GMES

TERRAFIRMA

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C1: Policy Foundations Review

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Terrafirma will service the European needs for accurate, timely information on ground motion and fulfil policy requirements to protect the environment and the security of the citizen both in their homes and places of work.

EXECUTIVE SUMMARY

"The GMES Initiative seeks to bring together the needs of society related to the issue of environment and security with the advanced technical and operational capability offered by terrestrial and space borne observation systems. It is a direct response to the growing concerns amongst policy makers to ensure in a timely manner access to information on the environment at global, regional and local scales"[1]

The *Terrafirma* service will be used to identify and monitor ground motion in relation to subsidence (and associated flood risk), building stability, landslides and seismicity. Each of these impact on the European citizen at a local level. Terrafirma provides city wide assessments of ground motion in the order of millimetres per year, with information available over the last 10 years, attributing these movements to causal factors.

The purpose of the Terrafirma Policy Foundations Review (PFR) is to provide a comprehensive review of major policies and legislation in relation to ground motion at a Local, National and International level. It shows that ground motion is a recurrent issue in a significant number of legislative instruments and policies across Europe.

Because ground motion is a local phenomenon, most of the policy regarding ground motion is implemented at the local level. The PFR's main focus will be on a cross-section analysis of local policies and laws which support the use of and access to *Terrafirma.*

Whilst subsidence is not a high priority for policy makers at the EC level, it is a high impact issue at the local level. In seeking to summarise and evaluate the weight of policy that supports *Terrafirma* for this first version of the PFR, the focus is on countries that are full partners to *Terrafirma*: France, Italy, the Netherlands and the United Kingdom. Future versions of the PFR will be able to consider policies from other countries.

Some examples of policies that will benefit from the use of Terrafirma are listed in Table 1 (below), split by geographic level. Because of the diverse nature of local policy, it is not easy to do justice to the weight of policy on one particular type of ground motion.

Policy at Local Level

There are many instances where ground motion assessment is crucial for the determination and prevention of hazards. This includes environmental impact assessment, land use planning, development and construction regulation and the prevention of flooding.

[1] Global Monitoring for Environment and Security (GMES), EC Action Plan (2001-2003) COM (2001) 606 final

The need for ground motion information differs from country to country and region to region. Areas more prone to land motion may be governed by more stringent local planning requirements, mandating the provision of such information. In addition, European Union member states have to follow and comply with European and international policies and obligations, which begin to take into account the need for ground motion monitoring.

Countries have developed laws and policies relating to subsidence based on the needs of a designated zone or area and which require implementation at local level. For instance, French law establishes Plans for the Prevention of Foreseeable Natural Risks (PPR) as an essential instrument of state intervention in the area of natural risks. The PPR must be attached to the local town planning programme. It reflects the local district's risk of exposure in the light of currently available knowledge and may be revised if the risk or the state of the knowledge thereof undergoes any significant change.

Ground motion hazards can be caused by numerous factors and fall under the competence of more than one authority. For example, an uplifted area exists south of the Saint-Lazare railway station in Paris. This uplift, which may be linked to an increase of underground water after the completion of essential construction works, is closely monitored by the city of Paris. However, the responsibility for monitoring underground activity may be shared with railway and local transport companies, as well as gas and electricity companies whose infrastructure may be affected.

Policy at National Level

At a national level in the United Kingdom, environmental assessment is generally governed by *the Town and Country Planning Act 1990*. The Secretary of State is to make regulations requiring an assessment of the likely environmental effects of the proposed development before planning permission for development is granted.

Policy at a European Level

One significant area where ground motion monitoring is essential at the EC level is the assessment of environmental impacts. The *EC Directive on the Assessment of the Effects of Certain Public and Private Projects on the Environment* places an obligation on Member States to implement an assessment procedure in certain projects. The purpose is to determine the potential effect on the environment and to ensure that potential negative impacts on the environment resulting from a particular activity or group of activities are prevented, or at the least, mitigated in advance.

Another clear example where ground monitoring is not only essential but compulsory concerns landfill sites. The *EC Directive on Landfill* establishes the general requirements for all types of landfills. A landfill site can only be authorized if it fulfils certain requirements. Some of these key requirements relate to the risk of flooding, subsidence, landslides or avalanches on the site.

An additional key policy instrument is The *6th Environmental Action Programme* of the European Community. It outlines the latest environmental strategy and priorities on the environment for the next five to ten years. It focuses on four action areas: climate change, health and the environment, nature and bio-diversity, and natural resource management. In

recognising that ' well-informed citizens who are actively involved in environmental decision-making are a powerful new force in achieving environmental results', *the 6th Environmental Action Programme* emphasises the importance of establishing and strengthening initiatives to empower citizens. Measures to improve accessibility and the quality of information provided to citizens on the environment (based on indicators and maps) are considered fundamental for achieving the objectives of the strategy.

Policy at an International Level

Ground motion and the problems associated to subsidence are rarely covered in international policies. International treaties and other instruments rarely mandate specific action for States. However, although treaties contain a great deal of discretion for States over implementation commitments, many procedural environmental regulations, such as public participation and Environmental Impact Assessments, are echoed in international treaties. The *Rio Declaration*[2] is an example of this. This Declaration, agreed at the 1992 UN Conference on Environment and Development, recognised the importance of public participation in environmental matters and the need to notify other states of natural disasters or activities with potentially significant transboundary environmental effects.

Related Policies

The emergence of environmental rights has an important bearing on governmental obligations regarding information dissemination and decision-making. For example, the Aarhus Convention imposes specific obligations on state parties for the collection and dissemination of environmental information. These obligations should be implemented by way of governments taking legislative, regulatory or other measures (including proper enforcement mechanisms) to establish and maintain a clear, transparent and consistent framework to implement the Convention's provisions.

On 24th October 2003 the European Commission adopted three proposals designed to align Community legislation with the provisions of the *Aarhus Convention*. These included a Directive enabling access to justice in environmental matters, a Regulation on the application of the provisions of the *Aarhus Convention* and a Council Decision on the conclusion, on behalf of the European Community, of the Convention. To date, the European Community has adopted *EC Directive 2003/4*[3], which provides access to environmental information, as well as *EC Directive 2003/35*[4] which provides for public participation in certain plans and programmes for environmental matters and amends *Council Directives 85/337/EEC* and *96/61/EC* with regard to public participation and access to justice.

Efforts in the area of civil protection are to be transparent and accessible to the public. The availability of information may generate greater awareness of ground motion issues, leading to a greater level of public protection and the demand for such information.

[2] *Rio Declaration on Environment and Development (1992)* 31 I.L.M. 876
[3] *(2003)Public Access to Environmental Information*. This Directive obliges Member States to integrate the European provisions within their national legislative framework by 14 February 2005.
[4] Member States are obliged to adopt the provisions contained in this Directive by 25 June 2005.

Contributing to Strong and Effective Future Policies

Terrafirma can provide policy-makers with the information necessary to create more effective regulations in the future. It will also supply necessary information to EU member states which are required proactively to put in place policies and plans to protect the population. In order to do this member states must be able to act on accurate information. Such information that is uniquely produced by *Terrafirma* will ultimately be available to citizens, thereby integrating them in the decision-making process.

Subsidence and ground motion has increasingly become a concern for governments and decision-makers. This is reflected in the growing number of laws, regulations and policies that mandate the provision of ground motion information.

Information on ground motion is now more frequently incorporated into earlier stages of the decision-making process. This helps develop better policy and regulation in the areas of land and land use planning and environmental assessment, thus both preventing and mitigating possible hazards related to ground motion. The *Terrafirma* Service represents a comprehensive and unique source of such information.

LEVEL	POLICY
Local	• *Lombardy Region (Italy)*: **Duty to assess and regulate risks of landslides.** • *Stoke-on-Trent Region (UK):* Extensive underground coal mining as a result of which **extensive subsidence** has occurred, leaving the **local planning authority** to deal with the problem. • *Dykes and embankments (Netherlands):* **Obligation to monitor and evaluate** their condition. Ground investigations are performed under the direction of **Water Boards** and the **Ministry of Transport, Public Works and Water Management.**
National	• *Italy:* Every river basin has a **Basin Plan** that governs the planning and programming of all activities of relevance for the basin, including **geological and hydraulic risk detention including subsidence.** • *France:* Interministerial **Steering Committee** created to clarify the various causes of ground motion. Legislation establishes Plans for the **Prevention of Foreseeable Natural Risks.** • *United Kingdom:* **Subsidence and Planning guidance** for local planning authorities, landowners, and developers on planning **controls over land use and development on land liable to subsidence.**
International	• *Sixth Environmental Action Programme*: Outlines the latest **environmental strategy and priorities** on the environment for the next five to ten years. • *EC Landfill Directive*: Determines **key requirements on the risk of flooding, subsidence, landslides or avalanches on landfill sites**. • *Aarhus Convention*: Obligations on state parties for the **collection and dissemination of environmental information**.

Table 1: Example policies relevant to *Terrafirma* at Local, National and International levels

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1 INTRODUCTION

1.1 The GMES Context

Global Monitoring for Environment and Security (GMES) is an EC/ESA initiative that seeks to put timely and relevant information pertaining to the environment and security in the hands of European institutions at all levels, including citizens. It represents a major part of the European strategy for space[5].

The EC GMES Action plan lists a number of priority themes that should be the focus of initial service development. One such priority, under the heading of "Systems for risk management" is the **stability of man-made structures**, with an assigned relevance to citizen's concerns and public security.

GMES covers the whole range of policy and scales of observations – from global and continental scale measurements that contribute to international policies and treaties, to local area information that is relevant to local authorities and population.

1.2 What is Terrafirma?

The *Terrafirma* service will be used to identify and monitor ground motion in relation to subsidence (and associated flood risk), uplift, building stability, landslides and seismicity. *Terrafirma* provides city wide assessments of ground motion in the order of millimetres per year, with information available over the last 10 years, attributing these movements to causal factors. Advanced products modelling the likely future motions in key areas will also be available, as will rapid response and monitoring products.

Terrafirma will make available information for monitoring ground motion hazards in all EU member states, EU applicant states and ESA full member states.

Terrafirma is structured in three stages. Stage 1: Present to 2 years, Stage 2: 2 – 5 years and Stage 3: 5 – 10 years. In Stages 1 and 2 the service will focus on mapping and monitoring subsidence, particularly in towns, but also along coastal zones and estuaries where subsidence could increase flood risk or landslides. In the last Stage *Terrafirma* will further consolidate and incorporate newer systems and process for assessing ground motion and monitoring seismic movements.

There are individuals and organisations whose work might be affected, directly or indirectly, by the impact of ground motions. These groups or individuals constitute the end users of *Terrafirma*. Regulators, builders and constructors, utility companies, transport providers, mineral resource providers, service providers and the public constitute the wide range of end users of *Terrafirma*.[6]

[5] COM (2000)597 final and ESA/PB-EO(2001)65. Rev. 1 – Joint Commission – ESA document on the European Strategy for Space

[6] See U2 Document for user segment profiles.

1.3 Objectives of this document

The purpose of the PFR is to provide a comprehensive review of policies and legislation in relation to ground motion. The PFR will focus on different levels: Local, National, European and International.

Because ground motion has its main consequences at local level, most of the policy regarding ground motion is implemented at this level. The main focus the PFR will therefore be on a cross-section analysis of local policies and laws, which support the use of and access to *Terrafirma.*

Whilst ground motion is not a high priority for policy makers at the EC level, it is a high impact issue at the local level. In seeking to summarise and evaluate the weight of policy that supports *Terrafirma* for this first version of the PFR, the chosen focus was on countries that are full partners to *Terrafirma*: France, Italy, the Netherlands and United Kingdom Some further examples are also taken from Germany, Greece and Spain. Future versions of the PFR will be able to consider policies from other countries.

Because of the local nature of ground motion, this document considers the local policy foundation for *Terrafirma* prior to member state and international level, as well as related policy.

Reference to the international level will be essential but will not constitute the focal point of the PFR. International treaties produce political and legal frameworks that are implemented and further developed at national, regional and local levels. At the European level there are legal instruments relating to ground motion monitoring. Such instruments are flexible in nature, in the sense that they provide room for discretion by national and local governments on how to implement European policies. Therefore, it is at the local level where more specific and detailed policies and laws relating to natural and anthropocentric ground motion are to be found. Additionally, local authorities have to respond to local long-term needs and specific geographic and geological characteristics.

There are a number of instances where ground motion assessment is crucial for the determination and prevention of hazards. This includes environmental impact assessment, land use planning, development and construction regulation and the prevention of flooding. Ground motion and subsidence issues also arise in the policy and regulatory regimes governing civil protection and emergency response. Parts of these requirements include the provision and dissemination of information to the public. This has an impact on governments and local authorities, in that they are required to monitor ground motion and register movements such as subsidence, which has the potential to cause harm to the population, infrastructure and the environment. In light of this, there is some discussion on the desirability of an environmental right to environmental information, participation and the protection from environmental damage.

2 POLICY ANALYSIS

The following sections list and describe Local, National and European policies that are particularly relevant to *Terrafirma* and will be a key input into dossiers U1, U5, S1 and the Cost Benefit Analysis.

What does become evident in the policy foundation review is that the national and local policies are the driving forces supporting use of *Terrafirma*. It is at the local level where particular ground motion occurrence can be addressed. International and EU policies cover a broader range of issues that potentially touch upon ground motion assessment. These relate to instruments of environmental protection, rights of participation in decision-making and civil protection planning.

The need for subsidence and land motion assessment information will differ from country to country and from region to region. Areas more prone to land motion may be governed by more stringent planning requirements that mandate the provision of such information.

