European Cooperation in the field of Scientific and Technical Research
- COST -
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Secretariat

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COST 267/06

MEMORANDUM OF UNDERSTANDING

Subject :	Memorandum of Understanding (MoU) for the implementation of a European Concerted Research Action designated as COST Action 929 A European Network for Environmental and Food Virology (ENVIRONET)

Delegations will find attached the Memorandum of Understanding for COST Action 929 as approved by the COST Committee of Senior Officials (CSO) at its 165th meeting on 27/28 June 2006.

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MEMORANDUM OF UNDERSTANDING
FOR THE IMPLEMENTATION OF A EUROPEAN CONCERTED RESEARCH ACTION DESIGNATED AS

COST ACTION 929

A European Network for Environmental and Food Virology
(ENVIRONET)

The signatories 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 400/01 "Rules and Procedures for Implementing COST Actions", or in any new document amending or replacing it, the contents of which the Signatories are fully aware of.

2. The main objective of the Action is to construct a network of expert European scientists, who will cooperate to promote the study of, and to tackle the issues associated with, food- and environmentally transmitted pathogenic viruses.

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 Euro 30 million in 2005 prices.

4. The Memorandum of Understanding will take effect on being signed by at least five Signatories.

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 6 of the document referred to in Point 1 above.

COST ACTION 929

A European Network for Environmental and Food Virology (ENVIRONET)

A. ABSTRACT

The ENVIRONET COST Action seeks to strengthen the area of food and environmental virology in Europe. Cooperation between experts and research teams will establish systems for effective European responses to viral hazards associated with food and environmental contamination, and promote the production of effective analytical tools for food and environmental virological analysis. Information and knowledge will be gathered on identification of environmental viruses and the implications of their presence for public health, and strategies for controlling food and environmental contamination will be determined. The outcomes of the Action will be disseminated to various European stakeholders, leading to a better understanding of the role of food and the environment in the transmission of enteric viruses.

B. BACKGROUND

Environmental Virology is the study of viruses which can be transmitted through water, sewage, soil, air, fomites or food. Such viruses will include human and animal pathogens which may contaminate food or enter the environment through faecal shedding by infected individuals or through sewage pollution, and be transmitted back to susceptible individuals to continue the cycle of disease. This cycling of viruses may result in sporadic infections or outbreaks of disease.

Previous research

The origins of environmental virology lie in the work of Melnick and others who in the 1940s demonstrated that poliovirus could be detected in sewage. Subsequent studies showed that a variety of viruses shed from the intestines of healthy and ill individuals could be detected in a range of water types. Although the range of viruses detectable was largely confined to the enteroviruses and phages, many studies showed that these agents persist and survive in the environment longer than bacteria and are also resistant to disinfection. Further work in the late 1980s showed that shellfish harbour enteroviruses and phages and, more importantly, hepatitis A virus, even after depuration in fresh water, and that consumption of oysters and mussels grown in polluted water may constitute a hazard to human health.

Although work on enteroviruses provided much useful information on the behaviour of viruses in the environment, little work was done on the most important perceived hazard, the viruses of gastroenteritis, until the sequencing of the Norwalk virus genome in 1990 permitted the detection of this agent by the polymerase chain reaction. It is now possible to detect them and other enteric viruses not only in sewage but in polluted irrigation waters, drinking waters and contaminated foods.

Current state of the art

Noroviruses are now recognised as the main agent of foodborne gastroenteritis, causing many thousands of infections annually in Europe. A recent large outbreak in Denmark was attributable to contaminated raspberries. Noroviruses are difficult to study, since they do not grow in the

laboratory in any current cell line, and consequently much remains to be learned about their survival characteristics and response to disinfection and elimination procedures. It is however becoming more possible to evaluate their prevalence in the environment and potential contamination of foodstuffs, through the application of new molecular tools such as real-time polymerase chain reaction (PCR) and nucleic acid sequence-based amplification (NASBA). Another significant enteric virus is hepatitis A virus (HAV); its endemicity is low in most European countries, but the level of immunity within many populations is declining, which may encourage large outbreaks. The environmental prevalence of this virus is however not fully known. Some anticipated participants in the Action are already developing sensitive procedures for the detection of hepatitis A virus and norovirus in water, shellfish, and fresh produce. Sequencing of viral genes facilitates the uncovering of relationships between strains and enables tracing of the origins of outbreaks. It is now possible to detect viruses in food and the environment, and by sequencing to relate these isolates to reported outbreaks where the agent has also been isolated and sequenced. Such tracing has epidemiological, legal and commercial implications. However, no formal system is in place for food or environmental surveillance, or regular acquisition and analysis of environmental data.

