The Coal Authority

Resolving the impacts of mining

Mining Risk Policy Advice on “Na-ijlende gevolgen steenkolenwinning Zuid-Limburg”

Mining Risk Policy Advice Associated with the Former Hard Coal Exploitation in South-Limburg, Netherlands

December 2016

Disclaimer

This report has been prepared by the Coal Authority for the Ministry of Economic Affairs of the Government of the Netherlands.

Any conclusions or recommendations made are those based on information obtained for the report and our current knowledge and practices. Data used within the report, either obtained by the Coal Authority or 3rd Party, has been cited within the report. Limitations of the data are identified within the report. The Coal Authority does not accept liability for the accuracy of any 3rd party data. Should new data or information become available these results, conclusions and recommendations may require amending.

This report should only be used in the stated context.

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1. Introduction

The Coal Authority has been requested to provide mining risk policy advice to the Ministry of Economic Affairs of the Government of the Netherlands. It forms Phase 2 of a two-phase work programme. Phase 1 comprised a peer review of the GS-ZL working group research study into specific mining risks undertaken for the State Supervision of Mines (SodM).

In preparing this report on mining risk policy advice consideration has been given to the following:-

- The outputs from the GS-ZL working groups identifying and mapping all the mining risks in South-Limburg;
- The controls proposed by the GS-ZL working groups and alternatives developed in the Coal Authority peer review;
- The Bow-Tie-Analysis and Integrated Risk Model developed in the GS-ZL Summary Report;
- Discussion on liability and responsibilities;
- Management and communication on the risks that exist;
- Management and communication on things that could change or have an impact on the risks.

Reference to experience in the UK has been included to illustrate the approach adopted by the Coal Authority in managing the on-going risks from past coal mining.

The findings and initial thoughts on mining risk policy advice were presented to representatives of the Provincial and Local Authorities of South-Limburg in Maastricht on 3rd and 4th November 2016. The report takes account of and has subsequently been further developed following these presentations and discussion with the Ministry of Economic Affairs.

2. Bow-Tie-Analysis and Integrated Risk Model

GS-ZL has utilised Bow-Tie-Analysis which provides a systematic mechanism to appraise risk and compare relative probability of occurrence. Generally the risks identified within the GS-ZL Bow-Tie-Analysis are valid. The Coal Authority has referenced additional risks that should be considered for inclusion in the analysis.

To quantify and prioritise the risks and control measures within the Bow-Tie-Analysis an integrated model has been developed and presented in the GS-ZL Summary Report. This model contains an element of expert judgement which provides an effective way to consider and prioritise controls.

The model calculates risk factor by using the probability of the occurrence against the significance of consequence.

Probability is derived by using expert judgement and allocating a figure of:-

20 % Small
40 % Medium
60 % More likely than not
80 % Likely (assumed description but not stated within the report)
100 % Will occur (assumed description but not stated within the report)

Significance of consequence is estimated using expert judgement and a score of:-

1 small effect, no damage or injuries expected
5 medium effect, repairable damage or injuries expected
10 large effect, major damage or fatal injury

The integrated model then considers the usefulness of the control based on the risk factor against effect prevention and control.

The model also considers the cost estimation of the different prevention controls which then allows them to be grouped depending on cost from low to high

The usefulness and costs groups have been included into a final matrix that GS-ZL has developed into categories (shown in italics below) for implementation.

- *Category 0 - no regret, these include important measures for further handling of the potential impacts from rising mine water with low costs and also includes measures that serve the awareness raising and early regard to potential impacts in future planning, building and groundwater extraction. Some of these are administrative tasks and may also include the need for specific regulations to consider the impact of mining legacy.*

The Coal Authority agree, however would comment that although low cost, the manner in which these are implemented is important as it has the potential to generate concerns or objections from the public, questions and interest from the media, and perceptions of blight. These could lead to social and political pressure to provide solutions that may outweigh the original issues.

- *Category 1 - strongly recommended, these include basic needs for monitoring and remediation measures to handle severe potential risks. This comprises the monitoring of mine water and groundwater and remediation at 6 industrial shafts.*

  The Coal Authority agree.

