European Cooperation in Science and Technology
- COST -

Secretariat

Brussels, 16 December 2010

COST 4186/10

MEMORANDUM OF UNDERSTANDING

Subject :	Memorandum of Understanding for the implementation of a European Concerted Research Action designated as COST Action ES1006: Evaluation, improvement and guidance for the use of local-scale emergency prediction and response tools for airborne hazards in built environments

Delegations will find attached the Memorandum of Understanding for COST Action ES1006 as approved by the COST Committee of Senior Officials (CSO) at its 180th meeting on 1 December 2010.

MEMORANDUM OF UNDERSTANDING
For the implementation of a European Concerted Research Action designated as

COST Action ES1006
EVALUATION, IMPROVEMENT AND GUIDANCE FOR THE USE OF LOCAL-SCALE EMERGENCY PREDICTION AND RESPONSE TOOLS FOR AIRBORNE HAZARDS IN BUILT ENVIRONMENTS

The Parties to this Memorandum of Understanding, declaring their common intention to participate in the concerted Action referred to above and described in the technical Annex to the Memorandum, have reached the following understanding:

1. The Action will be carried out in accordance with the provisions of document COST 4159/10 "Rules and Procedures for Implementing COST Actions", or in any new document amending or replacing it, the contents of which the Parties are fully aware of.

2. The main objective of the Action is to evaluate and improve the reliability of neighbourhood-scale emergency response tools based on a comprehensive and cross-national approach.

3. The economic dimension of the activities carried out under the Action has been estimated, on the basis of information available during the planning of the Action, at EUR 64 million in 2010 prices.

4. The Memorandum of Understanding will take effect on being accepted by at least five Parties.

5. The Memorandum of Understanding will remain in force for a period of 4 years, calculated from the date of the first meeting of the Management Committee, unless the duration of the Action is modified according to the provisions of Chapter V of the document referred to in Point 1 above.

A. ABSTRACT AND KEYWORDS

Releases of hazardous agents in complex built environments pose a tremendous challenge to emergency first responders and authorities in charge due to the large number of casualties potentially involved. Air motions in built-up areas are very complex and adequate modelling tools have to be applied properly in order to predict the dispersion of hazardous materials with sufficient accuracy within a very short time. Different types of tools are applied; however, it is not always clear what the advantages and limitations of individual model approaches are. Therefore, it is of exceptional interest to compile a detailed inventory of the different models and methodologies currently in use, to characterize their performance and to establish strategies for their improvement. A consensus on reliable, efficient and suitable model approaches for given local threats and their scientific advancement is imperative. Consequently, the Action is aiming for a substantial improvement in the implementation of local-scale emergency response tools. By characterizing threat scenarios, compiling dedicated test cases, revealing model limitations and improving model approaches, the Action is delivering guidance for a reliable application of local-scale emergency response tools. The Action is a first cross-community initiative to join, to coordinate and to harmonize European efforts in threat assessment and reduction for local-scale airborne hazards.
Keywords: airborne hazards threat assessment, local-scale dispersion modelling, model evaluation, emergency response tools, European harmonization

B. BACKGROUND

B.1 General background

There is a growing concern that accidental or deliberate releases of hazardous materials into the atmosphere can lead to catastrophic results in terms of population casualties and damage to infrastructures and ecosystems. Therefore, a major challenge in applied environmental sciences is the development of local-scale emergency response tools for tracking and predicting airborne hazards from accidental or deliberate releases, such as terrorist attacks. The dispersion of airborne hazardous agents is a principal concern of communities and emergency managers which have to be prepared to deal with instantaneous releases from industrial sites, energy facilities, transportation of hazardous materials or even a CBRN terrorist attack. Different types of computational models have been developed, implemented and partially validated. Significant improvement was achieved for dispersion models in terms of air quality control and environmental health risk assessment. The continuous increase in computing power enables the use of advanced models in the context of local- and neighbourhood-scale releases of toxic and harmful substances. The models allow emergency first responders and management to plan for, to train for and to respond to accidents adequately, also at the very local scale, where the related risks and threats are extremely high. A variety of tools is applied or under development in different European countries and the need to harmonize and improve the techniques and procedures becomes more and more crucial within and beyond Europe.

The different scientific approaches and tools provided for modelling the dispersion of airborne hazards range from simple parametric and Gaussian methods to Lagrangian dispersion models and sophisticated pre-event CFD-based methods with subsequent fast data access. The various types of models and methodologies have specific advantages and disadvantages regarding efficiency, quality and reliability of the results generated for a given release scenario. In this context, it is often not clear what the limitations of an individual model approach are, where and when models can be applied with confidence and how reliable the predictions are. In reality, the situation is usually even more complicated since for accidental or deliberate incidents the duration of the release is often very short (minutes) and the source type is usually only partially known (e.g. amount and type of material released).

Moreover, in a typical local threat scenario the time for reacting to a given release is short and the local meteorological conditions are unknown or not instantly available at the desired level of accuracy. Because of the variety of methodologies developed and applied by different organizations involved in emergency response management, even for a well-defined release scenario a variety of answers can be expected to be given to the emergency response personnel.