Studies on the environmental survival and persistence of viruses have provided greater comprehension of the extent of the hazards these pathogens pose, particularly in water, where European groups have found viruses such as astrovirus and hepatitis A viruses to be able to persist for weeks and even months. Little work however has been performed to study virus survival in soils, air, and food in Europe, compared with North America. Data concerning virus survival in the environment, virus elimination during waste treatment or food processing, or inactivation of viruses by disinfection during sewage/water treatment, are of high importance for risk assessment. In environmental virology, risk analysis is still a relatively new discipline, though governmental institutions and industries within the EU are starting to utilise this approach as a tool to identify, assess and manage risk.

Complementarity with EU Programmes and National Projects.

Several teams in Europe are involved in research in different aspects of environmental virology. The principal scientific areas in the Action are Current and Emerging Issues, Analytical Methods, Stability of Viruses, and Data Analysis. In each area, many national projects, and some international ones, are underway, or will commence within the time-frame of this Action.

There are several national projects concerned with elucidating the involvement of food and the environment in the transmission of viral disease, and studying the implication of the presence of established and emerging pathogens. For instance in countries such as Germany, Greece, Italy, Norway and Poland work is underway to try to determine the extent of the presence of various viral pathogens in such matrices as foods, water and sewage. In Cyprus, a surveillance programme is being carried out to determine the frequency of poliovirus in sewage, in connection with the WHO guidelines on eradication of poliomyelitis. In the Netherlands and in Spain several projects are being conducted to assess the prevalence of the emerging hepatitis E virus (HEV). In France and Spain several projects are being conducted to investigate stability of viruses, in water and foodstuffs; while in Italy work is underway to study elimination of viruses from shellfish.

International projects include the FP6 project VIROBATHE, in which several anticipated participants in the Action participate. This project is in support of a proposed revision of a European Directive (76/160/EEC) to include analysis of noroviruses and adenoviruses in European bathing waters. Among the principal aims of this project are preparation of the technology for new Member States as part of the development of their environmental and social programmes, and sharing of technology between laboratories to achieve wider competence in the virological analysis of environmental materials. In Summer 2005, in response to a call in FP6 Thematic Priortity 4 “Emerging pathogens in drinking water sources”, several anticipated participants in the Action

submitted a project for funding. The proposed project (MICROSOURCE) will focus on health effects associated with the following microorganisms seen as emergent pathogens: hepatitis E, caliciviruses, new human enteroviruses, and adenoviruses.

Why COST?

The Action will greatly enhance dissemination of the knowledge accrued from the various national and cross-national projects in Europe, through establishing a network for formal organised communication, through promotion of exchanges between laboratories, and not least through the symposia and workshops which will be specifically designed to include members of the scientific, regulatory and industrial communities. Also, the Action will promote cooperation between food and environmental virologists from European regions, who may otherwise have a more limited sphere of collaboration. For instance, anticipated participants from the Nordic states are involved in a project to develop and standardise methods to detect viruses in food and water. The Action will facilitate cooperation between this group and colleagues in a wider European theater.
At present there is quite a degree of fragmentation amongst the various European groups studying aspects of food and environmental virology. The issues pertinent to viruses in foods and the environment are common throughout Europe, and affect all Europeans; therefore it is vital that European scientists cooperate more closely to tackle them. A COST Action is the ideal framework for establishment and promotion of the necessary formal cooperation. Many projects, currently being performed in isolation through national funding, will benefit significantly through the Action, since the Action will eliminate overlaps, facilitate collaboration, and make more efficient use of resources, and thus amplify the value of the research for all European stakeholders.

Cooperation between scientists in environmental and food virology is vital to strengthen the recognition that viruses in food and the environment pose a significant threat to public health in Europe. A network will facilitate integrated approaches to existing issues regarding environmental transmission of viral pathogens, and integrate responses to new problems or emerging diseases. A COST Action will provide that network by bringing together European Union and Associated State research teams working on specific topics, allowing them to share information, harmonise experimental approaches, validate and standardise methodology, and consolidate communication. Not least, the network will lead to formation of pan-European consortia to prepare research proposals to address any relevant European calls, and will also facilitate formulation of concept recommendations to relevant European authorities. The support for short-term scientific missions and exchanges available through COST will enhance integration between the various research teams. Finally, supporting the network by funding annual meetings and conferences specifically devoted to environmental and food virology would promote the establishment of the area as a recognised scientific discipline in its own right.