- *Category 2 - recommended, these include additional needs for a complete survey of the lagging effects and include the remediation measures at historic shafts and monitoring of ground movement and involve high investment costs.*

  The Coal Authority consider that further review of the costs and reasoning is required against other risks and the potential impacts.

- *Category 3 - good to have, these need to be reconsidered on the basis of the results from the monitoring category zero and category one and will provide a better understanding of the lagging effects in the long term.*

  The Coal Authority agree.

- *Category 4 - not advisable at the time being, these are measures that might be necessary in the future if water quality or ground movement issues become obvious on the basis of further investigation and monitoring and may include regulation changes relating to groundwater extraction.*

  The Coal Authority agree.

- *Category 5 - inadequate at the time being, these include measures that are too expensive to provide an adequate contribution to the prevention of the top event or severe risks.*

  The Coal Authority agree.

The Coal Authority in general agree with the catalogue of measures and monitoring plan developed from the integrated model. More detailed comments and recommendations are included within the SodM Peer Review Report.

The Coal Authority has developed and utilises a risk matrix (Appendix 1) that removes some of the subjectiveness around expert judgement. This ensures a more consistent approach is implemented by all staff when assessing or reporting on risk. This risk

matrix is also useful for considering what the impact of controls may have that the integrated model does not take into account. By way of example, the manner in which awareness raising and communication is managed needs to be assessed in terms of reputational and financial risk irrespective of the mining position. This type of analysis will be essential when formulating the implementation plan and communication strategy.

Additional information is provided in the matrix that helps define the risk appetite of the Coal Authority and is easy to review and amend in light of the experience that will be gained in managing the lagging effects and policy changes that may arise.

3. Strategies for Proactive and Reactive Risk Mitigation

The GS-ZL Reports and Peer Review Report have identified a comprehensive list of the risks and control measures that should be applied to the lagging effects of coal mining in the Netherlands. The method of implementation, responsibility and funding of these measures and the management of the on-going lagging effects now requires further consideration.

In broad terms the measures and management of the on-going lagging effects can be split into two areas:-

- Managing and communication on the risks that exist;
- Managing and communication on things that could change or have an impact on the risks.

Figure 1 below shows the elements needed to manage these two areas together with the central decision making and policies required to implement them. To a degree, all of the elements are interlinked and will have an influence on forward planning and decision making. This is reviewed in more detail with recommendations in the following sections.