2. 1 Local Policies

2.1.1 Planning and Construction

The most practical use of *Terrafirma* will arise when developers' and builders' activity is either on high-risk areas where land stability is a concern or where the activity would involve some form of excavation. Some countries may develop laws and policies relating to subsidence based on the needs of a particular designated zone or area. Such areas may represent a high hydro-geological risk with significant levels of subsidence to be expected. In **Italy**, there is a specific regime for basins of national interest. A Basin Plan is to govern the planning and programming of all activities of relevance for the basin. In the Plan, knowledge concerning geology is to be provided, with provisions being made for geological and hydraulic risk detention including subsidence.[7]

As a result, the need is precipitated either at the initiative of the developer/builder or where the government authority has required that ground motion assessment be warranted. The type and nature of the activity may create the need, as well as the impact on neighbouring property or a community resource. Overall, construction would need to ensure public safety, implying the monitoring of ground motion of such geohazard phenomena are likely to exist, although this may not necessarily prescribe specific ground motion assessment.

In **the Netherlands**, the government is not required to ensure that potential ground motion or subsidence impact are assessed prior to the commencement of development. However, the developer would be under an obligation to guarantee the safety as far as can be reasonably expected. Where this is a concern, the developer or a contractor for the work will commence a ground investigation. Any excavations would have to be performed in such a way that no damage would occur to property. Although the level of information to be provided to the authorities would not change in any formal way, due to the risks involved, a contractor will

[7] See *Criteria for Issuing of the Basin Plan,* D.P.R. (July 18, 1995); *Urgent Provisions for Hydro-logic Risk Prevention,* Law No. 267, August 3, 1998.

have to meet more stringent license requirements set by the regulating authorities, when performing the work. This could entail ground motion or subsidence impact assessment.

Flooding is a major concern in the Netherlands. Due to dewatering, large areas of western and northern parts of country have subsided below sea-level. An extensive system of dykes prevents areas of the country from flooding. Whereas the primary system of dykes, along the large rivers and coastal zones have been extensively renovated over the last couple of years, the large secondary system of dykes around polders are considered vulnerable to some degree. Recently, accidents have happened and several dykes have suddenly ruptured.

There is an obligation to monitor and evaluate the condition of dykes and embankment systems in the Netherlands. The type of embankment determines the character and intensity of monitoring. Ground investigations are performed under the direction of Water Boards for the secondary system of dykes, and more generally under the direction of the Ministry of Transport, Public Works and Water Management.

Governments may use instruments other than laws and regulations to alert developers to the need to assess ground motion and subsidence. These are more recommendatory than binding, but do suggest that laws and policies may follow from such recommendations. In the United Kingdom, the Office of the Deputy Prime Minister (ODPM) has published a number of Planning Policy Guidance (PPG) notes to provide assistance in respect of interpreting and applying law and policy. Planning Policy Guidance (Note 4)-Development on Unsustainable Land (PPG 14)8 explains the effects of instability on development and land use. Its advice is targeted at local planning authorities and developers with the intention to identify unstable land at an early stage of the planning process so that planning applications can subsequently be decided based on sufficient and relevant information.

PPG 14 identifies the different parties involved in land development and discusses their respective responsibilities. Whilst the landowner and local planning authority both have important roles to play throughout the development process, it is the developer that is identified in the PP*G* as having primary responsibility for determining whether land is suitable for the specified purpose.[9] Accordingly, it is recommended that the developer make a 'thorough investigation and assessment of the ground to ensure that it is stable or that any actual or potential instability can be overcome by appropriate remedial, preventive or precautionary measures'.[10]

In practical terms, where instability is suspected in a development area, a planning authority can request a stability report to accompany development applications. A stability report should consider issues such as ground and water conditions and other relevant factors influencing stability, based on desk studies, site reconnaissance and subsurface investigation, laboratory testing and monitoring, where appropriate.[11] Finally, *PPG No. 14* recognises the need for expert advice in respect of the assessment of ground instability and

[8] http://www.planning.odpm.gov.uk/ppg/ppg14/pdf/ppg14.pdf.
[9] *PPG Note 14* explicitly states that it is not the responsibility of a local authority to investigate ground stability of any development site unless they propose to develop the site. See Paragraph 20.
[10] Paragraph 16. This may differ for urban land development. Under the *PPG 3 on Housing,* local planning authorities should assess potential housing sites for physical and environmental constraints on the development of the land, such as land stability (paragraph 31).
[11] Paragraph 28.

the associated risks. The need to utilise commercial consultants to advise on aspects of instability may be appropriate in some circumstances.[12]

Since the release of PPG Note 14, there have been two Annexes subsequently concluded which are to be read in conjunction with PPG Note 14.

Annex 1 – Landslides and Planning[13] provides substantial detail on the problems and causes of landslides. It deals specifically with problems caused by landslides or unstable slopes. In response to the concern for the damage created by landslides in Britain, the guidance specifies strategies for dealing with the problem, namely control through use of the *Building Regulations* and the operation of a planning system. Planning control measures include a step-by-step approach to landslide identification and hazard assessment and the production of a 'slope stability report' as part of the development process. Where there is the potential for landslides that could affect development, a slope stability report should be prepared in order to demonstrate whether a site is stable, or can be made so. Appendix 1B states what details should be included in a slope stability report – much of which must be provided by a competent person (being a person or organisation able to demonstrate relevant specialist experience in the assessment and evaluation of slope stability). Geological mapping and stability assessment forms the core information requiring professional evaluation under the report.

Annex 2 – Subsidence and Planning[14] provides guidance for local planning authorities, landowners, and developers on planning controls over land use and development on land liable to subsidence. The unexpected nature of subsidence means that an emergency response and crisis management strategy should be established in order to cope with events affecting existing development. However, controls on development via building regulations and the planning system is the main focus. In recognising the local individual characteristics of land that may cause subsidence (mining, underground construction, natural cavities etc), it is acknowledged that it is up to local planning authorities to implement the *PPG* in this *Annex* relevant to its specific polices and practices.

In revoking and replacing earlier building legislation, the *Building Regulations 2000*[15] impose requirements on people carrying out certain building operations. Specifically, building work (which includes the erection, extension, alteration, or underpinning of a building)[16] must be carried out so that it complies with the requirements specified in the *Building Regulations*. Ground motion is identified as creating specific requirements that building work must comply with, in particular "the building shall be constructed so that ground motion caused by …swelling, shrinkage or freezing of the subsoil or reasonably foreseeable land-slip or subsidence … will not impair the stability of any part of the building".[17]

A requirement to assess potential geo-hazard risk may be invoked in an excavation for residential basements. The *Party Wall Act 1996,* requires notifying the owners of adjoining

[12] Paragraph 48.
[13] http://www.planning.odpm.gov.uk/ppg/annex1/index.htm
[14] http://www.planning.odpm.gov.uk/ppg/ppg14/annex2/index.htm or http://www.planning.odpm.gov.uk/ppg/ppg14/annex2/pdf/annex2.pdf.
[15] SI 2000 No. 2531, Regulation 3, *Building Regulations 2000* (SI 2000 No, 2531).
[16] Regulation 3*, Building Regulations* 2000 (SI 2000 No, 2531).
[17] Regulation 4 and Schedule 1 (Requirement A2) *Building Regulations 2000* (SI 2000 NO.2531). Note that these regulations relate only to buildings and controlled services or fittings, which excludes buildings that are not occupied by people.

property when excavating near their property.[18] The property owners would reach an agreement about the proposed works through negotiation or dispute resolution procedures. Approval may also be necessary from the London Underground or Rail Company as well as from the local authorities. In order to show that there will not be damage, evidence is to be shown that there will be no change for the worse and therefore an archive of ground motion will be determinative.

The *Geo-Hazards Planning Policy Guidance* was drafted in 1990. As with the other PPGs, it is not binding but can be used as a basis to deny planning permission where there is a geo-hazard risk. However, with discretion instilled at the local level, the local government should have a reason to believe there is a risk. If so, the applicant must address this and undergo an assessment usually involving the hiring of a consultant to do a report. This must include the degree of hazard and the proposed efforts at mitigation. The local authority would then be satisfied with the measures and may include conditions in the planning approval.

The discretion afforded to local planning authorities differs from other countries, such as **Spain**, that have mandated geo-scientific research, analysing subsurface quality and vulnerability for subsidence, landslides or other geo-hazards, to be undertaken prior to any construction.[19] The Italian government has identified requirements for geo-technical and geological studies, which are needed for the construction of galleries as well as any underground excavation. Enforced by the Local Administration, the Geo-Technical and Geological Study is to account for slope stability and subsidence.[20] Similar studies are also required for any construction in a "seismic" zone[21] or on public works.[22] Dams are afforded special attention in **Italy**, requiring the production of a Dam Operating and Maintenance Dossier.[23] The dossier is to include: statements of periodic monitoring, including surrounding slopes; statement of geologic, geo-technical and hydraulic studies; provision of flood effect; definition of alert thresholds; and seismic safety conditions.[24] The definition of alert levels for hydro-geological risk is based on the monitoring.[25]

In **France**, the local town planning program (PLU) and the natural risk prevention plan are determined by order of the Prefect. Risk Prevention Plans cover natural risks aimed essentially at preventing unsuitable projects or defining precise requirements governing the project. The local town planning program, or PLU, sets out the local district development project in terms of housing, employment, and equipment, as well as general rules and constraints. It is intended as a genuine strategic and operational planning tool at the local district level.

[18] This includes excavating, or constructing foundations for a new building, within three metres of a neighbouring owner's building where that work will go deeper than the neighbour's foundations, or excavating, or constructing foundations for a new building, within six metres of a neighbouring owner's building where that work will cut a line drawn downwards at 45 degrees from the bottom of the neighbour's foundations.
[19] See *infra,* European Federation of Geologists (2003) at 18.
[20] The Local Administration is to provide the overall approval for the completeness and adequacy of design documents. See *Technical Provisions for Geological and Geotechncial Investigations,* Ministry of Public Works Decree (11 March 1998).
[21] *Provision for Constructions in Seismic Zones,* Law No. 64 (2 Feb. 1974); *Technical Provisions for Constructions in Seismic Zones,* Ministry of Public Works decree (16 January 1996).
[22] *Provisions for Public Works,* Law No. 109 (11 February 1994).
[23] *Rules for Design Construction and Operating of Dams,* D.P.R. No. 1363 (1 November 1959); *Technical Regulations for Design and Construction of Dams*, Decree of the Ministry of Public Works (24 March 1982); and *Integrating Provisions for Dams,* Provision by the Presidency of the Council Ministry No. DSTN/2/22806 (13 December 1995).
[24] In the future, automatic monitoring will be used , which would feature data transmission systems in real time and a database.
[25] *Provisions of Civil Protection for Basins with Dams,* Provision by the Presidency of the Council Ministry, No. DSTN/2/7019 (19 March 1996).

The French law of 2nd February 1995 created the Plans for the Prevention of the Foreseeable Natural Risks (PPR) that constitutes the essential instrument of State intervention in the area of natural risks.[26] The PPR must be attached to the local town planning program. It reflects the local district's risk exposure in the light of currently available knowledge and may be revised if this exposure or knowledge thereof undergoes any significant change. The risk prevention plan consists of three parts: a descriptive note (zones concerned, type of natural phenomena and their impact in light of current knowledge); one or more graphical documents outlining the zones at risk; and, a set of regulations stipulating prohibitive measures and applicable instructions, preventive, protective, and safeguard measures. A single PPR can cover various types of risk, including subsidence and ground motion.

The object of the PPR is to chart zones of natural risks and define the rules for urbanisation, management and construction of existing and future structures and buildings. Zones are designated as being unfit for development or capable of development, with particular conditions attached, as well as measures to be taken to preserve active and existing activities in the risk zone. There is a public inquiry and consultation with local authorities before the prefect of the département approves the PPR that imposes requirements for construction permits approved by the mayors.

Along with the PPR, is a note issued by the département, which must include:

- the reason for the prescription of a PPR;
- the known natural phenomena reinforced by facts and significant illustrations;
- areas, underlining certitudes, incertitudes and explaining the retained hypothesis;
- what is at stake;
- the objectives of the PPR;
- the choice of the zone and the regulatory measures of this objective; and,
- illustrations and graphical documents that distinguish the zones exposed to risk and those not directly exposed but the usage of which could aggravate the risks.

It is on this basis, that permits authorising construction and development are based upon. Where construction or division of the land either conflicts with the PPR or fails to meet the conditions stated in the permit, it is a punishable offence.

In **France**, an Inter-ministerial Steering Committee was created to clarify the various causes of ground motion. Its role was to prepare government recommendations for anticipating regulations focused on the origin of the problems. This included:

- methods for the Ministry for Industry to check the guaranties provided by a private company regarding the state of an industrial site that has exploited before the company abandons the site;

- the provision of tools that will provide an impetus to homogenise legislation in area of unstable sites; and,

- a preventative tool for urban authorities before authorising new settlement.

[26] Article L.562-1 of the *Environmental Code*.

In addition, the French National Assembly and Senate are debating legislation on the "prevention of technological and natural risks and the repair of damage". It provides for more restrictive measures aimed in particular at industrial operators. These restrictions set out to reduce the risk at source.

The restrictions create the need for information at two levels:

- *a hazard study* - the keystone of the entire system - serving as the basis for defining protective boundaries before the decision to build the facility is taken, and;

- the *obligation to provide information* concerning any event relating to the safety of the facility safety during its lifetime.

With regard to the "hazard study", the method must identify all the conceivable accidents that might occur, including the various elements making up natural risks. The government also intends to improve operating feedback with the aim of increasing safety. This entails more effective characterisation of incidents and accidents occurring on sites required to declare such events.