Research activities focusing on local-scale hazard dispersion are typically based on national activities and generally lack a concerted approach at European level. A dedicated interdisciplinary and inter-institutional platform for scientific information exchange, consensus building and model improvement is thus required. COST provides the best available mechanism for broad European networking and capacity-building. A COST Action is the most appropriate framework since only in a non-competitive, interdisciplinary environment it will be possible to identify and verbalize the weaknesses and uncertainties related to local-scale emergency response modelling approaches, to develop common strategies for improving the performance of such tools and to develop and broaden the available research expertise.

The intended COST Action will involve, support and harmonize the various existing national activities but will explicitly extend the scientific focus towards short-term and local-scale threats, which most often concern the local emergency services. It will benefit from the results of previous COST Actions, such as 615, 710, 715, 728 and 732. One innovative aspect of the proposed Action is the effort of bringing together scientists and experts in emergency response in order to push development and implementation of state-of-the-art scientifically justified methodologies of local-scale airborne hazard modelling in emergency response systems. In order to ensure a direct impact of the scientific output, the Action is characterized by a high level of specialization and is aiming at a well defined target. Based on the joint expertise and contacts with international programmes, the Action will harmonize with the most recent developments in the USA and Japan.

B.2 Current state of knowledge

The European Security Research Advisory Board ESRAB formed in 2005 signalized Europe's intent to significantly contribute to homeland security research. Member States are encouraged to develop national security research programs and a significant amount of EU research funding is attributed to security-related research whereas emphasis is put on increasing the security of citizens. Contributions were made, for example, within FP6 by the EURANOS project, focusing on nuclear and radiological emergency management and rehabilitation. Larger-scale emergency response and decision support systems such as RODOS were established and improved, providing real-time on-line decision support for off-site nuclear emergency management in Europe. The ARGOS consortium formed by several European countries as well as Australia, Brazil and Canada, developed an information system for enhancing Crisis Management for incidents with CBRN releases. The EU/ESA GMES initiative (Global Monitoring for Environment and Security) has been successfully established, implementing an Earth observation service system based on satellites as well as ground based and flying sensors to monitor the planet's environment and to support the security of citizens. Within FP7, the GMES Emergency Project SAFER has just been initiated. SAFER will develop rapid mapping services for actors involved in crisis and emergency management and is intended to potentially address all types of disasters, including technological accidents and civilian-military crises. The 'Monitoring Atmospheric Composition and Climate' project (MACC), started in June 2009, aims at providing qualified inputs for local-scale air quality forecasts which may be useful for improved local-scale airborne hazards modelling as well. Substantial efforts are undertaken in order to improve sensor techniques and data collection using advanced technologies such as UAV's (e.g. COST Action ES0802) in order characterize local airborne hazards. However, it must be stated clearly that all local-scale monitoring activities generally lack predictive capabilities as they are needed for training for and respond to local scale airborne hazards. Despite the comprehensive activities listed above, an internationally harmonized effort in the improvement of local-scale airborne hazard modelling is still required.

Current transnational research activities are not sufficiently addressing the specific objectives of the intended Action. Here, the focus clearly is one of the most crucial and scientifically most challenging parts of emergency response systems – reliable modelling of airborne hazards dispersion at short and intermediate distances (from meters to few kilometres) and for the shortest release and response times (less than a few hours). Considering that typical industrial incidents or deliberate releases last less than an hour, the development of application-oriented tools and strategies substantially extending existing methodologies is likewise important and challenging. Instead of an overall widening of modelling capabilities, as done in other parts of the world, the innovative intention of this Action is to specify and possibly quantify the strengths and weaknesses of available modelling concepts. This will support focussed and efficient advances in neighbourhood-scale accidental release modelling. Within the COST Action the focus will be on conceptual and application-oriented scientific improvements rather than on model diversification.

B.3 Reasons for the Action

It is timely to introduce the Action since related national research activities are under way. Recently, the Austrian ZAMG reviewed the capabilities of existing modelling tools based on a limited set of test scenarios. The comprehensive study reveals clearly, that the selection of proper model input data, the choice of the model, as well as the model performance are crucial in reacting to local-scale, short-term threats. In France, the Ministry for Environment has established a Working Group dedicated to 3D modelling of local-scale accidental releases. This activity was initiated after discovering significant discrepancies between model results from established emergency response tools and results from more sophisticated tools applied to similar problems. In Germany, the Federal Office of Civil Protection and Disaster Assistance initiated a pilot study which intends to scientifically and practically evaluate a new approach to reliable local-scale airborne hazards modelling. Combining results from high-resolution pre-accidental modelling with an application-oriented data post-processing enables the results from complex, scientifically justified models to be used even for the purpose of local-scale disaster management and emergency response.