C. OBJECTIVES AND BENEFITS

The main objective of the Action is to construct a network of expert European scientists, who will cooperate to promote the study of, and to tackle the issues associated with, food- and environmentally transmitted pathogenic viruses.

The aim of the Action is to increase the knowledge of the role of the environment and food in the transmission of enteric viral disease.

The secondary objectives are based on the Action's Working Groups (WGs) and Management Committee (MC) objectives:

- To establish systems for effective European responses to current and emerging viral hazards associated with food and environmental contamination. (WG1)

- To promote the production of the most effective analytical tools for food and environmental virological analysis. (WG2)

- To gather information and knowledge on identification of environmental viruses and the implications of their presence for public health, and formulate systems to acquire optimal information from data on the prevalence of viruses in foodstuffs and environmental matrices. (WG3)

- To evaluate the elimination and degradation characteristics of indicator targets able to model viral behaviour in different environmental matrices. (WG4)

- To establish a programme of short-term scientific missions, and exchanges between laboratories (a) to facilitate the transfer of knowledge and technical information from the more experienced laboratories to those wishing to increase their experience in food and environmental virology and (b) to facilitate harmonisation between laboratories engaged in complementary studies; and (c) to promote educational exchanges. (WG2)

- To disseminate the outcomes of the Action, through meetings, symposia, workshops, publications and the Internet. (MC)

The benefits will be manifested through the deliverables:

- An updatable Food and Environmental Virology Project Database (WG1)
- An algorithm for acquisition, evaluation and interpretation of environmental data (WG1).
- A documented structure for an environmental surveillance network (WG1)
- Implementation of new skills and knowledge in developing laboratories (WG1)
- The identification of at least one method for each target and each (group of) environmental matrices. (WG2)
- A guideline on internal and external quality controls, to be used both for the conduct of research projects and sample analysis. (WG2)
- A series of reports from short-term scientific exchanges (WG2)
- A statistical tool for evaluation and interpretation of environmental data (WG3)
- A modelling tool for quantitative assessment of risk of viral diseases contracted via the environment and foods. (WG3)
- A definition of the relative resistances of each target used in food and environmental virological analysis (phages, infectious viruses, RNA / DNA viral genomes) (WG4)

- A definition of the resistance characteristics of viral indicators for each group of environmental matrices (WG4)
- The proposition to end users and industries of a target or a group of targets for detection of virus contamination (WG4 with WG2)
- A definition of the critical points for the estimation of viral inactivation, based on a HACCP-style approach (WG4)
- Two symposia on current and future issues in food and environmental virology (MC)
- Two workshops: one on analytical methods implementation, the other on use of the statistical and modelling tools (MC)
- A regular newsletter (MC)
- A series of focused publications (MC)
- A publicly accessible website. (MC)

D. SCIENTIFIC PROGRAMME

The objectives will be achieved through a coordinated scientific programme organised through Working Groups (WGs). The WGs are designed to encompass a complementary and interacting sequence of topics: what are the issues in food and environmental virology – how to gather information? – How to analyse the information? – How to control the problem? The objectives of each consecutive WG are focused on these topics in turn; and the deliverables of the WGs will lead to a better understanding of the role of food and the environment in the transmission of enteric viruses.

The WGs are:

WG1 Current and Emerging Issues

WG2 Analytical Methods

WG3 Data Analysis

WG4 Stability of viruses

WG1 Current and Emerging Issues

This Working Group will bring together a Network of expert European scientists, who will cooperate to establish systems for effective European responses to current and emerging viral hazards associated with food and environmental contamination.

