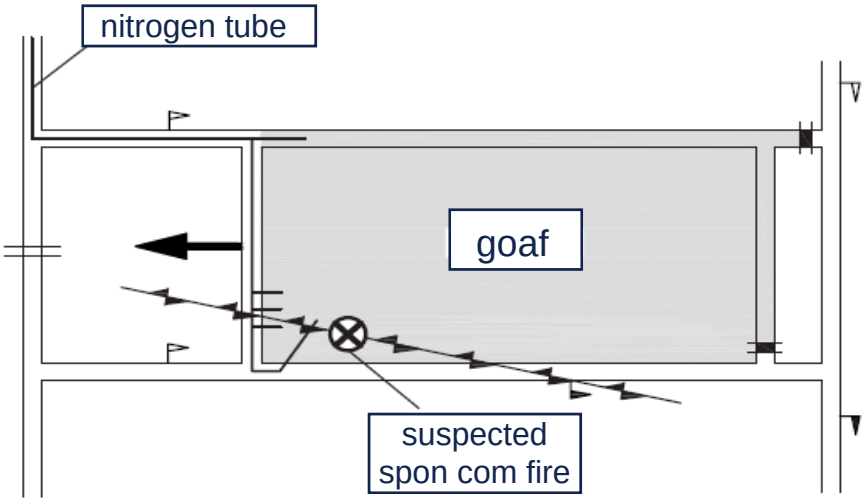
Fire in a conveyor section in 2005

In March 2005, **a 900 m conveyor section was on fire** at the Prosper-Haniel mine / Nobody was injured. 8 teams per shift worked in 4 shifts over two weeks.

Firefighting with nitrogen inertisation



Full space inertisation



Goaf inertisation

Tendencies within rescue work

- The average age of the rescuemen now corresponds to the age of the average employee at DSK, which is the mid-forties. Work in mine rescue teams generally ends at this age within the international coalmining industry.
- One quarter of the rescuemen are no longer mainly or continuously employed underground (habituation to climate).

- Tried-and-tested tools exist In order to maintain endurance (Dynavit tests, running competitions, excercises).
- Because of the changed employement and age structure of the rescuemen, however, there is a need for further measures as regards maintaining the capacity for heavy physical work.

Examinations, Tests, Exercises

- Annual medical examinations (G26)
  (> 40 Jahre)
- Fitness test at least 2x/ year
- 5 breathing protection excercises
- Strength test *neu*

Fitness Committee Action Plan

- Pilot test with 60 members of the rescue brigade (above all with older members in their late 40s)

- Test of the muscle groups in the back, abdomen, shoulder and breast, also knee extensors and knee flexors.

- Formulation of minimum requrirements (torques) based on the average values established in the pilot test; plausibility testing using the manufacturer‘s information: David, Neu-Ulm (Manufacturere of the test and training equipment used).

- Establishment of a test cycle for rescuemen and possible exclusion criteria; inclusion of the results in the DSK body of rules and regulations.

Strength test

Test for all rescue brigade members

- every two years
- 4 of 6 exercises have to be passed
  (standards Nm/kg,
  depending on body weight)

Strength test

Strength test for muscles of

- back / abdomen
- shoulder / breast
- leg tensors and extensors

Results

- In the tests which have been carried out to date (with around half of the DSK rescuemen) a good fifth of those taking part received training recommendations with a requirement to repeat the test.

- Training offers

- In agreement with the state mining supervisory authority, the age limit for mine rescuemen has now initially been raised to 55.

Training offers

- Training room at the mine rescue center

Thank you for listening.