Ground motion hazards can be caused by numerous reasons and can normally fall under the competence of more than one authority. For example, an uplifted area exists south of the Saint-Lazare railway station in Paris. This uplift, which may be linked to an increase of underground water after the completion of essential construction works,[27] is closely monitored by the city of Paris.

The city of Paris, being responsible for the area, has the duty to monitor and verify the security situation in that the area. This obligation is the same for other owners of property. The monitoring can be done by having recourse to services within the administration or to external specialists (subcontractors) operating on the basis of a specific request. The responsibility for monitoring underground activity may be shared with railway and local transport companies, as well as gas and electricity companies whose infrastructure is affected.

Generally, policy-makers in urban areas have increasingly started to integrate constraints relating to the underground in their management of cities and urban decision-making.[28]

Another country that has proposed legislation concerning subsidence relating to development and planning requirements is **Spain**. There is draft legislation that will amend the Technical Building Code. The problem of subsidence will be an additional factor to take into consideration when designing the foundations (Cimentaciones) of a building. This is expected to be passed at the end of July 2003, having national scope. Currently, the law governing the construction of buildings[29] does not typify the need for the geotechnical study of buildings, although there are provisions requiring insurance for structural damages of a building. As a result, the Technical Organs of Control require that the promoter of a project undertake a geological study for the proposed building. This is mandatory in the Community

[27] See http://www.terrafirma.eu.com/brochures/paris.pdf
[28] BRGM *Rapport Annuel: Volume 1 Synthèse générale et projets* (2002) 73.
[29] *Ley 38/1999*.

of Madrid, where the building requirements stipulate that no building license is granted without the completion of a geotechnical study.[30]

Countries that are prone to extensive land motion such as landslides and earthquakes may require certain information before any building approval can be given. In **Greece**, lands categorised as having high seismic risk, would require detailed investigation and research, as well as the provision of adequate measures of enhancement of the land's properties and the particular problems.[31] For the construction of foundations, girders and land constructions, the subsoil, topography and the general geology of the area must be able to withstand the risk of soil rupture and land instability during any period of seismic vibrations.

In the Lombardy Region in **Italy**, the government authorities are under a duty to assess and regulate risks of landslides.[32] The Regional Council is authorised to provide provisions for the implementation of studies and standardised procedures for hydro-geological risk assessment. Local Administrations are to provide geological studies and actions for risk mitigation.[33] The geological study is to establish guidelines and methods for landslide risk assessment as well as hazard and risk zone designation.

Germany is an interesting example of a country that has specific legislation for the ground protection. The *Federal Soil Protection Act,*[34] stipulates requirements when dangerous land changes exist. This arises when there is danger, considerable disadvantage or annoyance for individuals or the community.[35] Preventive measures would be required to combat the disadvantageous effect on the ground.[36] Individuals are under an obligation not to do anything that would cause dangerous land changes.[37] Owners and occupiers of land are under a similar obligation and must also take preventive measures to avoid such land changes.[38] If a reasonable suspicion of dangerous land change exists, the State can order the landowner or occupier to undertake tests.[39] Anyone who owns an affected piece of land or anyone whose rights are generally affected in the community, is entitled to notice of any tests or investigations conducted by the landowner.[40]

The German federal government sets the "land values" above which dangerous land change is to be anticipated.[41] Where there are indications of damages to land change, the responsible authorities are required to take appropriate action.[42] For instance, where there is significant ground erosion or deposits due to water or wind changes, an investigation must be done.[43] Under some circumstances, the responsible authority must compensate owners/occupiers for loss of the use of land as a result of these measures.[44]

[30] *Ley de Calidad de la Edificacion Ley 17-3-1999* 2/1999 BOE 29/05/99 128
[31] *Hellenic Anti-Earthquake Regulation* (2000), Part 2.3.6.
[32] *Prevention of the Hydro-Geologic Risk,* Lombardy Region Law No. 41 (24 November 1997).
[33] *Procedures for the Assessment and Zonation of Hazard and Risk of Landslides in Lombardy Region,* Lombardy Region Bulletin No. 51, (November 2000).
[34] *Gesetz zum Schutz vor schädlichen Bodenveränderungen und zur Sanierung von Altlasten (BBodSchG),* 17 March 1998.
[35] *Ibid,* § 2:3(3).
[36] *Ibid,* § 1
[37] *Ibid, §* 4(1).
[38] *Ibid,* § 4(2). The types of measures are to be proportionate to the extent of the danger. See § 7.
[39] *§* 9(2).
[40] *§* 11(2).
[41] § 8(2).
[42] § 8(3).
[43] § 3(5), *Bundes-Bodenschutz-und Altlastenverordnung (BBodSchV),* (12 July 1999). .
[44] *§* 10(2).

2.1.2 Mining

Mining is an example of extraction-induced (man-made) ground motion, others may also include water, gas and oil abstraction. For mining subsidence, the slow motion in the ground constitutes a dangerous hazard. In the **United Kingdom**, the British Coal Corporation is under a duty to take remedial action (in the form of remedial works, payments for remedial works, or payments for depreciation in respect of damaged property) where subsidence damage occurs. Under the *Coal Mining Subsidence Act 1991*,[45] subsidence damage means any damage to land, buildings or structures caused by the withdrawal of support from land in connection with lawful coal-mining operations. Compensation would be required for such damage. Remedial action will only be taken where the owner of the property has provided the required notice stating that damage has occurred and has afforded the Corporation reasonable facilities to inspect the property. Finally, where it appears that subsidence damage is likely to occur, the Corporation may undertake preventative works, with the consent of all parties.[46]

The British Coal Corporation may benefit from the use of technology that monitors environmental change such as land subsidence. Where the Corporation is liable for subsidence damage, technology allowing for early detection and preventative measures must offer considerable value. Moreover, the *Terrafirma* technology information will be helpful in meeting the regulatory requirements of providing information to the public as discussed below.

The Secretary of State is authorised[47] to appoint an independent person as a Subsidence Adviser.[48] The function of the Advisor is the provision of information and assistance to those experiencing coal mining subsidence problems (i.e. members of the general public). Information is provided to persons (other than a person with responsibility for subsidence affecting land) with information relating to the obligations on persons with responsibility for subsidence affecting land and the procedures for making and discharging claims under the subsidence provisions. The Adviser may provide assistance by way of advising and/or investigating complaints that persons responsible for remedying subsidence damage have acted improperly in the discharge of claims. An annual report must be completed by the Adviser at the end of each financial year. The Report must include details regarding the functions the Adviser carried out during the year, and the way in which responsible persons have conducted themselves in relation to investigated matters.[49]

Where it is proposed to undertake underground coal-mining operations, the Corporation must give notice to the owners or occupiers of the land that might be affected by subsidence as a result of the operations.[50] The *Coal Mining Subsidence (Provision of Information) Regulations 1994*[51] stipulate what information must be provided with the notice, which largely relates to contact information of the persons responsible and a copy of the document 'Coal Mining Subsidence Damage - a Guide to Claimants Rights'.[52] The Guide provides advice for

[45] As amended by the *Coal Industry Act 1994.*
[46] S.33 *Coal Mining Subsidence Act 1991.*
[47] Coal Mining Subsidence (Subsidence Adviser) Regulations 1994 (SI 1994/2563).
[48] See the Office of the Subsidence Advisor http://www.subsidenceadviser.org.uk/. At present the Subsidence Adviser is Malcolm Webb, a Fellow of the Royal Institution of Chartered Surveyors and a Member of the Chartered Institute of Arbitrators, with a wide knowledge and experience of handling coal-mining subsidence claims.
[49] Regulation 6 *Coal Mining Subsidence (Subsidence Adviser) Regulations 1994* (SI 1994/2563)
[50] s.46, *Coal Mining Subsidence Act, 1991.*
[51] SI 1994/2565.
[52] Regulation 2 *Coal Mining Subsidence (Provision of Information) Regulations 1994* (SI 1994/2565).

owners of damaged property to make a claim in respect of damage caused by coal mining subsidence. Depending on where a claimant lives, responsibility will lie with either the mining company or the Coal Authority. Information is to be provided to property owners (usually the general public) outlining: (i) the obligations on mine owners and the Coal Authority (being those with responsibility for subsidence affecting land), and (ii) procedures for making and discharging subsidence claims. The obligations on mine owners and the Coal Authority are set out in the *Coal Mining Subsidence Act 1991*.

The Stoke-on-Trent region experienced extensive underground coal mining for numerous years before most of the mines were more recently abandoned. However, as a result of these underground coal operations, the region is now experiencing significant subsidence problems due to collapsing roofs, supports and pillars, and seasonal water logging. The extensive subsidence occurring in the area coupled with the urban development of Stoke-on-Trent has lead to numerous problems for the natural environment and the local population.[53]

In **France**, mining activities are regulated under the *Code Minier*.[54] A permit is required for the operation of the mine although the responsibility is not limited to the mining works alone, the duration of the title or damages inside the perimeter.[55] The prospector or operator of the mine is responsible for all damages caused by the activity. Any vendor of the property over a mining site must inform the purchaser in writing of the dangers and important inconveniences resulting from the mining activities. Where there are damages[56] resulting from a mining disaster, due to a collapse, the State is to indemnify the victims, with a residual right of the state to subrogate the rights of the victims against the operator of the mine.

In 1994 and 1999, two French laws were passed to regulate post-mining management in two separate modules: one applying to relations between the authorities and former operators, the other applying to relations between individuals and former operators. Responsibility for damages resulting from the mine lies with the manager or the person who held the mining title.[57] Such laws have given rise to conflicts and uncertainties, necessitating various solutions. These include:

setting up effective compensation procedures;

ensuring fair arbitration between concerns over population protection and local development;

mining risk prevention plans (PPRM) to be used as a reference, (will only be available in 7 or 8 years); and,

organising the technical supervision of mine closures, in particular when the practices involved are unfamiliar or when their impact cannot be determined for want of hindsight (e.g. submergence).

[53] For more information on active and closed mining operations in Europe, see *Mining in Europe* (http://www.mining-europe.de/).
[54] *Loi no. 98-297* du 21 avril 1998, art. 5 Journal Officiel du 22 avril 1998.
[55] Article 68-11, *Loi no 99-245* du 30 mars 1999, Art. 7 Journal Officiel du 31 mars 1999). Article 75-1, *Loi no. 99-245* du 30 mars 1999 art. 1, Journal Officiel du 31 mars 1999).
[56] This is defined under Article 75-2 II, as causing the ruin of one or several buildings or causing damages of which the repair is equivalent to a total or partial reconstruction.
[57] *Loi no. 99-245* du 30 mars 1999 *relativeà la responsabilité en matière de dommages consécutifs à l'expoloitation minière et à la prevention des risques miniers apes la fine de l'expolitation.*

The manager or person holding the mining title is required, after the closure of the mine, and where no reasonable measures exist, to warn or prevent any problems, and to attempt to identify the important risks that may arise. Measures must be presented, including monitoring and supervision.[58]. In this case there is clearly a potential demand for a new system for monitoring and preventing mining risks and this will lend great impetus to the promotion of *Terrafirma* technology techniques.

Under Article 4 of *Loi No. 99-245*,[59] an Agency for the Supervision of Mining Risks was established. The Agency is responsible to Ministers of industry, interior, lodging, environment and Planning. This agency collects and preserves all documents under Item 91 of the *Code Minier*, making them available to any person or group concerned with the prevention or repair of the damages linked to the mining exploitation. The agency participates in the preparation of prevention measures linked to mining risks.

The *Royal Mining Decree* in **the Netherlands** regulates the production plan, the storage plan, and the required measurements in case of ground motion.[60] Part of the production or storage plan is public; amongst it the prediction of ground motion and the proposed counter measures. The Technical Commission on Ground Movement (TCBB), an independent government committee, tests the predicted ground motion in the production plan.

The Dutch State Supervision of Mines is a regulatory body in the field of raw material mining. Dutch law regulates the measurement over specific areas of ground motions as a result of mining in two forms: ground motion information of fixed benchmarks in a spatial grid as a function of time and information on sudden ground motions (earth tremors) as a result of the mining of raw materials.

As of the 1st of January 2003, a new *Mining Act* has been passed by the Dutch parliament. Part of the *Mining Act (2003),* regulates the requirements for a production plan. A production plan is required for every mining activity on land (deeper than 100 meter below ground-level), related to natural minerals, oil, gas, the storage of substances and production of geothermal energy (deeper than 500 meter below ground-level). Amongst other things, a production plan has to address the expected ground motion and measures needed to prevent damage.[61] Article 33 of the *Mining Act* establishes a duty to provide for: the license-holder, or the one who held the last license, to take all measures to prevent any negative effects for the environment, damage due to ground motion, harm to safety or the systematic management and exploitation of natural resources.

In Germany, operators are required to carry out surveys that demonstrate the determination of the nature and extent of expected and observed resulting effects of the mining activity upon the surface.[62] Surveys are required only for certain areas, where adverse effects on the surface by mining operations affecting building structures either have occurred or are expected and if the surveys can be material for the protection from danger or life, health or important tangible property.[63]

[58] Article 5.
[59] *Infra* Note 54
[60] Articles. 24, 26, 30, 31, and 32.
[61] Article 35 (f).
[62] *Dritter Abschnitt Bergbau und öffentliche Verkehrsanlagen,* §125 (1).
[63] §125 (2).

2.2 National Policies

2.2.1 Environmental Impact Assessment

National Environmental Impact Assessment legislation and guidelines use the EU instruments as the framework to design their own requirements. Ground motion and subsidence assessment will be at the prerogative of the national government, depending on the geohazards present, who in turn may delegate the decisions concerning the need for and scope of such assessment to the local authorities who approve of any activity that may have ground motion impacts. This becomes a project-specific exercise although legislation governing planning (designations of building zones) as well as laws and policies relating to large infrastructure development or mining may prescribe ground motion investigations.