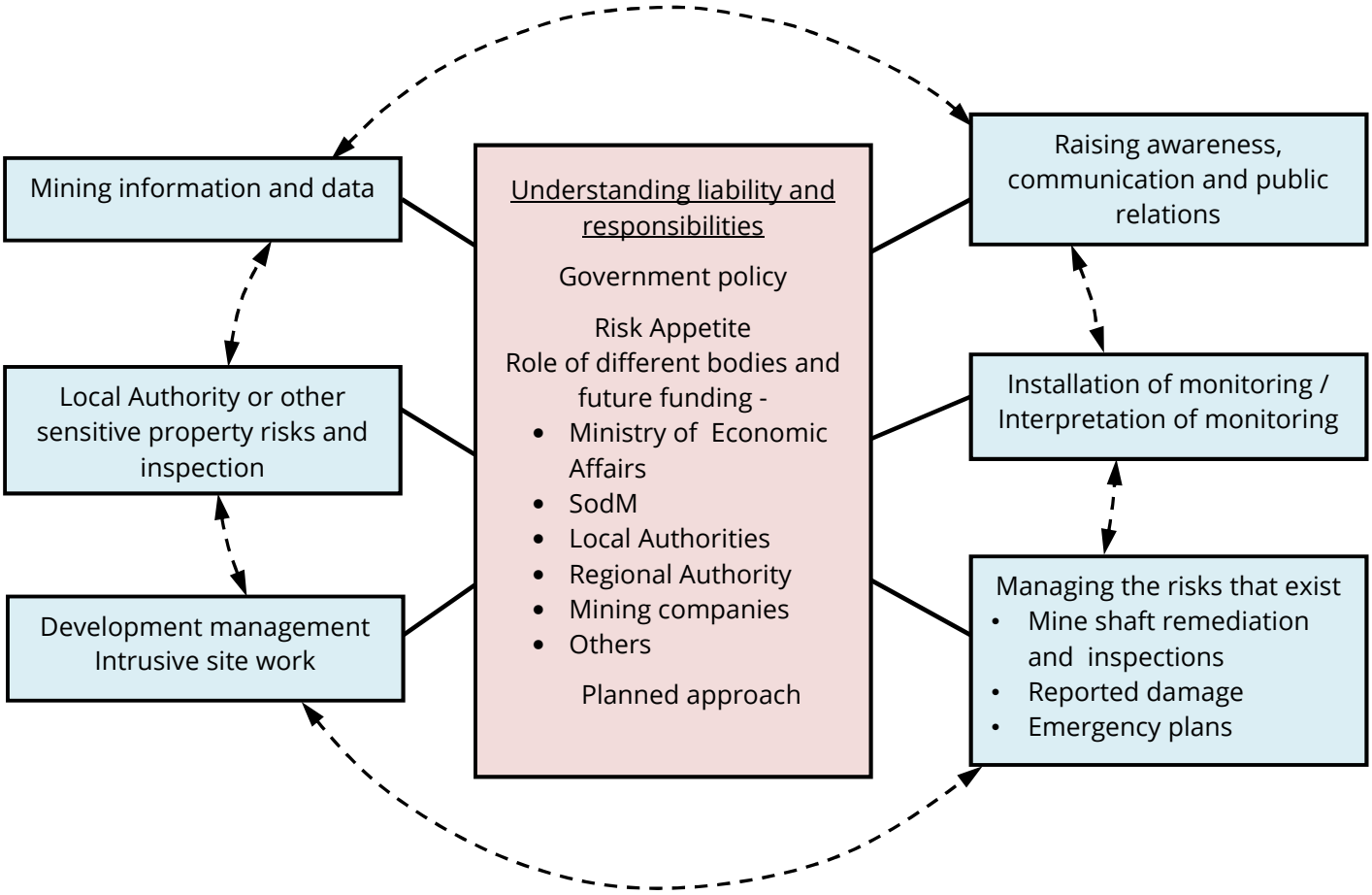

Figure 1 – overview of the measures and management for the on-going lagging effects of coal mining. These boxes are further reviewed in the following sections

4. Understanding Liability and Responsibilities

The Coal Authority recommend that the Ministry of Economic Affairs establishes a clear legal position along with defined procedures for managing the future potential claims and liabilities that may arise from releasing mining information.

This would include a clearly defined claims management process, identifying experts that are able to assess and investigate building defects and differentiate between damage associated with past mining and other potential causes. This may also need to consider limitations of liability where old mining damage may be present that should be excluded from any new claim.

It is understood that under the current legislative framework, liability for damage attributed to mining rests with the former mining companies who held the concessions. If liability is to be managed in a different way this needs to be implemented such that it protects against retrospective claims being submitted for old damage or liability being transferred for defective repairs.

Further discussion is required with the Ministry and other stakeholders to develop processes for managing future liability, and may include:-

- Current legislation and statute of limitation;
- What function did Government have in granting and managing concessions and the public perception?
- The responsibility and function of the different bodies shown in Figure 1;
- Landowner liabilities;
- Due regard to the safety of the public;
- Monitoring of public areas;
- The value placed on drinking water aquifers and compliance with Water Framework Directive;
- If the Government were to accept some liability what would be included:
    - only new damage?
    - no liability for new developments?
    - the approach to funding?

Given the relatively small coalfield in South-Limburg, it appears appropriate that the resource to oversee the implementation of the policies related to the mining risk is located in the region where expertise can be developed to properly evaluate and approve proposals. This also lends itself to effective knowledge transfer and succession planning to ensure consistency of approach and establishment of a specialist skill base rather than reliance on Consultants who are more likely to have a transitory workforce, lack detailed local knowledge of mining and development issues and fail to provide long-term continuity and strategic oversight.