The Action is needed now, because ongoing research will benefit immediately in the context of the conceptual and application-oriented improvements achieved by the Action. The dissemination of the scientific results and the best practice recommendations produced by the Action, through publications and special sessions at conferences and workshops, will have an immediate impact on applied local-scale emergency response modelling and model development. On an intermediate-term perspective, the Action will reveal the weak points and limitations of currently applied local-scale emergency response models and approaches and will outline the most preferable direction for future developments. Recommendations will be based on a broader scientific base than national efforts can provide. In addition to the best practice recommendations given by the Action, a major outcome will be a comprehensive database, scientifically and practically qualified for benchmarking local-scale emergency response models. Although a few data sets do already exist from previous field and laboratory campaigns (e.g. Joint Urban 2003, DAPPLE, MUST), most of them have not been fully summarized, quality-assured and prepared for model evaluation thus far. In this regard, the Action will establish the basis for a dedicated application-oriented test data base for local-scale airborne hazard models, similar to those available for example for air quality modelling. Together with a complete inventory of available models and modelling systems, the Action will establish a scientific and methodical reference for local-scale airborne hazards modelling. Finally, the Action will help to improve the quality of hazardous materials dispersion models at regional and larger scales by providing a more reliable characterization of their initial dispersion conditions, particularly in complex structured environments. A more accurate representation of complex source terms will directly add reliability to this scale of emergency response modelling as well.

B.4 Complementarity with other research programmes

Europe-wide transdisciplinary co-operations, focussing on local-scale airborne hazard modelling do not yet exist. The ongoing research efforts are attributed mostly to the development of integrative emergency management tools such as GIS based decision systems, the use of information technology in the context of emergency management and to the development of technologies for improving the security of citizens (e.g. sensor/detector development). Recently (June 26, 2009), the European Commission proposed a new policy to enhance chemical, biological, radiological and nuclear security in the EU. In the EU Action plan, one key activity will focus on provision for and response to CBRN threats. In this context, the Action will provide a valuable scientific basis and essential background information needed for prospective concerted research activities in the framework of European security research. As stated above, the Action will complement ongoing and planned regional and large scale CBRN modelling activities by providing improved input data.

C. OBJECTIVES AND BENEFITS

C.1 Main/primary objectives

The main objective of the Action is to evaluate and improve the reliability of neighbourhood-scale emergency response tools based on a comprehensive and cross-national approach. This will be achieved by providing both a substantially improved scientific background and comprehensive practical guidance for the use of models for tracking and predicting the dispersion of airborne hazards, resulting from accidental or deliberate releases in complex urban and industrial environments.

C.2 Secondary objectives

- To collect, summarize and document information on national research activities in the field of local-scale airborne hazards modelling.

- To gather available scientific, operational, administrative and managerial expertise addressing the Action topic.

- To address the impact of uncertainties in source term descriptions for accidental or deliberate releases on risk assessment.

- To inventory models, tools and methodologies currently applied in the context of emergency management and local-scale threat reduction.

- To categorize and characterize local-scale threat scenarios considering the specifics of neighbourhood-scale dispersion of airborne toxic agents.

- To identify and document the practical problems encountered by first responders, personnel of civil protection, security management and stakeholders when confronted with outputs from modelling tools.

- To develop and establish scientifically and practically justified means and methods for assessing the performance of local-scale airborne hazard dispersion models.

- To collect, prepare and publish reference data sets qualified for testing the performance of local-scale emergency response models.

- To identify and document the limitations of different local-scale emergency response methodologies by assessing the actual uncertainty of model results.

- To define development requirements not only for the next generation of local-scale airborne hazards models but also for improving the quality of currently applied tools.

- To provide scientific advice and counselling for the organization of European research in the field.

C.3 How will the objectives be achieved?

- By combining scientific and institutional expertise: Directly linking scientists and developers with managers and stakeholders from civil protection and security authorities will facilitate the harmonization and synergistic interaction of the scientific knowledge with the operational practices for accidental release events. In the frame of the Action a Panel of External Experts, composed by civil protection and security personnel, will be established and will participate in key meetings, to ensure a continuous exchange of information and feedbacks during all the Action activity.

- By developing a cross-national transdisciplinary information forum: In this context, the Action will form a cross-national and multi-institutional platform collecting the necessary manpower and knowledge from the scientific community (Universities and Research Institutions) and legislative / executive bodies that will be maintained even beyond the Action. Web- and e-utilities will be implemented to manage the forum during the Action and in following years.

- By organizing a series of open workshops/symposia: Workshops/symposia with a clear focus on individual aspects of local-scale emergency response modelling will be organized by the Action at least once per year. At these events, topics such as threat characterization, tools and models applied, model testing, validation and implementation and the integration of models into existing and future (environmental and urban) information management systems will be discussed and documented. The workshops and symposia will widen the information input and foster the immediate dissemination of results produced by the Action.

- By implementing a continuous dissemination of results: The results produced by the Action will be published regularly by submitting papers on selected topics of the Action, presenting the Action results at international conferences and by publishing the proceedings of Symposia organized by the Action. Inviting stakeholders and members of corresponding legal bodies to meetings and symposia will significantly improve the information exchange between the scientific community and potential users.