In the **United Kingdom**, environmental assessment is generally governed by the *Town and Country Planning Act 1990.*[64] The Secretary of State is to make regulations requiring an assessment of the likely environmental effects of the proposed development before planning permission for development is granted. The *Town and Country Planning (Environmental Impact Assessment) (England and Wales) Regulations,*[65] implement the *EIA Directive*. The Regulations provide details as to the procedural requirements to be met where an environmental impact assessment is required. A developer is required to submit an environmental statement to the relevant local planning authority before planning permission can be granted. An EIA is mandatory for development occurring either in a number of prescribed circumstances, or where it is deemed necessary following the evaluation of certain selection criteria. First, the prescribed circumstances include development projects listed in a schedule to the *Regulations,* extending to activities such as the construction of motorways, railway lines, airports, inland waterways and ports, dams, quarries and open-cast mining,[66] all of which pose a potential significant threat to land stability. Risk of accident or natural disaster is not a prescribed factor to be considered because they are not seen as a "likely" effect. However, an account of landslide flooding potential would normally be included, especially with installations sensitive to seismic activity such as nuclear installations.

Some development activities will require an EIA where certain selection criteria are met. In this case, the characteristics of the development must be taken into account (including the risks of accidents, having regard to the particular substances and technologies used) and the location of the development, incorporating the consideration of the environmental sensitivity of geographical areas likely to be affected by development.[67] Whilst land stability is not a specific requirement to be considered, the nature of development activities requiring an EIA and the prescribed selection criteria result in an *implied obligation* for developers to assess issues regarding land motion and stability.

Under the *Highways Act, 1980,*[68] there are also regulations implementing the *EIA Directive* as they relate to highway development. An environmental statement must be published for projects where the construction or improvement of a highway falls within either Annex I or

[64] S. 71A *Town and Country Planning Act 1990*
[65] (1999) SI 1999/293.
[66] Regulation 2(1) and Schedule 1.
[67] Regulation 4(5) and Schedule 3.
[68] As amended by the *Highways (Assessment of Environmental Effects) Regulations 1999/369*.

Annex II (having regard to the selection criteria) of the EC *EIA Directive*.[69] It is the duty of the Secretary of State to determine the need to carry out an EIA in respect of projects falling within Annex II of the *EIA Directive* under a case-by-case examination and/or thresholds or selection criteria. Moreover, the environmental statement shall include an outline of the main alternatives and an indication of the main reason for the choice taken, taking into account the environmental effects.

There are other environmental assessment regulations for specific types of projects, such as: pipeline works (oil, gas and chemical);[70] pipeline works by a public gas transporter;[71] and, the decommissioning of nuclear reactors.[72] These potentially introduce some subsidence matters into the assessment process. Specific requirements also exist for projects on the use of uncultivated land and semi-natural areas for intensive agricultural purposes,[73] as well as land drainage projects.[74] There are also extensive projects propagating subsidence issues that are governed by assessment requirements. For instance, the Channel Tunnel Rail Link is subject to planning permission requirements.[75]

In England and Wales the *Landfill Regulations 2002*,[76] which came into force on June 2002, implement the requirements of the *Landfill Directive*. The regulations set tighter controls over the regulation of landfills. The regulations are primarily the responsibility of the Environmental Agency, however there are implications and responsibilities for the County Council as Waste Planning Authority.

Planning permission under the *Town and Country Planning Act 1990* may be granted only if the requirements of paragraph 1 (1) of Schedule 2 to these Regulations have been taken into consideration. Paragraph 1 (1) (d) of Schedule 2 refers to the consideration requirements relating to the risk of flooding, subsidence, landslides or avalanches on the site.

[69] S.105A(3), *Highways Act 1980.*
[70] *Pipe-line Works (Environmental Impact Assessment) Regulations 2000/1928*
[71] *Public Gas Transporter Pipeline Works (Environmental Impact Assessment) Regulations 1999/1672.*
[72] *Nuclear Reactors (Environmental Impact Assessment for Decommissioning) Regulations 1999/2892.*
[73] The *Environmental Impact Assessment (Uncultivated Land and Semi-natural Areas) (England) Regulations 2001/3966* also implement the EC *EIA Directive*, as well as *Council Directive 1992/43/EEC[73] on the Conservation of Natural Habitats and of Wild Fauna and Flora (the Habitats Directive)* in relation to projects for the use of uncultivated land and semi-natural areas in England for intensive agricultural purposes. No person can carry out a project without first obtaining a screening decision. In determining whether a project is likely to have a significant effect on the environment (as required by the screening decision), the risk of accidents and the environmental sensitivity of geographical areas likely to be affected by projects must be taken into consideration. See Regulation 5 and Schedule 1, *Environmental Impact Assessment (Uncultivated Land and Semi-natural Areas) (England) Regulations 2001 (SI 2001/3966).*
[74] For specified land drainage projects in England and Wales, the *Environmental Impact Assessment (Land Drainage Improvement Works) Regulations 1999/1783* would apply. The Regulations apply to projects (improvement works) for which planning permission is granted without the requirement for an application to be made under the *Town and Country Planning Act 1990*. Improvement works include projects to deepen, widen, straighten or otherwise improve any existing watercourse, or the removal or alteration of milldams, weirs or other obstructions to watercourses, or any existing drainage work. Drainage bodies are prohibited from carrying out improvement works unless specified conditions are met, which includes the preparation of an environmental statement to assess improvement works that are likely to have significant effects on the environment.
[75] *Channel Tunnel Rail Link (Assessment of Environmental Effects) Regulations 1999/107.* There are limited situations where planning permission will not be deemed to have been granted by the Act and thus, additional permission must be sought. See Regulation 3, *Channel Tunnel Rail Link (Assessment of Environmental Effects) Regulations 1999/107.*
[76] Statutory Instruments 2002 No. 1559 Environmental Protection, England and Wales.

2.3 European Policies

2.3.1 Environmental

Environmental assessment is undertaken to ensure that potential negative impacts on the environment resulting from particular or a group of activities are prevented, or at the least, mitigated in advance. European countries all require such assessment with most of its guidance coming from European, and to a lesser extent, international instruments. Assessing ground motion and subsidence would not be specifically mentioned in such instruments.

Although ground stability is an obvious component of environmental integrity, such concerns would only arise where some reason exists in fact, based on the type of project or the area where the project will be developed. National governments have implemented their EIA requirements in a way that transforms the obligations into national law but does not add further requirements, leaving most of the decision making at the discretion of the authority, which may approve of such construction or project.

2.3.2 Environmental Impact Assessment

European EIA obligations must be understood in relation to instruments that the European countries have agreed to internationally, as well as what is required under European Union Law. At the international level, the *Convention on Environmental Impact Assessment (EIA) in a Transboundary Context (Espoo, 1991*)[77] recognises the need for states to develop anticipatory policies to prevent, mitigate and monitor environmental impact in general and more specifically, in a transboundary context. The general obligation under this *Convention* is the requirement that states take measures to prevent, reduce and control significant adverse transboundary environmental impact from proposed activities. The focus is on assessment at an early stage of planning with states also obliged to notify and consult each other on all major projects under consideration that are likely to have a significant impact across boundaries. The *Convention* stipulates that an EIA must be undertaken prior to a decision to authorise or undertake a proposed Appendix I activity[78] that is likely to cause a significant adverse transboundary impact.[79]

There is a *Protocol on Strategic Environmental Assessment (SEA)* to the *Espoo Convention (1991).*[80] It recognises the importance of integrating environmental considerations into the preparation and adoption of plans and programmes and to the extent appropriate, polices and legislation. It places an obligation on state parties to take the necessary methods (legislative, regulatory or otherwise) to implement the provisions of the *Protocol* into national systems.[81]

Strategic environmental assessment as a procedural requirement includes the production of an environmental report (evaluating the likely environmental and health effects), the carrying-

[77] (1991) 30 I.L.M. 1461.
[78] Appendix I includes activities such as oil refineries, power stations, chemical installations, waste disposal installations, mining activities, groundwater abstraction (10 million cubic metres or more per year) and the construction of major motorways and railways and airports. For a full list of applicable activities, see Appendix I to the Convention.
[79] Article 2(2).
[80] The *Protocol* was made available for signature at the 'Environment for Europe' Conference in Kiev, Ukraine in May 2003.

out of public participation and consultations, and the taking into account of these aspects in the subsequent plan or programme.[82] Under the *Protocol,* members of the public not only have the right to know about the plans and programmes, but also the right to comment, have their comments taken into account, and be told of the final decision and why it was taken.[83]

Both of these agreements include both EU and non-EU European countries. EU countries would have supplementary obligations under EU law. There are specific environmental assessment instruments within the European Union. The *Directive on the Assessment of the Effects of Certain Public and Private Projects on the Environment of 1985*[84] places an obligation on states to implement an assessment procedure of certain projects to determine their potential effect on the environment. An EIA must be undertaken by a developer for the projects listed in Annex I to the *Directive*, which contains activities considered to pose the highest risk to the environment.[85] Furthermore, projects listed in Annex II to the Directive are subject to the EIA procedure where states determine (either by a case-by-case analysis or by established thresholds or criteria) that an assessment should be undertaken.[86] When determining whether an Annex II project should be subject to an EIA, certain selection criteria must be considered, including the characteristics of the project, and in particular the risk of accidents having regard to substances or technologies used.[87]

The *EIA Directive* primarily covers construction work and installations affecting the natural environment or landscape. Annex III of the *EIA Directive* lists the characteristics of projects that must be considered in an assessment. These include: the size of the project; accumulation with other projects; and, risks of accidents. The environmental sensitivity of geographical areas must also be considered. The type of information to be submitted is listed in Annex IV.

The specific obligation on EU member states in accordance with the *Directive* is to ensure that EIA is integrated into either existing procedures for consent to projects, or alternatively into specific procedures established for the purpose of compliance with the *EIA Directive*.

The *Strategic Environmental Assessment (SEA) Directive*[88] requires an assessment of plans and programmes rather than the single project assessment under the *EIA Directive*. Plans and programmes include those likely to have a significant effect on the environment and which are prepared and adopted by a competent authority, or prepared by a competent authority for adoption by means of a legislative act.[89] A SEA shall be carried out for all plans and programmes which are prepared for town and country planning, land use, transport, agriculture, industry, waste management, water management, telecommunications and tourism, and which set the framework for future development of consent projects listed in

[81] Article 3(1).
[82] Article 2(6).
[83] Article 8.
[84] *Council Directive of 27 June 2985 on the assessment of the effects of certain public and private projects on the environment (85/337/EEC), OJ L 175/40*. As amended by *EC Directive 97/11/EC*.
[85] Article 4(1).
[86] Article 4(2).
[87] Article 4(3) and Annex III(1).
[88] *Council Directive 2001/42/EC on the Assessment of the Effects of Certain Plans and Programmes on the Environment, OJ L197/30*. This Directive came into effect on 21 July 2004. It applies to plans and programmes begun after that date as well as to those begun before 21 July 2004 and not adopted by 21 July 2006, unless the Member State in question considers this unfeasible and informs the public. As of 20 July 2004 nine of the twenty-five Member States have transposed the Directive into their national law. They are: Cyprus, Czech Republic, Denmark, Ireland, Latvia, Lithuania, Malta, Slovenia and the UK. Most other Member States claim to be making good progress towards transposition.
[89] Article 2(a).

Annexes I and II to the *EIA Directive*.[90] This ensures that environmental consequences of certain plans and programmes are identified and assessed during their preparation and before their adoption. Moreover, public participation and consultation again forms an integral part of the assessment process.

The *Natura 2000 Directive*[91] establishes a European ecological framework for the conservation of wild fauna and flora, and habitats of community interest. To promote the maintenance of biodiversity, the *Directive* requires states to identify special areas of conservation, including habitats and species of special interest. Any plan or project that may have a significant effect on the site (although not directly connected to the management of the site) is subject to assessment of its implications in view of the site's conservation objectives. Moreover, the competent national authorities must agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the site – although exceptions do exist where imperative reasons of overriding public interest can be established requiring the adoption of compensatory measures.[92] In addition to the requirement for assessment, Member States must also undertake surveillance of the conservation status of the specified natural habitats and species.[93] Thus, where states designate and conserve natural habitats and wild fauna and flora in accordance with *Natura 2000*, governments are further obliged to undertake an assessment of any plan or project which may impact on the site, and furthermore undertake surveillance to ensure an adequate conservation status.

Overall, EIA requirements at the EU level do not specifically address subsidence or ground motion issues. Geology is not one of the listed areas to be dealt with in an EIA under the various pieces of EU legislation. However, there are areas that geological information can have relevance such as soil (aquifers) and water (groundwater). Geological information relating to land motion or subsidence may be relevant, but the information may not be deemed critical in an EIA, due to the absence of relevant information or the information not being readily understandable.[94] Moreover, EIA regulations at the EU level provide only basic requirements, leaving the Member States, who are in a more favourable position to determine needs based on local geological conditions, with the discretion to supplement what is required.