Risk Appetite and Management

The risk appetite associated with managing the lagging effects of mining in the Netherlands needs to be developed and agreed. Within the UK this has been shaped by legislation, policy, historical practices and the scale of the coal mining legacy. In managing the risks it has always been acknowledged that the impact of injury from past mining can be high and potentially fatal but the likelihood of this happening is very low.

Prior to undertaking awareness raising within the UK the Coal Authority considered statistical analysis on the likelihood of injury due to past coal mining. Even with the large extent of coal mining within the UK, due to the very low likelihood of injury occurring it was difficult to drawn any meaningful conclusion other than to provide some headline statements that were useful in discussions with various stakeholders and the public.

In the UK, if a coal mining related hazard is suspected or has occurred, the Coal Authority has a structure in place to immediately respond, secure the area, investigate and if found to be coal mining related to repair the damage. This position arose out of the fact that all coal and mines of coal were nationalised and hence ownership rests with the government. Funding is provided to the Coal Authority by central Government. For non-coal mining related hazards, the liability typically rests with the mineral owner or where this cannot be identified, the landowner or in some cases the local authority. By way of contrast, the control measures and standards adopted by the Coal Authority in managing mining related risks are typically more robust than those adopted by landowners.

In the UK, emphasis is placed on assessing the root cause of the failure through a combination of desk top study, monitoring and site investigation to identify the cause. This then facilitates the design of appropriate remedial measures to prevent recurrence or the rejection of the claim if the damage is determined to be non-mining related. For any claim made under coal mining subsidence legislation the requirement is for the Coal Authority to prove that damage is not attributable to coal mining. Damage which may at first be thought to be associated with mining subsidence or settlement of fill in a shaft may actually be caused by numerous other factors. Typically the Coal Authority annually receives over 1,100 notifications of hazards or claims for damage in coalfield areas. After investigation, liability for damage attributable to the ongoing effects of past coal mining is only around 40% of these.

The Coal Authority has also trialled the use of statistics and analytical modelling in an attempt to predict the probability and potential location of public safety hazards relating to coal mining. In spite of the large data set within the UK the results were inconclusive when considered against the numerous external factors that could influence any occurrence of a hazard. The Coal Authority's preference has been to use high level mining risk mapping to raise awareness in the public domain and the planning and development regime to proactively manage development with a view to minimising the likelihood of new public safety risks being created.

5. Mining Information and Data

The research and compilation of the GS-ZL working group reports and plans has produced a comprehensive database and GIS of the available mining information.

The GS-ZL Summary Report recommends that results from the monitoring data should be summarised in yearly reports with an updated risk assessment and proposal for further monitoring. The Coal Authority agrees with this.

The mining database should be held in a central location to facilitate assessment and further development of risk management policy. It should be updated on a regular basis when new information becomes available. The data from the proposed monitoring should be incorporated along with the interpretation of the data into an understandable format. The database should also include records of damage, monitoring, investigation and treatment works.

The mining database, updating of information, interpretation and release into the public domain should come under the responsibility of a single organisation. Ideally this organisation would also provide expert advice on the mining legacy to consultants, drillers, developers, local authorities and the general public. Dependent on the level of advice and information to be provided part of this could be subject to a fee paying service designed to recover operational costs.

To manage the identified mining risks that exist the mining database and GIS should be considered against any sensitive properties, structures or locations that may require special consideration, risk assessment or particular awareness raising to manage the risk. Within the UK the Coal Authority undertook this exercise for schools and other public property to support discussions on managing the mining risks with local authorities.

The mining data will need to be presented in varying formats to different groups of people. For the general public and identification of mining risk areas for planning and development purposes high level plans within a web based GIS package are appropriate. General information on mining risks within public facing documents or electronic web pages needs to be written in non-technical language that can be readily understood.

At the other end of the scale for structural design and assessment of development in mining risk areas examination of the original base information and plans will be required to allow for full appraisal and mitigation of the risks.

To ensure the quality of future mining data common standards of data capture and reporting should be fully considered and implemented.

There will be an ongoing need for mining knowledge and expertise. As this is currently limited it is important to ensure knowledge transfer and succession planning takes place.