- By organizing Short Term Scientific Missions (STSM): In order to intensify the work on individual tasks of the Action, such as preparing test data sets or testing local-scale emergency response tools, STSM's will be organized. The involvement of early-stage researchers and young scientists will be particularly encouraged.

- By maintaining a web page: A website will be established for efficient information exchange between the members of the Action, dissemination of results and for improving public awareness.

C.4 Benefits of the Action

- Forming a dedicated transdisciplinary cross-national pool of information exchange will be one of the generic benefits of the Action intended to last even beyond the lifetime of the Action.

- Bringing together experts from both the scientific developers of accidental release models and the operational communities will immediately help to increase the confidence and to improve the communication and information exchange between them. For example, the scientific community widely accepts that local-scale emergency response modelling requires dedicated approaches fundamentally different from standard air quality management tools. However, the executive bodies such as national and local civil protection authorities or emergency management are often not fully aware of the profound limitations of existing models and tools and the tremendous potential of new dedicated methodologies. Moreover, model development will be more efficient if developers maintain a professional dialog with end-users.

- With the scientific expertise and manpower provided by the COST Action, it will be possible to identify sources of modelling uncertainty. This will enable efficient targeted improvements such as a more reliable characterization of source terms or a scientifically justified representation of transient dispersion phenomena as they dominate the local-scale dispersion.

- European security research programs as well as local-scale emergency management will directly benefit from a documented standard for testing existing as well as future accidental release models and methodologies, enabling the quality of model results to be evaluated and compared based on objective criteria.

The practical guidance for a proficient use of local-scale airborne hazards dispersion tools to be developed within the scope of the Action will be particularly beneficial for executive bodies and decision makers.

C.5 Target groups/end users

Target groups for the outcomes of the Action are equally the scientific community as well as legislative and executive bodies. Model developers will be provided with tools and measures to asses the quality of time dependent local-scale dispersion modelling, to identify and quantify potential weak points and gaps and to improve model performance. The users and decision makers will get comparable information on different modelling approaches and an application-oriented practical guidance for the implementation of local-scale dispersion modelling in emergency management systems.

D. SCIENTIFIC PROGRAMME

D.1 Scientific focus

A broad consensus among scientists and decision makers exists regarding the imperative need to 'critically examine the observational and modelling tools used for tracking the atmospheric dispersion of hazardous materials and to assess the value of dispersion forecasts for providing useful information to emergency responders and the generals public' (National Research Council of the National Academies, 2003). The major tasks in such an initiative are

- to review the current suite of tools and models that are used in characterizing hazard dispersion and examine how these models are applied operationally for emergency response efforts,

- to identify deficiencies in the tools and models that limit their effectiveness and operational use in emergency situations and,

- to determine the observational and input data needed to initialize, test and use these models effectively and to identify ways to improve their accuracy.

The Action is arranged to address these three tasks in a comprehensive and scientific way.

Both developers and users of airborne hazards dispersion models have a mutual interest in assessing the performance and reliability of tools applied for emergency management. In order to measure the quality of model results and to improve the implementation of dedicated local-scale models, a task-specific validation and application procedure must be adopted. Assessing the fitness for purpose of different modelling approaches requires a structured set of local threat scenarios to be established. Test cases must clearly distinguish between building/street-scale scenarios, neighbourhood scale threats and larger threat zones in open terrain. In this context, possible sources and release situations have to be characterized and categorized considering specific model requirements. Already existing exposure indices, as defined for example by the ECETOC (European Centre for Ecotoxicology and Toxicology of Chemicals) have to be taken into account. Defining threat measures for groups of released agents (e.g. dosage-based or extreme-event-based exposure evaluation) and distinct release scenarios (instantaneous/continuous release, release after explosion/fire/leakage) will enable a qualified and precise definition of model requirements. Hence, one of the first scientific deliverables of the Action will be a state-of-the-art report on a modelling-oriented characterization of local-scale threat scenarios as seen by emergency management and first responders.

A second task to be coordinated and worked on by the Action is the setup of a dedicated comprehensive inventory of models applicable to local-scale accidental releases. In many cases, National and/or institutional inventories have been compiled but a complete and consistent European catalogue of tools and models is not yet available. Considering the variety of models and tools to be listed now and in the future, it will be a task of the Action to develop a flexible structured, relational model data base. This will enable efficient access to the desired information such as physical background, computational demands and information on model verification or related performance measures. More specific features such as backtracking sources from existing measurement data or interfacing with common information- and emergency-management systems will be documented as well.

Testing and evaluating available models by model inter-comparison as well as by comparison against test data from qualified field and laboratory experiments will be another important research task to be coordinated and worked on throughout the entire Action. Assuming that a typical emergency response model has already been validated with regard to local-scale dispersion modelling, the existing model evaluation and validation strategies (e.g. Model Evaluation Group, 1994 or COST 732, 2009) have to be extended towards task- and application-specific measures for accidental release scenarios such as extreme value prediction, backtracking verification, source reconstruction or exposure assessment.