One area where subsidence and ground motion may be at the forefront is in the area of soil protection. The European Commission is currently undergoing the formulation of a plan with a view to developing a Community strategy for soil protection. In the EU Communication,[95] it is noted that there is no explicit Community policy, and therefore a thematic strategy for soil is needed, in light of the objective of protecting soils against erosion and pollution as stated in the *Sixth Environmental Action Programme.*[96] In response, the European Parliament has

[90] Article 3(2).
[91] *Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora, OJ L 206/7*. As amended by *EC Directive 97/63/EC*.
[92] Article 6.
[93] Article 11.
[94] Institute of Geologists in Ireland (2002), *Geology in Environmental Impact Statements,* (Dublin). http://www.igi.ie/docs/Geology_in_EIS-A_Guide.rtf.
[95] Communication of 16 April 2002 from the Commission to the Council, the European Parliament, the Economic and Social Committee and the Committee of the Regions – Towards a Thematic Strategy for Soil Protection, [COM (2002) 179 final).
[96] 6th Environment Action Programme of the European Community "Environment 2010: Our Future, Our Choice, COM (2001) 31 final. See the European Union website http://europa.eu.int/eur-lex/en/com/pdf/2001/en_501PC0031.pdf

issued a resolution on the EU Commission Communication[97] calling upon the European Commission to present a thematic strategy for soil protection by July 2004 which will identify solutions to the problems facing soil protection. Soil quality is seen to be under threat from erosion, the compacting and sealing of soil, as well as an overall decline in soil quality. The Commission is expected to draft guidelines, addressed to the Member States and the competent regional authorities, for preventing, monitoring and controlling soil pollution. The effects of landslides and floods can also have a significant impact on soil quality. As a result, further study on subsidence and ground motion will complement efforts on soil protection currently underway at the Commission and enable soil protection to be better integrated into Community policies.

Related to ground monitoring are also Community measures on waste management. The *Waste Framework Directive* of 1975[98] lays down only the general provisions for the handling of waste and sets up a system for the coordinated management of waste within the Community in order to limit waste production. More specific rules on ground monitoring can be found in the *Landfill Directive* of 1999[99] The Directive sets a series of national targets to reduce the amount of biodegradable municipal waste (BMW). By 2020 the target is to reduce the amount of BMW to 35% of the 1995 levels. Furthermore, the Directive sets stringent operational and technical requirements for waste and landfills, to provide for measures, procedures and guidance to prevent or reduce as far as possible negative effects on the environment, as well as any resulting risk to human health from land filling of waste during the whole life-cycle of the landfill.[100] The system of operating permits for landfill sites leads to a more consolidated control of ground. Application for permits must for instance contain a description of the types and quantity of waste, the capacity of the disposal site, a description of the site, and especially the proposed operation, monitoring and control plan. Annex 1 of the Landfill Directive establishes the general requirements for all classes of landfills.[101] Landfill can only be authorised if they fulfil certain requirements. Some of these key requirements relate to the risk of flooding, subsidence, landslides or avalanches on the site.[102]

On 14 October 2004 the European Council reached a political agreement on a proposed *Directive on the management of waste from the extractive industries*.[103] Waste from the extractive industries involves materials such as topsoil, overburden, waste rock and tailings, discarded during the prospecting, extraction and treatment of mineral resources. The management of such waste can have severe environmental impacts such as physical effects on ecosystems to pervasive acid drainage and leaching of heavy metals. Especially the

[97] 19/11/2003 European Parliament resolution on the Commission communication Towards a Thematic Strategy for Soil Protection (COM(2002) 179 – C5-0328/2002-2002/2172(COS)). See the European Parliament website http://www4.europarl.eu.int
[98] *Council Directive 75/442/EEC of 15 July 1975 on waste OJ L194/39.*
[99] *Council Directive 1999/31/EC of 26 April 1999 on the landfill of waste OJ L182/1.*
[100] Article 1, *Council Directive 1999/31/EC.*
[101] The general requirements for landfills is supplemented by *Council Decision 2003/33/EC* of 19 December 2002 establishing criteria and procedures for the acceptance of waste at landfills pursuant to Article 16 and Annex II to *Directive 1999/31/EC.*
[102] *Council Directive 1999/31/EC* Annex 1.
[103] Proposal for a Directive of the European Parliament and the Council on the management of waste from the extractive industries, COM(2003) 319 final. See also Council of the European Union, Press Release of 14 October No 12908/04, 2610th Council meeting, Environment, <http://ue.eu.int/newsroom>.

collapse of facilities hosting such waste shall be prevented. Therefore, the proposal introduces a system for the planning, licensing, operation, closure and after-care of waste facilities. Here, the monitoring over time of waste management is one important instrument. According to Art 11 of the Directive Member States are for instance asked to ensure the proper monitoring and inspection of the waste facility by competent persons. Records of this monitoring must be kept and the operator must notify any events likely to affect the stability of the facility and any significant adverse environmental effects revealed by the control and monitoring procedures of the waste facility. Similar rules exist for the closure and after-closure procedures for waste facilities. From the business sector especially operators of mines and quarries will be affected as will all on-shore oil and gas operators.

2.4 International Policies

International polices and laws provide an appropriate backdrop to support the use of remote sensing information. Most initiatives are the product of a multilateral response to global or transboundary environmental problems. At that level, there is limited scope to address more localised issues such as subsidence and land motion. International treaties and other instruments rarely mandate specific action for states. Several instruments take the form of "soft law", where stipulated provisions are not binding. In the binding documents such as treaties, there is a good degree of discretion afforded to States to implement any commitments. Many procedural environmental regulations such as public participation and EIA are mirrored in international treaties. In addition, most national and even local policies are based on multilateral commitments and therefore its significance as a guide for EU, national and local action is notable.

The *Rio Declaration*[104] is an example of a soft-law document, agreed to at the 1992 UN Conference on Environment and Development. There are a number of provisions in the *Rio Declaration* that have policy implications for ground-motion risk assessment and a state's obligations to its citizens in that regard. For instance, it is recognised that environmental issues are best handled with the participation of all citizens concerned. At the national level, this creates an obligation on governments to provide each individual with appropriate access to information concerning the environment, and the opportunity to participate in decision-making processes.[105] Secondly, environmental impact assessment is recognised as a national instrument, which should be undertaken for proposed activities likely to have a significant adverse impact on the environment. The need to notify other states of natural disasters or activities with potentially significant adverse transboundary environment effects adds further detail to the objective of environmental assessment and monitoring.

Agenda 21,[106] agreed to at the Rio Conference, represents the global plan of action. It outlines objectives, activities and means of implementation for the principle of sustainable development as a way forward in the integration of environmental and development interests. One priority area recognised in *Agenda 21* is environmental monitoring and assessment, specifically for the purpose of strengthening and making operational the early-warning function of bodies such as the United Nations *Earthwatch Initiative*.[107] In addition to the objectives of public participation, access to information and environmental impact assessment, *Agenda 21* provides detail on the collection and analysis of data, especially

[104] See *Infra,* note 2
[105] Principle 10
[106] http://www.un.org/esa/sustdev/documents/agenda21/english/agenda21toc.htm.

from satellite sources. The collection, assessment and analysis of this information is considered to be particularly relevant due to the recognition that large quantities of data from satellite sources will need to be processed in the future. Accordingly, *Agenda 21* calls for the strengthening of such institutions and programmes at all regulatory levels so as to make use of these new techniques. In order to ensure adequate information is provided for decision-making, governments are encouraged to 'develop mechanisms for efficient and harmonised exchange of information…including revision and establishment of data, access and dissemination formats, and communication interfaces.'[108]

The *Convention on Biological Diversity*[109] includes the objective of conserving biological diversity, which effectively encompasses all aspects of the natural environment and the species and ecosystems therein. Under the *Biodviersity Convention*, national governments are to ensure environmental impact assessments are undertaken for proposed projects likely to have significant adverse effects on biological diversity. Moreover, there exists a further requirement for public participation in these situations where it may be appropriate.[110] Similar obligations relating to public participation and access to information exist under the *United Nations Framework Convention on Climate Change*.[111] A further obligation placed on national governments party to the *Biodiversity Convention* is the promotion of arrangements for emergency response to activities or events – occurring either naturally or otherwise – which present a grave and imminent danger to biological diversity.[112] Monitoring and assessment of the environment is paramount for participants of the *Biodiversity Convention* to be able to achieve its stated objective.

The *United Nations System-wide Earthwatch Initiative*[113] (*Earthwatch*) operates in order to facilitate the cooperation of environmental observation activities within the various UN-agencies. Its objective is to 'analyse the state of the global environment, assess global and regional environmental trends, and provide early warning information on environmental threats, based on the best scientific and technical capabilities available'.[114] Accordingly, the work undertaken by *Earthwatch* involves the integration and analysis of environmental assessments, observations, data and reports in order to provide environmental and socio-economic decision-makers with valuable information and early warning of emerging problems. In order to successfully undertake this role, *Earthwatch* forms partnerships with global assessment and monitoring bodies and the scientific community to collaborate information that is then subsequently disseminated to the relevant bodies, primarily throughout the United Nations.

In 2000 *Earthwatch* published an "Environmental Observing and Assessment Strategy",[115] outlining the strategic goals and vision for the initiative, whilst also identifying the products or 'outputs' the programme should contribute. Although *Earthwatch* currently has a number of institutional links with international assessment centres,[116] the technology associated with

[107] See *infra,* note 151 at paragraph 38.22(d).
[108] Paragraph 40.23.
[109] (1992), 31 I.L.M. 822.
[110] Article 14(1)(a).
[111] United Nations Framework Convention on Climate Change, (1992) 31 I.L.M. 849, Article 6(a)(ii) and (iii).
[112] Article 14(1)(3).
[113] http://earthwatch.unep.net/index.php
[114] http://earthwatch.unep.net/about/about.php
[115] Environmental Observing and Assessment Strategy UNEP/EWWP6/4 (9 March 2000). See the Earthwatch website http://earthwatch.unep.net/about/docs/ewwp6wp4.htm
[116] For example, the Intergovernmental Panel on Climate Change, the World Conservation Monitoring Centre, the Global International Waters Assessment and the Millennium Ecosystem Assessment.

Terrafirma technology and the resulting global environmental information and indicators would prove an invaluable addition to the extensiveness and credibility of *Earthwatch's* current programme.

In response to growing international concern of the human, economic and social losses occurring due to natural hazards and the related technological and environmental disasters, the United Nations established *the International Strategy for Disaster Reduction (ISDR)* as a global framework for action. Building on the experience and knowledge gained during the International Decade for Natural Disaster Reduction (1990 to 1999),[117] the objectives of the *ISDR* include increasing public awareness about disaster reduction, obtaining commitment from public authorities, creating inter-disciplinary and inter-sectoral partnerships, and advancing scientific knowledge about the causes of natural disasters and the consequences of natural hazards.

The *ISDR* appears as a strategic vision based primarily upon the provisions established in the *Geneva Mandate on Disaster Reduction*[118] and the *Yokohama Strategy on Natural Disaster Reduction*.[119] The essential elements of these documents centre on the recognition of a need for increased information exchange, improved early warning capacities, technology transfer and technical cooperation. More specifically, attention is drawn to the importance of risk assessment, early warnings, and disaster prevention and preparedness in development policy and planning, with a strategic plan of action detailing the activities required. The *Yokohama Strategy* details numerous activities for the adoption by national governments including *inter alia* risk assessment programmes, emergency plans, national disaster management plans, environmental impact assessments, cost-effective technologies including forecasting and warning systems, community involvement and public awareness of disaster reduction.[120] In 2001, the *ISDR* concluded a framework for action including an implementation plan for the *ISDR* strategy that coordinates the initiative's approach towards disaster reduction.[121]

Finally, during the International Decade for Natural Disaster Reduction, a specific thematic conference was convened in Potsdam, **Germany** on Early Warning Systems for the Reduction of Natural Disasters.[122] Participants recognised that there is a need to ensure that the early warning of natural disasters becomes an integral part of government policy. The benefits of partnerships in the development of technological innovation and related commercial opportunities were highlighted in order to utilise technologies related to earth observation. Moreover, it is recognised that data and scientific information must be translated into early warning systems and forecasts of potential natural disasters, so that the relevant authorities can take protective action.

The *Risk Assessment Tools for Diagnosis of Urban Areas Against Seismic Disasters (RADIUS*)[123], was launched in 1996 by the IDNDR Secretariat, along with the support of the Government of Japan. It aims to promote worldwide activities for the reduction of urban

[117] The International Decade for Natural Disaster Reduction (IDNDR) resulted in a number of regional conference and declarations. For further information see the IDNDR archive website http://www.unisdr.org/unisdr
[118] See the *Geneva Mandate on the ISDR* website http://www.unisdr.org/unisdr/intention.htm
[119] See *the Yokohama Strategy on the ISDR* website http://www.unisdr.org/unisdr
[120] See the activities required at the community and national levels in Part II, paragraph 11 of the *Yokohama Strategy*.
[121] For further details see the ISDR website http://www.unisdr.org/unisdr
[122] The *Declaration of the Potsdam Early Warning Conference* 1998 is available on the ISDR website http://www.unisdr.org/unisdr
[123] http://www.geohaz.org/radius/

seismic risk, particularly in developing countries. The primary goal of the initiative is to increase understanding regarding seismic risk and raise public awareness. The objectives of RADIUS are:

- to develop earthquake damage scenarios and action plans in nine case-study cities selected worldwide;
- to develop practical tools for seismic risk management applicable to any earthquake-prone city in the world;
- to conduct a comparative study in order to understand urban seismic risk around the world; and,
- to promote information exchange for seismic risk mitigation at city level.

The UN Division of Early Warning and Assessment (DEWA)[124] is part of the UN's global environmental information centres known as the Global Resource Information Database (GRID). GRID aims to provide and facilitate access to environmental data and information for decision and policy making.

The aim of DEWA is to support environmental decision-making within the UN by generating and disseminating information about the state of the world's environment. To provide reliable environmental assessments, GRID specialises in handling and analysing spatial and statistical data on environmental and natural resource issues through computerised Geographic Information Systems (GIS) and remotely-sensed imagery. Over the years, GRID has compiled an archive of global, European and other geo-spatial databases as part of its information management function. This data forms part of the GRID. One of the major activities undertaken by DEWA is the provision of early warning information obtained through 'scientifically credible vulnerability assessments and other methods within the framework of the broader environmental observation and assessment process'.