It is recommended that a single organisation takes control of the mining information and collaborates with the Provincial and Local Authorities in South-Limburg to help develop the requirements for awareness raising and the planning and development procedures.

6. Communication and Awareness Raising

The GS-ZL Summary Report identifies the need for communication and awareness raising around the information on mining legacy and the Coal Authority fully agrees with this. This is particularly relevant where there is the potential for others to change the current position or 'status quo' that may then have an impact on or be impacted by the mining risks.

The main reason for undertaking awareness raising is to increase safe behaviour by informing and educating professional bodies, the public and other stakeholders. This also has the benefit that mining information is in the public domain facilitating open and honest views on the risks and their management.

Provision of the coal mining information into the public domain needs to be managed carefully, and needs to recognise the potential impacts of doing so. Communicating on the risks that exist and on things that could change these risks needs to be considered in conjunction with the need to have procedures in place to manage both the potential claims for damage and how future development can be safely implemented in the mining risk areas.

When the Coal Authority undertook a similar exercise on a larger scale this was done in a very controlled way with a step-by-step approach that incorporated mine shaft inspections, the release of high level risk plans on the Internet and a development control process with specific procedures. Early engagement with public bodies and elected representatives was an important aspect of the communication strategy.

It is not considered feasible to undertake awareness raising, making mining information available into the planning or development control regimes, without also raising awareness to the general public. This was particularly relevant in the UK when preparing for the general disclosure of mining information against the need to complete the residential mine shaft inspection programme which required face to face assurance to members of the public who had a mine shaft on their property.

In the Coal Authority's experience the manner in which this information is received by the general public is dependent on several factors including the facility to offer expert advice and a clear message relating to liability for mining related damage. The fact that the Coal Authority would investigate (and remediate if coal mining related) future problems did help soften this message, particularly where residential properties were impacted by mine shafts. This was further influenced by the Coal Authority being a trusted government body with a proven track record.

There are several ways of communicating the risk around mining into the public domain. These will need to be developed taking into consideration timescales, social

and political factors, how information may be received and the ability to implement some of the other identified control measures that would alleviate concerns raised.

Awareness raising for the planning and development control regime is covered within Section 7. The following paragraphs relate more to communicating on risk with the general public.

Before undertaking any awareness raising the following points need to be considered and addressed:-

- Full consideration of the risks and how these are going to be managed;
- Legal position, statutory duties and any responsibility for having due regard for the safety of the public;
- Responsibility on property owners (for the public) and any risk assessment;
- Clear approach and procedures to managing any liabilities;
- Mine shaft remediation, inspections and near surface mining risks;
- Position on perceived or actual 'blight'.

How the public view or perceive risk is often as important as understanding the risk itself. They can have a very different perspective to experts and this can be based on different assumptions. For example in the UK, the potential impact on property value outweighed the safety aspects in the eyes of some property owners. This is important when considering proportionality and the level of protection required. Communication should also be proportional and targeted to the risk. A low risk may be viewed differently by the public if the communication is not correctly managed or for example wrongly portrayed by the media. It is important to adopt a consistent message that provides adequate assurance and manages risk in a proportionate manner.

When communicating on the risks the public will make a judgement about the source of information, how it is delivered and if they trust those giving the information.

For these reasons it is necessary to have a communications strategy to:-

- Manage the risk;
- Map out the way ahead with a clear idea of the goal to be achieved and how to get there;
- Anticipate future problems so that they can be dealt with or to be prepared for them;
- Identify who to communicate with and when;
- Define what you want to say (your key messages);
- Decide how to reach your audience and what communications channels to use;
- Identify resources required;
- Provide a framework to monitor progress, review and evaluate;
- Deal with emergency and crisis through a well-defined escalation protocol.