In this regard, the provision of qualified and quality-assured model test data from field and laboratory tests is of utmost importance. Classification of existing test data with respect to completeness and usefulness for the present purpose is required. The uncertainty in the test data has to be assessed and - if possible - quantified. It is likely that only a few existing field and laboratory data sets will qualify for rigorous model testing. The information gaps in required data will be reported to scientists engaged in ongoing experiments in order to redirect funds and to influence pertinent experimental research. In this regard, it will be a scientific task of the Action to define desirable test scenarios for which data may be collected during field and/or laboratory experiments in the future.

A key task of the Action is to identify the main gaps, deficiencies and limitations in presently available knowledge and models and to determine the directions for the development of the next generation of models. Future models will not be just computationally faster and provide higher resolution than present ones but will have the potential to include substantially more detailed treatment of the source term and intricate processes characterizing the very early stages of an event at distances very close to the release location. Processes like fire and explosion dynamics, source aerosolization and heavy/light gases dispersion are not yet fully understood and often poorly parameterized in present models, thus scientific input is needed for corresponding improvements in future models.

A further scientific task to be addressed by the Action is the integration of airborne hazards modelling tools in existing and/or evolving information systems for urban/industrial emergency management. In this context it is important to consider not only the output results of local-scale airborne hazards modelling but also the possibility of information input, fed into dispersion modelling to improve the quality of model results, such as meteorological input data as they are available from localized chemical weather analysis and forecast systems. With the fast-changing information management systems (like GIS), particularly in urban environments, and the development of dedicated decision support systems in mind, it is of special importance to consider the definition and documentation of commonly accepted, bi-directional information interfaces. Collecting and integrating as much as possible information from outside of the Action for example by organizing workshops as mentioned in Section C will enable the information input to the Action to be maximized.

D.2 Scientific work plan methods and means

The scientific work of the Action will be carried out in three clearly structured task-specific Working Groups (WGs).

WG 1 **–** Threats, Models and Data Requirements - will characterize/categorize existing models, typical release scenarios, will compile, evaluate, possibly complete and document existing test data and will define application –oriented data requirements for further improvements in neighbourhood-scale airborne hazard modelling. Specific research questions asked and tasks to be performed will include:

- What are the currently applied models and methodologies and what is the current state-of-the-art in operational neighbourhood-scale emergency response modelling?

- Which model types and model systems are currently under development and favoured for future application?

- How are the emergency response models usually operated (pre-/post-accidental, on-site/off-site, operational/ event driven, manual/automated input, etc.)?

- How can models be efficiently classified regarding physical background, computational demands and application requirements?

- What information is available from past events of short-term releases of hazardous agents in urban and industrial environments?

- Which models are available, how have they been applied during actual accidents or training scenarios and how did they perform?

- What are the critical and challenging situations identified during a post-accidental analysis of real events?

- What are the threat scenarios and source terms specified by the different communities involved in local-scale emergency response such as civil protection, homeland security and industrial safety?

- What data is already available for testing emergency response models? Is existing data of sufficient quality?

As the first task, WG1 will summarize the state-of-the-art of emergency response tools for airborne hazards from accidental/deliberate releases in complex urban and industrial areas. A dedicated model inventory will be established. This inventory will also allow for model-specific guidance regarding an efficient and reliable use of different model tools. As a second task, WG1 will collect, characterize and document typical and relevant local-scale threats from releases of toxics in populated areas, guiding model development towards the present and future needs of emergency response management. A third important task to be performed by WG1 will be an application-oriented identification of critical model input requirements as well as the development of strategies for efficient provision of required data.
Deliverables: Based on previous and ongoing research work, a state-of-the-art report on applied local-scale accidental release modelling will be compiled, including

- a structured catalogue of threat scenarios and source terms of concern,
- a collection of complete data sets qualified for testing emergency response models, and
- a glossary of terms to be used throughout model development, evaluation and application.

WG 2 - Test, Evaluation and Further Development – will define (partially blind) test scenarios, will test and assess different modelling approaches and will develop scientific strategies for improving the implementation of corresponding tools. Simultaneously working on the testing of tools and models as well as on the improvement of their reliable implementation is expected to increase the efficiency of the Action. WG2 will comprise model developers and model users in order to facilitate a direct information exchange. Specific problems to be solved by WG2 are

- quantifying and documenting the performance of modelling approaches with regard to efficiency (speed and computational demands) and reliability (quality of application-oriented model results) based on qualified test schemes that will be developed,

- quantifying the scatter of results inherent in model results when different models and tools are applied to exactly the same threat scenario,

- quantifying the effect of uncertainties in input data (meteorology, release conditions, source term, etc.) on relevant model results such as cloud travel time and location, displacement of the maximum concentrations, dosage or the persistence of hazardous materials in built environments,

- developing and testing strategies for defining 'worst case' conditions to be applied when models are operated without detailed knowledge about the release and boundary conditions of an accident/release as usual for emergency response planning,

- demonstrating and evaluating the potential of integrated information systems as source of improved input data for simulations,

- developing and testing a structured application scheme for providing instant guidance in the selection of optimum simulation strategies for given threat scenario,

- developing model/tool-specific user training and guidance documents in the form of a dedicated best practice guideline

Deliverables: WG2 will generate the biggest scientific added value of the Action. In this context, the Action's scientific interest is not to rank or pillory individual modelling concepts but to facilitate open discussions on specific reasons for diverging model results and possible ways for improving modelling quality. As a results WG2 will deliver

- a critical review of the application-oriented model quality assurance procedures applied.