The UN Centre for Human Settlements (UN-Habitat)[125] acts for the promotion of sustainable urbanisation by policy formation, institutional reform, capacity-building, technical cooperation and advocacy, and the monitoring and improvement of the state of human settlements worldwide. Within UN-Habitat exists the Risk and Disaster Management Unit (RDMU), created to provide local government, communities and business organisations with practical strategies for mitigating and recovering from conflicts and natural disasters. The objective of RDMU is to support national governments, local authorities and communities in strengthening their capacity to manage human-made and natural disasters. This applies both to the prevention and mitigation of disasters, as well as the rehabilitation of human settlements.

2.5 Related Policies

2.5.1 Environmental Rights and Public Participation

Environmental rights can be broken down into procedural and substantive rights. The former would govern access to information relating to the environment, rights to participate in decision making potentially impacting the environment and even the ability to legally

[124] http://www.grid.unep.ch/index.php
[125] http://www.unhabitat.org/

challenge decisions pertaining to the environment. The more substantive aspects relating to environmental rights relate to the right to privacy, life or security, all which add context to the scope of environmental rights that citizens are entitled to. Subsidence and land motion information could be included amongst what governments are required to provide in order to ensure they have not infringed citizens' rights. Citizens could demand access to such information, especially since it can impact their safety and security. Government failure to ensure such safety and protection could lead to further violations of environmental rights.

Access to accurate seismic information, relevant to the protection of life and the environment, is encouraged by the European Seismic Commission (ESC). The ESC provides information concerning seismic activity and ground movement and aims to enhance European co-operation in seismology. Through a pan-European network of information centres, including the European Mediterranean Seismological Centre (EMSC) and the Observations and Research Facilities for European Seismology (ORFEUS), the ESC promotes seismological projects in member and non-member European Community countries and undertakes a number of functions relevant for the acquisition and interpretation of seismic data. This information can be used to prepare for, or mitigate against, harmful ground motion thereby protecting citizens as well as the environment from natural disaster.

In 1987 the EMSC was charged with providing the Council of Europe with seismic warnings within the framework of the Open Partial Agreement (OPA) so that they might prevent, protect against and organise appropriate relief in the event of a major natural and/or technological disaster. In order to share information about seismic activity in a more efficient and effective way, the ESC are currently seeking to establish European parametric databases for historical and instrumental seismicity. In addition, the ORFEUS Data Centre provides access to wavelength data from the European-Mediterranean area enabling competent authorities to disseminate information relevant to both environmental and human protection.

The emergence of environmental rights has an important bearing on governmental obligations regarding information dissemination and decision-making. There are several references to a right to a decent, or healthy or viable environment in numerous national constitutions. Moreover, these are expressed in several global and regional human rights treaties,[126] as well as declarations or resolutions of international organisations.[127] Principle 10 of the *Rio Declaration* states:

"Environmental issues are best handled with the participation of all concerned citizens. At the national level, each individual shall have appropriate access to information concerning the environment that is held by public authorities, including information on hazardous materials and activities in their communities, and the opportunity to participate in decision-making processes. States shall facilitate and encourage public awareness and participation by making information widely available. Effective access to judicial and administrative proceedings, including redress and remedy, shall be provided."

[126] See *African Charter on Human Rights and Peoples' Rights,* (1982) 21 *ILM* 52, Art. 24; *UN Covenant on Economic and Social Rights,* (1967) 6 ILM 360, Art. 12; *European Social Charter,* (1961) 529 *UNTS* 89; *Additional Protocol to the American Convention on Human Rights,* (1989) 29 ILM 156; *Convention on the Rights of the Child, (1989) 28 ILM 1448, Art. 243(2)(c).*

[127] See UNGTA Res. 45/94 (1990); *World Charter for Nature,* (1983) 23 ILM 455, principle 23; *Hague Declaration on the Environment* (1989) 28 ILM 1308; World Conference of Human Rights, *Vienna Declaration and Programme of Action,* UN Doc. A/CONF.157/23 (pt. 1), 20-46.

As mentioned above, environmental rights may be derived from other basic human rights, such as the right to life, privacy, property rights or the right to health. The European Court of Human Rights has interpreted the right to privacy under the *European Convention on Human Rights,*[128] to include a government obligation to control industrial pollution where there is sufficiently serious interference with the enjoyment of home and private life.[129] This would cover both direct and indirect (failure to prevent others) intrusions on the right to privacy and family life.[130] This can also extend to a positive obligation of States to prevent, or at least minimise, noise pollution to citizens living near Heathrow Airport.[131] Article 8 has also been interpreted to require access to information in order to determine a potential environmental danger or threat to human health.[132] Under the right to life, there may be a duty of the State to warn of risk to health from certain state activities although this will depend on the certainty of the risk of harm.[133] Where the state is undergoing hazardous activities that could adversely affect a person's health, the State may be required to ensure an effective and accessible procedure for the provision of information.[134]

In order to enjoy human rights as they relate to the environment, there is a clear importance of the right to access to information and to participate in decision-making. Access to environmental information is necessary so that the public can take decisions with full knowledge of the potential environmental implications. This can also inform participation efforts so that the participation in decision-making is more effective. This creates obligations on states to provide information. States are to facilitate and encourage public awareness and participation by making information concerning the environment widely available.[135] Principle 10 of the *Rio Declaration*, which contextualises the right, is reflected in other international instruments.[136] Access to information is also required under EU law.[137] The European Court of Human Rights has ruled that information concerning serious environmental health risks should be made available by government to those known to be at risk.[138]

To effect these rights, government bodies will be required to release environmental information to the public upon request. Where requests are refused, written reasons must be provided. The public authorities which are subject to such requirements is given a broad ambit in the EU under *Directive 2003/4/EC*[139] which revises *Directive 90/313/EEC* on the freedom of access to information on the environment.[140] For instance, Article 2(2) of *Directive 2003/4/EC* broadens the range of bodies subject to the *Directive*, extending to bodies with functions that affect the environment which are entrusted by law, or by some other arrangement, with the operation of services of general economic interest. This can include private sector bodies that perform a public administrative function. The Commission

[128] *European Convention for the Protection of Human Rights and Fundamental Freedoms,*(1950) 213 UNTS 221.
[129] See *Lopez Ostra* v. *Spain,* (1994) 20 EHRR 277, and *Guerra and Others v. Italy,* (1998) 26 EHRR 357.
[130] See *Powell* v. *UK* (1989) 9 EHRR 241; *Rayner* v. *UK* (1989) 9 EHRR 375.
[131] *Case of Hatton and Others v. The United Kingdom,* Application no. 36022/97), (2 October 2001). .
[132] See *McGinley and Egan* v. *UK,* (1998) 27 EHRR 1. In relation to nuclear testing on Christmas Island, the Court ruled that "Where a Government engages in hazardous activities…. which might have hidden adverse consequences (for) health, respect for private and family life requires that an effective and accessible procedure be established which enables such persons to seek all relevant and appropriate information. See also, *Guerra and Others* v. *Italy,* (1998) 26 EHRR 357.
[133] *LCBG* v. *UK,* (1998) 27 EHRR 212.
[134] *McGinley and Egan* (1998).
[135] *Rio Declaration (1992).*
[136] See Principle 23, *World Charter for Nature* (1982); *Council of European Convention on Civil Liability for Damage Resulting from Activities Dangerous to the Environment,* (1993), Articles 14-16; *Convention on EIA in a Trasnboundary Context,* Arts. 2(6), 3(8); *Convention on Biological Diversity,* (1992), Art. 14.
[137] See *EC Directives* 90/313/EEC and 85/337/EEC.
[138] *Guerra v. Italy,*(1998).
[139] *Infra*, note 2.

envisages that bodies that provide public services would be covered. For the purposes of ground motion information, this could include the transport sectors, which includes rail operators, road construction and the construction industry more generally.

Consistent with some of the developments at the European Court of Human Rights, the *Aarhus Convention*[141] guarantees the rights of access to information, public participation in decision-making and access to justice in environmental matters in order to ensure the protection of the right of every person (in both present and future generations) to live in an environment adequate to his or her health and well-being.[142] Concluded under the auspices of the UN Economic Commission for Europe (UNECE), the *Aarhus Convention* is open to states under (or having consultative status with) the UNECE.

The *Aarhus Convention* imposes specific obligations on state parties for the collection and dissemination of environmental information.[143] In particular, governments must ensure that public authorities possess and update environmental information relevant to their functions. This is especially relevant in the event of any imminent threat to human health or the environment (being caused by either human activities or natural causes). Where a public authority holds any information that could enable the public to take preventative or mitigating measures, it must be disseminated immediately to members of the public who may be affected. These obligations should be implemented by way of governments taking legislative, regulatory or other measures (including proper enforcement methods) to establish and maintain a clear, transparent and consistent framework to implement the *Convention's* provisions.

Finally, parties to the *Aarhus Convention* are required to ensure public participation in decision-making on specific activities,[144] plans, policies and programmes relating to the environment,[145] and during the preparation of executive regulations and legally binding instruments.[146]

Similar obligations under the *Aarhus Convention* exist at the EU level. The *EC Directive 2003/4/EC on Public Access to Environmental Information*, contains obligations on EU Member States guaranteeing the right of access to environmental information held by public authorities, and ensuring that environmental information is progressively made available and disseminated to the public. 'Environmental information' is defined to include information on the state of elements of the environment, such as air and atmosphere, water, soil, landscape, natural sites (including wetlands, coastal and marine areas), biological diversity, and the interaction between these elements.[147] Member states must ensure that the dissemination of environmental information includes at least *inter alia* data derived from the monitoring of activities affecting (or likely to affect) the environment, environmental impact studies and risk assessments.[148]

[140] *Council Directive 90/313* (June (1990)).

[141] (1998) Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters, 19 I.L.M. 38.
[142] Article 1.
[143] Article 5.
[144] Article 6 and Annex I.
[145] Article 7.
[146] Article 8.
[147] Article 2(1)(a).
[148] Article 7(2)(e) and (g).

The *Directive* contains a provision similar to that in the *Aarhus Convention* whereby in the event of an imminent threat to human health or the environment (caused by either human activities or due to natural causes) all information held by public authorities, which could enable the public to take preventative or mitigating measures, must be disseminated immediately.[149] Furthermore, Member States must ensure that any information compiled by them, or on their behalf, is up to date, accurate and comparable.[150] States must ensure the provisions of the *Directive* are incorporated into their necessary laws, regulations and administrative provisions by 14 February 2005.

In addition, *Directive 2003/35/EC*[151] guarantees the rights of public participation in environmental matters so as to be consistent with the provisions of the *Aarhus Convention*. The Directive contains rules on public participation in the preparation of a number of environmental plans and programmes concerning Directives on waste, air pollution and protection of waters against nitrate pollution. The 'public' is defined as meaning one or more natural or legal persons in accordance with the legislation or practice, associations, organisations or groups of the State. Member States must incorporate the provisions of the Directive into their necessary laws, regulations, and administrative provisions by 25 June 2005.

Directives 2003/4/EC and 2003/35/EC address the obligations under the first two pillars of the *Aarhus Convention* and the EU have recently proposed a Directive to deal with the third, namely access to justice in environmental matters.[152] It is thought that the Directive will contribute to the implementation of the *Aarhus Convention*, which envisages the right to administrative or judicial recourse following a violation of environmental law, and eliminate shortcomings in the enforcement of environmental law which are due, in part, to the lack of financial private interest in enforcing environmental law, something which is in contrast to the internal market and competition where economic operators require the correct application of legislation.

The proposal for this Directive stems in part from *The 6th Environmental Action Programme of the European Community*[153] which outlines the latest environmental strategy and priorities on the environment for the next five to ten years. It specifically focuses on the four action areas: climate change, health and the environment, nature and bio-diversity, and natural resource management. In recognising that 'well-informed citizens who are actively involved in environmental decision-making are a powerful new force in achieving environmental results', *the 6th Environmental Action Programme* emphasises the importance of establishing and strengthening initiatives to empower citizens. Measures to improve accessibility and quality of information provided to citizens on the environment (based on indicators and maps) are considered fundamental for achieving the objectives of the strategy.

Although the extent and quality of information to which a citizen would be entitled, or the manner of how the information is presented, is not specifically stipulated by government decree, or in any international, European, national or local instrument, it may be contingent

[149] Article 7(4).
[150] Article 8(1).
[151] *(2003) Providing for public participation in respect of the drawing up of certain plans and programmes relating to the environment and amending with regard to public participation and access to justice Council Directives 85/337/EEC and 96/61/EC.*
[152] COM(2003) 624 final, 2003/0246 (COD),Brussels 24/10/2003. See http://europa.eu.int/eur-lex/en/com/pdf/2003/com2003_0624en01.pdf

on the information the government has. The only obligation is that the information is available by electronic means and that public authorities make reasonable efforts to maintain environmental information in forms and formats which are readily reproducible and accessible by computer telecommunications. The type of information that would be required will relate broadly to anything regarding the environment, such as air and atmosphere, water, soil and land. This could also include the state of human health and safety, conditions of human life, cultural sites and built structures. Where the government requires such information from an occupier or developer, this would be material that the public should be able to access. In the Netherlands, citizens are entitled to any information relating to ground motion or subsidence, as long as this information was gathered by government or in commission for the government. However, there is no entitlement to data or information gathered by third parties including developers. In principle, citizens would be entitled to information about potential ground motion dangers.