The hierarchy of what is trying to be achieved by the awareness raising and communication is:-

1. Awareness – to make people aware that they live in an old mining area and what that means, some may not be aware;
2. Informed – people are aware of the risks involved, the context and how it may affect them;
3. Prepared - people know what signs to look out for and what to do if there is a problem including who to call and what to expect;
4. Comfortable – the public understand sufficient to be relaxed and able to accept the risks;

If the Ministry of Economic Affairs decides to adopt an approach similar to the UK in South-Limburg with regard to mine shafts inspections and reactive management then the Coal Authority experience in particular when talking directly to the public should be incorporated into the communications strategy. This included:-

- An initial cautious approach;
- Being honest, open and empathetic;
- Giving clear and consistent message;
- Don't provide information overload – provide simple accurate account of issues and what is being done;
- Ensuring all relevant staff know what to say, how to say it and when to escalate (if needed);
- Using the 'right' staff for frontline work who are genuine, can interact with the public, answer questions and provide assurance.

Some of the mining issues identified in the GS-ZL reports require additional monitoring to fully understand the risk and their implications. Where possible this monitoring should be implemented before commencing the wider information dissemination programme to provide assurance that it is being put in place. The results of the monitoring, implications and trigger levels can then be communicated to demonstrate that long term management of mining legacy issues are being addressed.

The GS-ZL reports conclude that the probability of a major collapse or injury is not high. The Coal Authority would recommend that awareness raising on the mining risks and locations is undertaken with the Emergency Services such that they are fully aware of the specific issues that they could face. The procedure for managing an emergency situation related to the mining should also be developed and disseminated to local authorities. This should include clearly defined escalation procedures (including flow diagrams), detailing roles, responsibilities and accountability for decisions relating to mining incidents.

It is recommended that a communications strategy is developed as soon as possible along with preparing responses to any immediate questions that may be asked.

7. Planning, Development Control and Intrusive Site Works

As development or site investigations can change the current position with regard to the mining risks and potentially cause instability it should be a mandatory requirement in mining risk areas that the risks are assessed before undertaking any site works. Policy and procedure on the management regime to implement planning and development control is therefore required. Mining issues should not preclude development or intrusive site works (drilling, trial pits or piling) within the identified risk areas however the developer or operator should take cognisance of the mining risk and mitigate this within their proposals.

The mining risk areas presented within the GS-ZL reports should be rationalised and then incorporated into a suitable web based GIS system to allow developers and local authorities to recognise if development or intrusive site works could be influenced by mining risk. This information should also be incorporated into the local authority future strategic 'development plans'.

Local authorities need to be able to identify if suitable mitigation is fully considered in the development designs. This needs to be incorporated into the planning and development control processes within the mining areas and will require specialist expert knowledge of development / building design with regard to mining risks.

The planning regime in the UK has adopted policy instigated by the Coal Authority (the Statutory Consultee for coal mining) whereby any developer embarking on development on the shallow coalfield or in close proximity to a mine entry must undertake a coal mining risk assessment and take appropriate care to ensure that the proposed development addresses the mining risks in a proportionate manner. To assist this, the following guidance is freely available on the internet "Risk Based Approach to Development Management – Resources for Developers". (Appendix 2)

The Coal Authority has produced policy advice and guidance when developing or undertaking intrusive site works in former coal mining areas. We recommend that similar policy advice is developed and implemented in the Netherlands, which should include:-

- Gas monitoring;
- Intrusive site works in mining areas;
- Construction over unstable ground and in the vicinity of mineshafts;
- Water monitoring;

- Water quality monitoring;
- Assessing building damage in mining areas.

A cautious approach should be taken in all cases of ground investigation related to mining high risk areas, mining subsidence damage or shaft investigation due to the risks presented by potentially unstable ground and mine gas.

It is recommended that a planning and development procedure is developed to cater for:-

- Mining information to be made readily available to developers and others engaged in evaluating, designing and implementing mitigation measures to address mining risks;
- A mandatory requirement for risks associated with past mining operations to be assessed prior to development taking place;
- Proportionate measures are implemented to address mining risks;
- Guidance to assist developers and those undertaking intrusive site works should be developed.

8. Mine Shafts and Near Surface Mining

With regard to mine shafts a proportionate approach should be taken to effectively manage risk but not necessarily require the risk to be eliminated. The Coal Authority agree with the GS-ZL view that development within shaft-protection-zones should be carefully controlled.