- The strengths and weaknesses of particular modelling concepts will be identified, quantified, and documented in order to stimulate further improvement of model quality.

- The requirements for future model developments will be developed and recommendations on necessary improvements and extensions will be outlined and published.

- The immediate dissemination of the scientific achievements will be facilitated by annual topic-oriented open workshops/symposia documenting the progress of the Action on a regular basis for a wider scientific- and user-community.

The proceedings of the symposia will be published as COST documents. The workshops/symposia on local-scale airborne hazards modelling are intended to be continued beyond the duration of the Action. A first version of a best practice manual for the application of neighbourhood-scale airborne hazards models will be compiled and released in order to immediately improve the quality of model results.

WG3 - Applicability, Implementation and Practical Guidance – will focus on the practical constraints in the use of local-scale emergency response models. The specific needs of first responders and authorities in charge of neighbourhood-scale emergency response management have to be taken into account in order to successfully implement the scientific improvements gained by the Action. WG3 will work together with the Panel of External Experts mentioned in section C.3, to ensure a bilateral feedback between the scientific and emergency management communities. From a clear user's point of view, WG3 will cover tasks such as

- to collect the requests and demands of the emergency-response experts for improving the practical applicability of the modelling systems,

- to provide guidance regarding the suitability of different types of model and methodologies for specific problems and at different stages of an incident,

- to give recommendations on the proper use of different models and methodologies and the reliable assimilation of measured data in the context of emergency response,

- to identify, characterize, visualize and quantify the uncertainties of emergency response modelling, enabling decision makers to interpret model results properly, and

- to support spokespersons, health authorities, social workers and others by providing reliable, proficient information regarding the consequences of the incident.

Deliverables: In WG3, end users manuals as well as guidance and training documents will be produced. The Action’s intention is not only to evolve scientific contents, but also to provide immediate practical tools. This will be emphasized by delivering/publishing

- a documentation of recommended application-oriented procedures for the use of local-scale dispersion models in the context of accidental releases and emergency management.

- information on what type of model(s) or approach(es) to be used for which type of release/threat scenario.

- quantitative information on the expected reliability / uncertainty of model results with reference to the quality and quantity of the input data available in a given scenario.

- practical guidance for the optimum use of models or modelling approaches and the meteorological input data required to improve the quality of model results.

In the last year of the Action, a summarizing report will be brought into a final form, peer-reviewed and published. It will be the task of the members of the Management Committee (MC) throughout the entire Action to actively promote the tools, strategies and standards developed by the Action not only in their member states or national bodies but also at the level of the European Commission and the European Security Research and Advisory Forum (ESRIF). The commonly accepted quality measures and application recommendations for specific models and modelling strategies will put pressure on model developers to carry out and document a commonly accepted quality assurance procedure and to improve modelling capabilities not solely driven by commercial interests. Similarly to previous COST activities, the Action is expected not only to improve the quality of model results but also to develop the 'culture' of using such tools for example by a scientifically justified selection of proper tools for a specific release scenario.

E. ORGANISATION

E.1 Coordination and organisation

The Action will last 4 years and is operated with a flat organizational structure, in full accordance with COST guidelines.

Since bridging the information and knowledge gap between model developers, test data providers and the users of emergency response tools is one of the explicit goals of the Action, the three groups have to be properly represented in the organizational structure. Thus, it is intended to support the Chair of the Management Committee by two Vice-Chairs instead of only one as usual. The Chair and the Vice-Chairs shall represent each of the participating communities.

During the first meeting of the Management Committee the implementation of tasks described in the Memorandum of Understanding will be particularized, complemented and finally agreed on. The Working Groups will be established, the Working Group Chairs, Vice-Chairs and Rapporteurs will be elected and the participants will be requested to specify their contribution and goals by an Expression of Commitment. Early stage researchers will be involved in the management of the Working Groups whenever available and possible. A panel of External Experts will be formed based on existing contacts with leading professionals in the field of emergency response. As a first milestone, within the first six months of the Action a dedicated website will be established to provide access to the Action's results and products. In particular, the emergency response tool inventory and scientific results, such as test schemes and data will be published on this website as soon as they are available and released by the Action. In order to facilitate information exchange within the Action and with other experts from outside the Action, a GoogleGroup will be established and maintained.