In the United Kingdom, the main purpose of the *Freedom of Information Act 2000* is to create a right of access to information held by public authorities. In particular, the Act allows for the creation of Regulations to implement into the national legal system the provisions of the *Aarhus Convention*.[154] The *Environmental Information Regulations (1992)*[155] implement *Council Directive 90/313/EEC* on the freedom of access to information in the environment.[156] An obligation is established for environmental information to be made available on request.[157] Environmental information can be obtained from the National Environment Research Council (NERC). The NERC Publication Scheme[158] outlines the procedure for obtaining information from the NERC under the requirements in the *Freedom of Information Act 2000*. Information published by the British Geological Survey (BGS), being one of NERC's research centres, is available by direction to the BGS website.

French citizens have the right of information for major risks, both technological and foreseeable natural risks. The scope of this right is commensurate with the certain territorial zone and the safeguard measures concerned. A Decree of the Conseil D'Etat outlines the conditions of the exercise of the right, including the modalities and safeguard measures that are to be brought to the public and the local citizens.[159]

2.5.2 Civil Protection

Subsidence and ground motion problems can lead to situations where emergency response is necessary. *Terrafirma* technology data may be useful in government efforts to address emergencies. Moreover, its ability to assist in designing mitigating measures in advance of such an emergency reinforces its utility. Government efforts in the area of emergency response and civil protection are to be transparent, accessible to the public. The availability of such information can generate greater awareness of subsidence and ground motion issues leading to greater public demand for the information.

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[153] 6th Environment Action Programme of the European Community Environment 2010: Our Future, Our Choice. COM (2001) 31 final. See the European Union website http://europa.eu.int/comm/environment/newprg/

[154] S.74 *Freedom of Information Act 2000.* Available online at http://www.cix.co.uk/~osanotts/DTIGuide.html. See *Aarhus Convention, infra.*

[155] (SI 1992/3240), As amended by the Environmental Information (Amendment) Regulations 1998 (SI 1998/1447)

[156] The *Environmental Information Regulations (2004)* come into force on 1 January 2005 and will implement the provisions of the *Aarhus Convention* relating to access to environmental information and the provisions of Council *Directive 2003/4/EC* on public access to environmental information, which repeals *Council Directive 90/313/EEC.*

[157] Regulation 3, *Environmental Information Regulations 1992/3240*

[158] http://www.nerc.ac.uk/foi/index.asp

A recent EU Communication[160] underscored the need to reinforce the civil protection capacity of the European Union by establishing a system allowing for immediate assistance through the civil protection teams of participting states. Ground motion is a contributing factor to civil stability, as was witnessed in the Iranian earthquake on 26 December 2003, and the Commission cites that, among many other natural disasters, as a reason why it must put various co-ordinating mechanisms in place to provide assistance, financial support and relief to countries affected by environmental catastrophes.[161] The Commission intends to make a formal proposal to amend *Council Decision 2001/792* to improve communication and co-ordination when responding to major disasters by requiring Member States to inform the Monitoring and Information Centre of castastrophes in their country as well as whether they intend to call for assistance on a bilateral or multilateral basis or if they are responding to calls for assistance.

In addition the *Council Decision 1999/847/EC Establishing a Community Action Programme in the Field of Civil Protection,*[162] establishes an EU Community action programme in the field of civil protection to support and supplement Member State's efforts at national, regional and local levels for the protection of persons, property and the environment, in the event of natural and technological disasters. The current *Community Action Programme* is established for the period 1 January 2000 to 31 December 2004. So that Member States meet their implementation obligations under this Decision, governments must take measures to:

- prevent risks and damage in the event of natural and technological disasters;
- increase the degree of preparedness of those involved in civil protection in order to increase their ability to respond to an emergency;
- contribute to the detection and study of causes of disasters;
- improve the means and methods of forecasting, techniques and methods of response and immediate aftercare after emergencies; and
- contribute to public information, education and awareness, so as to help citizens protect themselves more effectively.

A Community mechanism to reinforce the cooperation between the Community and Member States in civil protection assistance intervention in the event of major emergencies, or the imminent threat of major emergencies, was set up under *Council Decision 2001/792/EC Establishing a Community Mechanism to Facilitate Reinforced Cooperation in Civil Protection Assistance Interventions*. The general purpose of the mechanism is to provide support in the event of emergencies and to facilitate improved coordination of assistance intervention provided by the Member States and the Community. Notably, the *Decision* provides that the Commission must establish and manage a monitoring and information centre, which is

[159] Art. L.125-2, *Environmental Code, Inséré par Ordonnance nº 2001-321 du 11 avril 2001 art. 9 I, II Journal Officiel du 14 avril 2001.*
[160] Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, Reinforcing the Civil Protection Capacity of the European Union Brussels, 25.03.2004 COM(2004) 200 final.
[161] At pages 14, 7 and 8.
[162] *Council Decision 98/22/EC* replaced *Council Decision 1999/847/EC..*

publicly accessible and able to react immediately at any time, in order to satisfy the needs of the Member States and the Commission.[163]

The European Commission is planning to adopt a Communication on the subject of 'Civil Protection: Improvement of Public Awareness and Safety in the Face of Natural and Man-made Hazards'.[164] As part of this adoption process, the EU has recently proposed a *Working Document on Civil Protection: Improvement of Public Awareness and Safety in the Face of Natural and Man-Made Hazards*.[165] This aims to develop an integrated strategy of prevention and mitigation measures, reduce the number or disasters and reduce the damage to infrastructure, economics and social life. In the *Working Document*, it notes that the "general public is becoming increasingly concerned by natural and man-made hazards and that people are increasingly expecting "Europe" to help solve these problems."[166] This involves taking into account risk and vulnerability of the citizen in the development of EU policies, including the consideration of specific tools to facilitate this.

It is intended that the *Communication* will review a number of recent hazards (natural, technological and others) before describing existing community instruments and proposals for short and long-term actions. The *Communication* will be concluded with a view to establishing a European strategy on prevention, preparedness and response to natural, man-made and other risks and to promote measures for improved prevention of natural disasters.

There are also Council Resolutions aiming to ensure that civil protection assistance gets to the outermost and isolated regions;[167] there is cooperation in the field of civil protection training;[168] and, that the capabilities of the EU in the field of civil protection are strengthened.[169] Community cooperation on civil protection was called upon, noting the need for cooperation in preparation to cope with disasters, disaster prevention and risk management, so as to ensure that those required to prevent and deal with emergencies are better prepared.[170] A pilot project for a computerised information system for civil protection is also being developed, with the introduction of a complementary data bank of specialised resources available to Member States,[171] as well as a Guide to Civil Protection to provide information on the assistance available in each Member State in the event of a disaster.[172] The Council has also agreed that it is necessary to improve the transmission of information required to prevent and cope with disasters by promoting the use of advanced information systems and in particular, aerospace resources such as satellites.[173] All of these initiatives make room for greater information on subsidence and land motion data in the future.

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[163] Article 4.
[164] *An Integrated EU Strategy on Prevention, Preparedness and Response to Natural, Man-made and Other Risks*. A questionnaire on Hazard Mapping was sent to Member States, Accession Countires and EEA countries on 31 July 2003. As of 12 May 2004 twenty-four countries had officially replied. On 23 March 2004 the European Environment Agency published a report enititled *Mapping the Impacts of Recent Natural Disasters and Technological Accidents in Europe.* See: http://europa.eu.int/comm/environment/civil/prote/integrated_strategy_en.htm.
[165] http://europa.eu.int/comm/environment/civil/pdfdocs/outline_050203_3b.pdf, Brussels, 05.02.2003.
[166] At page 3.
[167] *Council Resolution 2003/C 24/03 on Special Civil Protection Assistance to Outermost and Isolated Regions, in Insular Regions, to Regions Which are not Easily Accessible, and to Sparsely Populated Regions, in the European Union*.
[168] *Council Resolution 2002/C 43/01 on Reinforcing Cooperation in the Field of Civil Protection Training.*
[169] *Council Resolution 2001/C 82/01 on Strengthening the Capabilities of the European Union in the Field of Civil Protection*. The Resolution emphasises areas where the strengthening of capabilities should focus including, information, education, communication, operational activities and instruments, international cooperation, and civil protection resources in the framework of crises management.
[170] *Council Resolution 94/C 313/01 on Strengthening Community Cooperation on Civil Protection*.
[171] *Council Resolution 90/C 315/01 on Community Cooperation on Civil Protection*.
[172] *Council Resolution 87/C 176/01 on the Introduction of Community Cooperation on Civil Protection*.
[173] *Council Resolution 89/C 44/03 on the New Developments in Community Cooperation on Civil Protection.*

The **UK** government has concluded that its current legislative framework regulating civil protection is no longer effective. As part of the overhaul of the current civil protection regime a *Civil Contingencies Bill* is being drafted in which emergency powers are being reviewed with a wider definition of emergencies, based around four types - public welfare, environmental, public order and defence – being proposed.[174] The Bill received its second reading in the House of Lords on 5 July 2004 and is expected to be promulgated close to November 2004.

The Home Office and the Civil Contingencies Secretariat, has published *Dealing with Disaster,*[175] outlining guidance for emergency services, local authorities and other organisations by way of detailing best practices during the planning for, response to, and recovery from disasters. In this context, 'disaster' is defined as 'any event (happening with or without warning) causing or threatening death or injury, damage to property or to the environment or disruption to the community, which because of the scale of its effects cannot be dealt with by the emergency services and local authorities as part of their day-to-day activities'.

There may also be a common law duty of care in respect of warnings for natural disasters. In an unreported judgment at Cardiff Crown Court on 16 October 1987, the Cardiff City Council and South Glamorgan County Council were both found to be negligent in their preparation and implementation of a flood emergency plan. It was concluded that a two-fold duty had been breached whereby, the *prior duty* was to take reasonable steps to ensure effective and continuing flood warning provisions *vis a vis* a flood endangered area – whilst the *duty on the day* … was to take reasonable steps to ensure communication of a public warning to persons in the flood endangered areas". Although there are other judgments, this is the most often quoted case where the local authorities' duty of care obligation was found wanting.[176]

In **France**, the State is to elaborate and put into action plans of prevention of natural and foreseeable risks that include ground motion, flooding, earthquakes and volcanic eruptions.[177] Such plans are to delimit the zones that are exposed to such risks as well as the intensity of such risks incurred from construction, activities or management of agriculture, forestry, artisal, commerical or industrial exploitation. This would include prohbiting such activity in certain areas or the prescription of certain conditions.[178]

Loi No. 2002-276 was enacted as an instrument to prevent the collapse of underground cavities and *marnières*, as well as provide a regime governing damages and compensation for victims of such incidents.[179] Communes or other government agencies responsible for urban planning are to delimit the sites situated above underground cavities and likely *marnières* that can provoke the collapse of the ground. All persons with knowledge of the existence of such cavities or *marnières* are to reveal its existence to the mayor, who then communicates this to the representative of the state in the *department,* as well as to the president of the general counsel.

[174] See the latest update on the *Civil Contingencies Bill* http://www.ukresilience.info/legislation/civilbill.htm
[175] 3rd edition ISBN 185 893 9208. Available online at http://www.ukresilience.info/contingencies/dwd/index.htm
[176] For a further discussion on this issue, see B. Barrett, 'Common Law Liability for Flood Damage Caused by Storms' (1992) *New Law Journal* 142.
[177] Article L. 562-1, *Environmental Code,* I.
[178] Article L. 562-1, *Environmental Code,* II.
[179] The underground cavities can be natural or of human origin. In the latter cases, they are excluded from the application of the present chapter the resultant damages of the past exploitation or in course of an expression.

In **Greece**, the government is required to implement measures to identify and mitigate natural and technological disasters, in order to meet the basic objectives of ensuring protection of the population, the environment and property.[180] The Ministry of Public Works and Environment holds the responsibility for floods, landslides and seismic prevention and protection under the Civil Protection regime in **Greece**.[181] In order to confront landslides, two types of measures are provided for – measures of prevention and measures of hindrance/interception. These could include: surface draining; basement draining; concrete/chemical injections; surface alleviation; and walls of support. To implement these measures there needs to be:

- knowledge of geological structure of band;
- knowledge of prevailing hydro-geological conditions;
- knowledge of geotechnical parameters that are of a geological nature that is influenced; and,
- knowledge of the soil-mechanic and rock-mechanic sizes that slide or are likely to slide.[182]

Disaster preparation and prevention related to hydro-geologic risk is also on the government agenda in **Italy**. The *Environment Action Strategy for Sustainable Development in **Italy**,*[183] calls for the introduction of a number of instruments including the development of protection systems for natural and anthropogenic subsidence. The overall risk prediction and prevention system would require the designation of risk area zones as well as the use of hazard, vulnerability and risk maps.[184] This would complement the development of an extraordinary plan of high precision remote sensing monitoring for hydro-geologic risk prevention.[185]

[180] *Law 3013/2002*, *Upgrade of Political Protection and Remaining Provisions.*
[181] http://www.civilprotection.gr/
[182] See *Law 3013/2002, Upgrade of Political Protection and Remaining Provisions.*
[183] *CIPE Decision No. 57*, Aug. 2002.
[184] *Establishment of the Civil Protection Agency,* D.L. No. 300 (30 July 1999).
[185] *Directives on Environment,* Law No. 179, (31 July 2002).

3 POLICY PERSPECTIVE ON THE POTENTIAL USER NEEDS FOR TERRAFIRMA

Another basis supporting the need for *Terrafirma* comes from the perspective of the potential user of such information. In these instances, the market drivers for such data motivate the need for *Terrafirma* products. Geological surveys, land conveyancers, surveyors, engineers represent only a few of the potential users, although many already utilise such information in their professional activities. There is even a financial incentive for such use as the insurance industry is starting to cover subsidence in their policies. Continual use and greater appreciation of the resource can be the progenitor of further regulatory reform, where the availability of the technical information can justify specific mandates to provide such information to the government.