In the UK, Coal Authority statistics show that the number of surface hazards associated with shallow mining is similar in frequency to those associated with mine shafts. If this similar probability of occurrence is applied to South-Limburg, the risk is one of severity versus the costs of prevention. It could be argued that the risk posed by the historical shafts is no different than that posed by shallow mine workings. However there is often a greater perceived risk around mine shafts and their threat compared to that of near surface mining.

The risk appetite associated with managing mine shafts in the Netherlands needs to be developed and agreed. The UK generally adopts the position that a shaft treatment is effective unless there is information to suggest potential instability or some signs of failure of the shaft or treatment that requires reactive measures to be taken.

The GS-ZL reports have identified industrial shafts that may have a low factor of safety and the Coal Authority agree that these require further investigation or monitoring.

In the case of the historical shafts in Kerkrade the Coal Authority agree that the target should be to avoid creation of new risks however we believe there is insufficient justification at the present time to establish a target to eliminate the risks of shafts subsiding or collapsing.

The Coal Authority recommend that an inspection programme is established to monitor the location of shafts and to disseminate information to those that may be affected, particularly for residential dwellings. This accords with the approach adopted in the UK. Due to the low number of mine shafts the frequency between inspections could be short with the ability to note indicative signs of change or movement

Before undertaking the mine shaft inspection programme the communication strategy with reference to mine shafts around residential dwellings will need to be developed and should include:-

- Free inspection service;
- Provision of generic information;
- Reassurance and empathetic approach;
- Use of plain language;
- Notification of who the responsible body is to undertake and fund any repairs;
- No proactive investigation or remedial action (dependent on risk appetite);
- No funding or compensation for perceived diminution in property value (dependent on risk appetite).

9. Mine Water

The installations of mine water and ground water monitoring points (piezometers) has been identified within the GS-ZL Reports and they are essential for the ongoing assessment of the risks to aquifer pollution, potentially wetting and surface outbreak of mine water.

The installation of piezometers can be technically difficult and expensive particularly when drilling into deep mine workings. The future programme of monitoring work should be carefully prioritised and managed to ensure the piezometers are correctly designed, installed and monitored.

Data from the piezometers needs to be reviewed by technical specialists who can interpret the data to further calibrate the mine water and ground water models and predictions. Based on the monitoring and predictions trigger levels, actions points

should be developed to allow sufficient time to develop and implement any proposed mitigation measures as these may require extended timescales to implement.

Ground and surface water bodies are subject to Water Framework Directive requirements and will need to be considered at Government level if there is the possibility of deterioration. If aquifers are to be threatened there will be a need to undertake a form of benefits valuation to assess the benefits of retaining good water quality compared with the potential cost of resuming pumping of mine water at an appropriate time to prevent pollution occurring.

There should be early discussions with the water authorities and abstractors in the South-Limburg area to fully understand the value of the ground water bodies and potential threats to supply. At this stage it is unwise to discount any options in favour of allowing the aquifer to become polluted, at least locally near (known or unknown) hydraulic windows. This is because allowing the pollution is effectively irreversible. The cost and complexity of multiple relocations to aquifer abstractions may be very large, and possibly excessive. The cost burden may even be unacceptable to private industry.

It is recommended that the benefits of selected approaches to managing the risks from rising mine water be evaluated once further information is gained.

10. Conclusions and Recommendations

The mining database, updating of information, interpretation and release into the public domain should come under the responsibility of a single organisation. Ideally this organisation would also provide expert advice on the mining legacy, part of this could be a fee paying service.

Provision of the mining information into the public domain needs to be carefully managed with recognition of the potential impacts.

In conjunction with this there needs to be procedures in place to manage both the potential claims for damage to existing property and how future development can be safely implemented.

Liability for damage associated with the lagging effects of mining has to be clearly defined.

Given the relatively small coalfield in South-Limburg, it appears appropriate that the resource to oversee the implementation of the policies related to the mining risk is located in the region.

There will be an ongoing need for mining knowledge and expertise.

It is recommended that:-

- A single organisation takes control of the mining information and collaborates with the Provincial and Local Authorities in South-Limburg to help develop the requirements for awareness raising and the planning and development procedure.