The next milestone of the Action will be the first workshop/symposium after the first year of the Action, focussing on the state-of-the-art report on emergency response modelling.
The main scientific work of the Action will occur during the entire second and third year as well as parts of the fourth year of the Action. During this period the Action members will rigorously test and evaluate modelling approaches, will identify and verbalize weaknesses and work on improvement strategies from both the scientific and the end users perspective. Moreover, the focus will be on identifying new algorithms, techniques and methodologies for improving model performance. Since the topic of the Action is continuously developing and under active research, a significant number of contributions are expected to originate from ongoing PhD studies and related national research projects. In this context, the Action will encourage the active participation of young scientists and early-stage researchers in order to develop their capabilities in cross-national networking and concerted research activities. Young scientists will be requested to be responsible and leader of sub-groups dealing with specific topics within the activity of the main WGs. As an efficient way of actively incorporating young scientists in the Action, STSMs will be organized and coordinated by the MC.

As another organizational task, annual and thematically focussed symposia will be organized as described in section C, facilitating the immediate dissemination of results of the Action and the continuous collection of valuable input from outside the Action. The Symposia will be organized either as a part of larger conferences or as an independent, cost-efficient series of meetings to be continued even once the Action will end. The symposia will be part of the milestones of the Action, which will be summarized in a series of proceedings.

In order to intensify the dissemination of the results of the Action, the annual symposia will be accompanied, at least twice, by Training Schools on Emergency Response Airborne Hazards Modelling. Primarily, the Working Groups will present the results of their work, involving lecturers from all three participating communities. The intention is to familiarize both junior and senior researchers and qualified users with the new concepts in quantifying the reliability of emergency response model results and improving their practical implementation as they are developed by the Action. The Training Schools will provide an ideal platform for establishing dedicated think tanks, formed by young scientists.

In order to maximize the efficiency of work, it is intended to combine MC meetings with joint Working Group meetings, minimizing the costs for travelling.

E.2 Working Groups

The Action will be based on three Working Groups (WGs):
WG 1: Threats, Models and Data Requirements
WG 2: Test, Evaluation and Further Development
WG 3: Applicability, Implementation and Practical Guidance

The Working Groups will be operated simultaneously. Each Working Group will have a responsible Group Leader, a vice-coordinator and a 'Rapporteur' responsible for collecting scientific results within the WG, presenting them during joint wrap-up meetings and ensuring all valuable results to be included in reports.
When organizing the Working Groups it will be intentionally avoided to separate participants into 'model developers', 'data providers' and 'model users' in order to promote and encourage a direct as possible interaction of all three communities involved in the topic.

E.3 Liaison and interaction with other research programmes

As with every atmospheric dispersion model, the quality and reliability of emergency response dispersion tools largely depends on the provision of sufficiently accurate initial and boundary conditions for model simulations and threat predictions. Whereas boundary conditions can be properly defined for releases modelled in a laboratory and - at least to some extend - for past events at full scale, it is still difficult to access real-time or now-casted weather conditions in the case of an accident. In this context, information from COST Action ES0602 'Towards a European Network on Chemical Weather Forecasting and Information Systems' will be collected by the MC and integrated into the Actions' research activities. Exchange of information will be organized by inviting experts to contribute to the Symposia and possible to corresponding Working Group meetings.

By the time the proposal is prepared, similar concerted actions focussing on quality assurance and improvement of local-scale emergency response models are under preparation in the US and Japan and probably in other countries as well. Information exchange with these activities has started and will be continued in the context of the annual Symposia as well as based on direct contacts between members of the MC and colleagues from the US and Japan.
Although no particular formal liaison or interaction with other research programmes is proposed at present, the Action will remain open to cooperation with complementary activities or programmes not envisaged in the proposal.

E.4 Gender balance and involvement of early-stage researchers

This Cost Action will respect an appropriate gender balance in all its activities and the Management Committee will place this as a standard item on all its MC agendas. The leading role of responsibility in the chairing positions, in the MC and in the WGs will be assigned with a gender-balanced approach whenever possible, on the basis of personal availability. The Action will also be committed to considerably involve early-stage researchers, also in leading roles, as previously described. This item will also be placed as a standard item on all MC agendas.
As indicated in section E.1, the Action will provide and encourage young scientists' participation also by arranging for STSMs, particularly for early-stage researchers. Their contributions will be presented at the annual Symposia. The Training Schools, organized by the Action, as well as the engagement in the management of Working Groups is intended to stimulate the interest of young scientists during the most crucial stages in their scientific career.
The MC will reflect efforts to ensure gender balance during the organization of the symposia in invitations, also for key notes, for WG management and for lead authorship of reports and publications. Early stage researchers will be asked to take care of after-Symposia tasks (preparation of reviews, data collection, etc.), preferentially within the scope of Short Term Scientific Missions combined with research visits at guest institutes.

F. TIMETABLE

The Action will run for 4 years.