The British Geological Survey (BGS) is a public-good, not-for-profit organisation. Its funding originates in equal proportions from the government (distributed via NERC's allocation of the science budget) and income from external sources such as the delivery of the commissions, sales and services. The largest client for BGS information is central government, for which the BGS provides public domain geoscience knowledge that underpins informed and open decision-making concerning sustainable land, marine and resource utilisation.

The principle business of the BGS is the execution of the *Core Strategic Programme,* which takes place through three Directorates, namely Land and Resources, Environment and Hazards, and Information Services and Management. The Core *Strategic Programme* involves activities such as long-term surveying, monitoring, databasing, undertaking key environmental science research, and the provision of scientific advice (knowledge transfer). The Environment and Hazards Directorate is comprised of five programmes which collaborate to provide information on the manner in which geoscience impacts on humans and their environment.[186] The Earthquake and Forensic Seismology and Geomagnetism programme undertakes national earthquake monitoring, whilst the Urban Geoscience and Geological Hazards programme researches the likely occurrence of geological hazards.

The BGS's Strategic Plan '*Foundations for a Sustainable Future'*[187] nominates a number of environmental challenges and subsequently identifies the manner in which the BGS can contribute to each challenge. Of particular relevance is the challenge of mitigating hazards and risks, whereby the recommended actions include the assessment of risks from natural hazards (such as magnetic storms, earthquakes, and random gas emissions) and the identification of areas of land instability caused by both mining and natural geological hazards.[188]

BRGM, in **France,** is the active geological survey, providing analysis and information on subsidence and ground motion relating to urban construction and installation. Their aims are to understand geological phenomena and intervene in the sustainable management of the

[186] The five programmes are: Groundwater Systems and Water Quality; Earthquake and Forensic Seismology and Geomagnetism; Urban Geoscience and Geological Hazards; Pollution and Waste Management and Extractive Industries; and Coastal Geoscience and Global Change Impacts.
[187] http://www.bgs.ac.uk/about/docs/Strategicplan.pdf
[188] The BGS has teamed up with the specialist insurer Hiscox Syndicates Ltd to create the 'Monica Seismic Risk System' computer programme that can access the earthquake risks to a reinsurance portfolio. See http://www.quakes.bgs.ac.uk/hazard/monica.html.

resources of underground spaces. It is within their remit to provide the necessary tools to the public for management of the ground, basement and underground resources, as well as the prevention of the natural risks and pollution.

In land and property transactions, information on ground motion is becoming more relevant. In the **UK**, the insurance industry has incurred significant losses as a result of paying off claims for damages due to subsidence/geohazards.[189] Geohazards were recorded as being responsible for 1.5 billion pounds in payments between 1989-1991 due mainly to the swelling and shrinking of clay soils. Other estimates are at a rate of 600 million per year.[190] Insurance policies most often include coverage for subsidence like swelling and shrinking. BGS had recommended that premiums should be adjusted according to each geographical area, based on geohazard risk. As a result, an information system was developed geared to save 2 to 3 billion pounds, with 35% of the insurance industry using the system.[191]

The insurance industry has also suffered losses as a result of some of the massive flooding that took place in the autumn of 2000 in the **UK,** as well as the major flooding in Germany, Austria and other European countries in the summer of 2002. Such disasters have been partly linked to population growth encroaching on more geo-hazardous areas. Insurance companies now want to be more pro-active, but are having difficulty finding the appropriate information to make flood risk more ascertainable. The insurance industry appears to be recognising subsidence issues. This relates to insurance coverage in most household insurance policies as well as ones for industrial and commercial buildings.

In light of the real and empirically proven property damages as a result of geohazards, parties involved in real estate transactions are starting to explicitly flag the subsidence issue before agreeing to the final purchase. Conveyancing in England and Wales remains founded in the maxim of *caveat emptor* (let the buyer beware). As a result, the seller has only a limited duty of disclosure (i.e. cannot misrepresent to the buyer), whilst it is the responsibility of the purchaser to find out as much as possible about the property before contracts are exchanged. There are a number of searches a buyer can undertake in order to find out about the property, including the past history or the risk in relation to landslides, flooding, land motion or instability. Undergoing these inquiries might fall within due diligence requirements of the solicitors involved in the purchase.

In the **UK**, a Coal Mining Search is undertaken to determine if the property is in an area designated for past, present or future coal mining. This is important in respect of land subsidence. This search may involve consultation of the Law Society's *Coal Mining Directory* (to see if the property is in an area where a coal mining search is required) and *Guidance Notes* of 1994 (which contains a list of towns and parishes which have, or maybe affected by mining). Finally, depending on the location of the property, localised searches may also be necessary for limestone mining, clay mining, brine extraction, and tin mining.

Environmental searches can cover many details including land contamination, flooding, subsidence, and current and historical land use. Searches can be undertaken by the

[189] In 1989-1991 a dry climate caused more shrinking therefore risk was not properly assessed and so policies were issued with too low a premium.
[190] Earls (2003) found in the European Federation of Geologists *(EFG), Advice Document to the European Commission on Civil Protection and Natural Hazards*, (27 March 2003), http://eurogeologists.de/Advice_document_to_EC_on_Civil_Protection_28032003.pdf at page 8.
[191] Interview with Martin Culshaw, *British Geological Survey*, April 17, 2003.

Environment Agency, but they are often time consuming and lack sufficient detail.[192] Accordingly, there are a number of companies offering environmental searches for property in the **UK**. These include Landmark[193] (a commercial supplier of land quality and property search information, that can, in conjunction with RMSI, offer products and services based on Global Information Systems (GIS) and spatial solutions); RMSI:[194] (whose services include the provisions of information in respect of GIS (including remote sensing) and technological and natural hazard risk management); and Homecheck (website offering a free summary of issues relevant to potential property buyers). The information supplied by Homecheck is supplied from the Ordnance Survey, Environment Agency, the British Geological Survey, Valuation Office, English Nature and the Department of Environment, Food and Rural Affairs (DEFRA). In addition, Homecheck offers a service for use by conveyancers and surveyors (Homecheck professional), which is subscription (i.e. payment) based and also offer a land insurance policy for protection against polluted or contaminated land.[195] Homecheck obtains its data from various specialist organisations and promotes itself as making a continual investment in quality data.[196] Recently, Homecheck reached an agreement with the Ordnance Survey involving an investment in excess of £1 million, declared to be one of the largest data capture projects with a mapping base ever undertaken by a private company in the **UK**.

Real estate solicitors may also need to respond to subsidence issues since there are potential liabilities flowing from misrepresentations regarding land stability. The Law Society has offered recommendations on what lawyers should do relating to the information they need to seek and provide. It was suggested that lawyers should get the information from the local authority on mining, in order to avoid any negligence.

Property owners are raising concerns about the dissemination of information that could negatively impact the value of their property. The blight issue is a paramount concern. Blight occurs when proposals for development negatively impact on the value of a person's land and where the developing body possess (or have access to) compulsory purchase powers. Information in the proposal about the land stability could render such an impact. Information of subsidence may have such effect. The *Town and Country Planning Act 1990* sets out the current statutory blight provisions.[197] Currently, a landowner can serve a blight notice requiring the body responsible for the proposed development affecting the land to purchase it at open market value. However, these provisions only apply to certain types of blight, certain categories of landowners, and are dependent on the status of the project.

Due to the prospective devaluation of property from a government response to subsidence phenomena, people may not want to know about the problem since it may impede their ability to sell the property. This may overlook the necessary balancing between personal safety and the loss of property value from releasing ground hazard information. The Government has recently concluded a green paper relating to the issue of blight and compulsory purchase

[192] http://www.environment-agency.gov.uk/subjects/flood/?lang=_e. As mentioned, the Environment Agency (EA) also provides a search service. The EA offers a free search for maps indicating flood liability based on UK postcodes. Maps do not indicate the level of risk, but just reflect information of patterns of floodplains, groundwater, discharges to sea, bathing waters, etc.
[193] http://www.landmarkinfo.co.uk/corp/home.jsp.
[194] http://www.rmsi.com/index.htm
[195] Insurance operates in response to the new regulatory regime set out in Part IIA *Environment Protection Act 1990*, which was inserted by s.57 *Environment Act 1995*.
[196] http://www.homecheckpro.co.uk/default.asp?howhear=.
[197] See sections 149-156 and Schedule 13 *Town and Country Planning Act 1990.*

powers that addresses the present anomalies in the law.[198]. The *Compulsory Purchase and Compensation – the Government's Proposals for Change*[199] proposes the introduction of a discretionary power for agreements between landowners and developers (where appropriate) and the rationalising of statutory blight provisions so they apply in a more consistent manner.

For **France**, information on ground motion and stability is particularly important to the "constructeur". Under Article L111-13, the "constructeur" is responsible for damages resulting from the construction, even including any defaults in the soil (*vice du sol).*[200] A constructeur can range from architects, entrepreneurs, technicians and other persons who are responsible for the work, as well as vendors of such property. The Municipal Police has the responsibility to warn of, and prevent, natural disasters relating to ground motions, ruptures in dykes, and floods.

4 CONCLUSIONS

Ground motion has increasingly become a concern for governments and decision-makers, a point that is reflected in the growing number of laws, policies and regulations that mandate the provision of ground motion information. Data on the history of ground motion can assist in the identification of higher risk areas and the ensuing fortification of building construction in such areas. Civil protection tools and mechanisms can also be supported by the availability of information about subsidence and ground motion.

The most direct use of ground motion data in government policy is seen in the laws and policies governing environmental impact assessment, land, land-use planning and mining. It is in this area that information on ground motion is most critical, since proposed construction on certain lands may be problematic without a proper understanding of land stability. Decisions relating to whether this needs to be assessed by a project proponent will depend on the local characteristics of the land as well as the concerns of decision makers and planning approval bodies. High risk of subsidence and ground motion will warrant such an analysis. For instance, larger infrastructure projects, especially those involving underground excavation or tunnelling, would command some form of ground motion analysis considering the project's potential threat to land stability.

Information on ground motion is being progressively incorporated into earlier stages of the decision-making process. In the future, this will help develop better policy and regulation in the area of land and land-use planning and environmental assessment.

Ground motion is a considerable issue for extraction-induced activity such as mining. For mining subsidence, the slow motion in the ground constitutes a dangerous hazard. Where subsidence has occurred, mining operators may be required to provide compensation to affected landowners, to monitor subsidence both during the operation of the mine and its decommissioning and even take remedial measures. Government liability may also flow from such damage. Before commencing mine operations, production plans can be required to

[198] http://www.planning.odpm.gov.uk/consult/greenpap/compurch/
[199] Published 12 December 2001.
[200] This might be exempted where the builder can prove that the damages had a foreign cause. See also Art. 1792 (*Loi no 78-12*, 4 Jan 1978).

include measures addressing expected ground motion and the use of preventative strategies. *Terrafirma* data is obviously relevant to meet the statutory obligations therein.

Where no specific requirements exist for ground motion monitoring, the interests of public safety may influence planning authorities' decisions to impose such an obligation when approving a construction. Discretion to impose such an obligation may also be supported by government recommendations or guidelines alerting both developers and local governments of the need to search for subsidence. Such recommendations potentially lead to the development of legally binding instruments mandating ground motion assessment. Some countries have set up special committees to identify whether further regulation is needed. Other countries have taken this further by enacting legislation governing any activity that impacts the ground. In order to meet such regulations, ground motion monitoring will be used which relies on *Terrafirma* to provide accurate data.

Information on subsidence and ground motion may also be necessary for governments when meeting their human rights commitments. Rights relating to the environment can be both procedural and substantive. Citizens are entitled to access environmental information as well as participate in decisions affecting the environment and have access to justice allowing them to challenge such decisions. The right to a clean and safe environment can also be subsumed in the basic human right to privacy and security of the person. Relevant information on subsidence should be available to the public in order to meet human rights obligations. The information should be accurate and provided by a wide range of public authorities whose decisions can impact the environment. European policy as represented in the most recent Environmental Action Programme is partly focussed on empowering citizens, which includes improving the accessibility and quality of information.

An emerging priority for the European Union is civil protection and proactive emergency planning. Information in this regard is useful to plan for the advent of such emergencies and design appropriate mitigating measures. Governments are under obligations to formulate action plans to prevent natural and foreseeable risks. Databases and other methods of disseminating information to the public are warranted. *Terrafirma* data can form part of these systems.

In addition to regulations and policies creating requirements for ground motion monitoring, the economic market appears to be driving the need for such information. The significant economic losses incurred due to subsidence and ground motion, and the subsequent losses in the insurance industry, has underscored the importance for such information. Subsidence is becoming a significant issue for various professions engaged in property development and land transactions. Guidelines are being set by professional associations, dictating good practice in relation to ground motion assessment. New services are becoming available to provide a comprehensive account of a prospective property that includes relevant searches for information relating to subsidence.

Terrafirma can provide policy-makers with the information necessary to create more effective regulations in the future. It will also supply necessary information to EU Member States which are required to proactively put in place policies and plans to protect the civil population. In order to do this Member States must be able to act on accurate information. Information produced by *Terrafirma* will be available to citizens, thereby integrating them into the decision-making process.

It is clear that ground motion has an increasing relevance in the policy and decision-making process at a national, European and international level. Beyond the usual inference that can be drawn from using ground motion information, namely the preservation and the protection of life and the environment, the dissemination of ground motion data raises issues of public participation in policy decision-making and inclusion in the plans and programmes designed to protect the global environment. The right to privacy and security of the person is buried within the provision of a clean and safe environment and governments are increasingly aware of their commitment to meet their human rights obligation.

The *Terrafirma* service represents a comprehensive source of the type of information that will significantly contribute to the development of better policy and regulation in the area of land and land-use planning and environmental assessment, thereby preventing and/or mitigating potential hazards related to ground motion.

END