- A communications strategy is developed as soon as possible.

- A planning and development procedure is developed to cater for:
    - Mining information to be made readily available to developers and others engaged in evaluating, designing and implementing mitigation measures to address mining risks;
    - A mandatory requirement for risks associated with past mining operations to be assessed prior to development taking place;
    - Proportionate measures are implemented to address mining risks;
    - Guidance to assist developers and those undertaking intrusive site works should be developed.

- The risk appetite around mine shaft remediation is developed. This should include an inspection programme to monitor the location of shafts and to disseminate information to those that may be affected, particularly for residential dwellings.

- The benefits of selected approaches to managing the risks from rising mine water should be evaluated once further information is gained.

The Coal Authority has gained valuable experience and expertise in managing on a larger scale the on-going lagging effects of coal mining in the UK. We believe that much of this can be transferred and implemented with local variations to the Netherlands and would be very willing to assist with the implementation of the proposals.

Appendix 1 - Coal Authority Risk Matrix

	Impact type						Probability				
	Financial Exposure	Operational	Reputational	Compliance	Safety	Information	**<5%** Very Unlikely: Highly improbable that it will occur	**>5%,<20%** Unlikely: Not probable that it will occur Rare/ infrequent	**>20%,<50%** Possible: Could occur but less likely than not	**>50%,<80%** Likely: More likely than not to occur on frequent occasions	**>80%** Very Likely: High expectation that it will occur
Crisis	Increase **>£5m** NAO qualify accounts	Significant impact on delivery of high level objectives DR or BCP invoked	Public enquiry Public Accounts Committee hearing BEIS reputational risk Complete loss of public confidence in BEIS and Coal Authority	Legal challenge which halts delivery of programme Substantial damages Damage to CA reputation	Multiple fatalities or multiple injuries	Loss or corruption of a number of critical operational datasets Significant or material distress to the public Significant loss of commercially sensitive data Significant loss of IPR, copyright, patents, industrial design rights or trade secrets Failure of a number of critical operational services	**Medium**	**High**	**High**	**Very high**	**Very high**
Critical	Increase **>£1m <£5m**, NAO criticism	Significant impact to business plan targets Significantly more resource needed Overhaul of approach required	National media criticism Requirement to brief Ministers Public criticism by MPs or regulators Loss of public confidence in BEIS and Coal Authority	Significant legal challenge High likelihood that judgement will be lost	Fatality or catastrophic injury	Loss or corruption of a critical operational dataset Distress to public Loss of commercially sensitive data Loss of IPR, copyright, patents, industrial design rights or trade secrets Failure of a critical operational service	**Medium**	**Medium**	**High**	**High**	**Very high**
Significant	Increase **>£0.25m <£1m**, Increased NAO scrutiny / significant management letter points	Business plan targets are compromised Significant project delay / budget overrun	Probable media / public awareness Brief Officials MP complaint EA/SEPA/NRW fines Harms public perception in BEIS and Coal	Potential for moderate legal challenge Increased potential that judgement would be lost	Major injury Hospitalised Emotional trauma	Loss of all or part of a number of non-critical operational datasets Distress to some members (>10) of the publicLoss of commercial data Significant suspension of a non critical operational service	**Low**	**Low**	**Medium**	**High**	**High**
Marginal	Increase **>£10k <£250k**	Limited impact on business plan targets Minor deviations from project resource, timescale or targets	Possible local media / public awareness. MP enquiry Impacts public perception in BEIS and Coal	Potential for minor legal challenge Out of court settlement	Minor injury Medical treatment required	Loss of a non-critical operational dataset Distress to individual Suspension of a non critical operational service	**Very low**	**Low**	**Low**	**Medium**	**Medium**
Negligable	Increase **<£10K**	No impact on business plan targets Minimal impacts to project / programme efficiency	Minor reputational damage Minor impact to public perception in BEIS and Coal Authority	Minimal / zero impact were breach to occur	No injury	Partial loss of a non-critical dataset Minor distress to an individual	**Very low**	**Very low**	**Low**	**Low**	**Low**

Appendix 2 - Risk Based Approach to Development Management – Resources for Developers