During the first half year of the Action the Management Committee particularizes, completes and finally agrees on the implementation of tasks described in the Memorandum of Understanding. A survey workshop will be organized and the basis for the projected scientific work will be established. Results achieved within the first year of the Action will be released in a first jointly published document available at the first Symposium.

The main research work will be conducted within the Years 2 and 3 and possibly a fraction of Year 4. During this period of time the focus of the Action will be on rigorously testing different local-scale hazard modelling approaches and evaluating and quantifying the quality of model results in the context of local-scale emergency response management. Best practise guidance and user training documents will be developed jointly within the Action and test data sets will be prepared for release. In an iterative process, strategies for improving model results and practical guidance concepts for applying models proficiently will be developed and documented. Symposia will be organized preferably on an annual basis and, on average, three MC/WG meetings per year will be held to maintain the momentum of the Action and to closely follow after the Members' activities. The Panel of External Experts will participate in the Symposia and key MC/WG meetings.

Year 4 of the Action will be dedicated to the compilation of a final document summarizing the developed practical guidance for the proficient use of local-scale dispersion modelling in the context of emergency management and response. A final workshop/symposium will provide a suitable platform to disseminate the results to a wider scientific and institutional community. Well known scientists and stakeholders from around the world will be invited to take part in the final workshop.

G. ECONOMIC DIMENSION

The following 16 COST countries have actively participated in the preparation of the Action or otherwise indicated their interest: AT, CZ, DE, ES, FI, FR, EL, HR, HU, IL, IT, NL, NO, PT, SI, UK. On the basis of national estimates, the economic dimension of the activities to be carried out under the Action has been estimated at 64 Million € for the total duration of the Action. This estimate is valid under the assumption that all the countries mentioned above but no other countries will participate in the Action. Any departure from this will change the total cost accordingly.
Japan and USA have also expressed their interest to participate to the Action.

H. DISSEMINATION PLAN

H.1 Who?

Results of the Action will be equally important for model- and tool-developers as well as the 'users' of emergency response systems and decision makers at a local, regional, Governmental and European level. Scientists and decision makers that actively contribute to the Action are expected to establish connections with their local authorities and at the same time maintain contacts with bodies at a regional or national level. The Management Committee will be able to invite a large number of model developers, users and decision makers to join the annual Symposia, where all relevant results of the Action will be disseminated. The latter will benefit from the Action by obtaining quantitative estimates of the 'uncertainty' to be considered in the decision making process and to obtain practical guidance in using the available tools. Particular attention will be paid to policy and decision makers, i.e. to propagate the results to local authorities in charge of emergency management as well as to national and European Bodies involved in civil protection. Numerous national bodies have indicated high interest in a possible implementation of the Actions outcome (e.g. ISPESL in Italy, Federal Office for Radiation Protection and the Federal Office for Civil Protection and Disaster Assistance in Germany, National Protection and Rescue Directorate in Croatia, the Portuguese National Authority of Civil Protection, the National Institute for Public Health and the Environment in the Netherlands, INERIS - Institut National de l'EnviRonnement industriel et des rISques and IRSN - Institut de Radioprotection et de Surete Nucleaire in France, the Czech State Office for Nuclear Safety and others).

Research frameworks and Academia will benefit from the results of the Action by getting a scientifically based and commonly accepted evaluation scheme of current modelling systems and a clear guidance for further focused research and development in order to improve the overall quality of emergency response dispersion modelling. The Action will facilitate concerted scientific research across the member states.

H.2 What?

The results of the Action will be disseminated to the scientific community through usual methods for scientific research such as international conferences. Information will be released via a dedicated web site, published reports and peer-reviewed publications. Specific to this Action, it will not only deliver scientific output but also products to be used by decision makers and legal bodies involved in public security. Depending on the resources available to the Action, electronic/audio-visual training tools for decision makers can be delivered.
Thematically focused Symposia as well as the Action's website will provide an excellent platform to reach the scientific community and the policy and decision makers.

H.3 How?

An efficient way for reaching a wider target audience is to provide permanently updated information on the Action's website and to announce changes of the information content via Twitter or RSS feeds. In order to minimize printing costs while providing the most recent information, reports will be published mainly as downloadable versions at the website, providing only a limited number of hardcopies. Advertising the information available on the website will be done by flyers with continuously updated information on the Action. These will be distributed at conferences and workshops or sent directly to members of the target audience.
Contributions at established international meetings such as Conferences on Urban Air Quality or Emergency Management, the Harmonisation within Atmospheric Dispersion Modelling for Regulatory Purposes or the NATO/ITM Conferences on Air Pollution Modelling and its Application will be made.

The proposed dedicated, application-oriented Symposia will be organized by the MC Chairs and WG coordinators in order to actively promote the dissemination of the most recent results of the Action. This enables relevant audiences to be targeted directly. In this context, special efforts will be made to invite keynote speakers and to publicise the Symposia outside the Action.
The dissemination of results will be carefully evaluated by the MC members at least on a yearly basis. If dissemination of results can be improved by using additional dissemination methods, corresponding actions will be taken by the MC.