The principal viral agent of gastroenteritis, Norovirus, is endemic within Europe, and food- and waterborne transmission is thought to contribute significantly to the incidence of cases and outbreaks (Koopmans et al., 2003), and these viruses have been detected in water, food and sewage in European countries (Hörman et al., 2004; Le Guyader et al., 2004; Lodder et al., 2005). Also endemic, albeit in most countries at low levels, is HAV; this agent has also been detected in European food and environmental samples (Bosch et al., 2001; Chironna et al., 2002; Croci et al., 1999; Pina et al., 2001). Especially in France, the Netherlands and Spain, the health aspects of transmission of viruses by foods (particularly shellfish) and water are being studied, but the scope of such studies needs to be widened to include all European regions. Currently, although there are systems in place for viral disease surveillance in Europe through the analysis of clinical and veterinary samples, there is no system in place for food or environmental surveillance following an outbreak of disease implicated to an enterically transmitted pathogen. Such a system would provide essential information on the extent of public exposure to a viral pathogen, and thus aid in applying measures to limit exposure and protect public health. Through the series of meetings, WG1 will consider the actions necessary to provide information on any involvement and extent of food and environmental contamination after a reported outbreak. These actions will be defined in algorithm format. The WG will also devise a structure for an environmental surveillance network in Europe, based on the Action participants' laboratories in each country. The details of this surveillance network will be documented and presented as a deliverable for consideration by national and international public health and regulatory bodies. The extent of the possession of the required expertise and facilities in each country will be determined by the WG, and, via a programme of short term scientific missions, specific targeted training will be organised where necessary to build experience in individual countries.

WG1 will also consider the issue of emergent food- and waterborne viral pathogens. Emergent water- or foodborne diseases can be defined as those that have newly appeared, or are rapidly increasing in incidence and / or geographic range, or those for which water or foodborne transmission routes have only recently been recognised because methods for their detection have become available. It is difficult to predict when or where a new pathogen might emerge, or what its impact might be, and effective investigation at the first sign of emergence of a new disease is vital. Many more viruses are enterically transmitted than previously thought, including "respiratory" viruses such as various adenovirus groups. Another example of an emerging virus is hepatitis E virus (HEV). HEV can be found in some animals such as swine and deer in the Far East, and has been detected in pigs, in slaughterhouse sewage and in urban sewage in some industrialised countries of Europe, areas previously considered non-endemic for the virus (Pina et al., 2000, van der Poel et al, 2001; Widdowson et al, 2003). The prevalence and survival potential of this pathogen needs to be determined in order to assess the degree of environmental exposure within the population. Another example is the viral agent of avian influenza, which, as recent experiences in Asia have demonstrated, could be a significant future public health threat. This virus can be excreted in the faeces of infected birds, but its potential for environmental survival and therefore for transmission to susceptible hosts is unknown. National research projects, particularly in the Netherlands, are beginning to investigate some aspects of environmental survival and transmission of avian influenza, but there is an imperative need for international research here, and WG1 will play an important role since a critical mass of expertise will be available within this Action to enable informed and detailed research requirements to be formulated. Other areas to be addressed by this WG include: (a) surrogates for food and environmental studies on hazardous viruses; (c) food and water monitoring schemes for poliovirus surveillance for support of European and global eradication strategies; (d) deliberate release of viral pathogens into the environment through bioterrorism.

Deliverables of WG1:

- An updatable Food and Environmental Virology Project Database (containing non-confidential project details)
- An algorithm for acquisition, evaluation and interpretation of environmental data.
- A documented structure for an environmental surveillance network.
- A report on the implementation of new skills and knowledge in developing laboratories.

WG2 Analytical Methods

This Working Group will bring together a Network of European scientists, expert in the detection and analysis of pathogenic viruses in food and environmental matrices, who will work in cooperation to promote the production of the most effective analytical tools for food and environmental virological analysis. Within WG2 there will be a subgroup to oversee the programme of targeted short-term scientific missions, and a quality subgroup.

A critical factor in understanding the role which the environment and foods play in the transmission of viral disease is the ability to detect viruses therein. In some circumstances, such as food or

environmental samples harbouring very low loads of viruses, exquisite levels of sensitivity can make a difference. Virus levels may be extremely hard to detect and yet they can cause disease. Technical limitations in the extraction/detection methodologies can hamper virus analysis. At the present time, the virological quality of a food or environmental matrix can be investigated using different approaches.

The indirect approach consists of estimating any presence or extent of faecal pollution. Faecal bacterial indicators (*E. coli*, *Enterococci*) are usually used, and their acceptable levels are prescribed in regulations. However, it is known that their behaviour is different from enteric viruses, and therefore in some cases viral pollution is underestimated. Faecal bacteriophages (somatic coliphages, F-specific RNA phages or *Bacteroides fragilis* phages) have been proposed as indicators of viral pollution, as because of their viral nature their behaviour should be closer to pathogenic enteric viruses. Moreover, they can be detected by culture methods, and therefore their viability or infectivity is clearly demonstrated.

The direct approach to detection of pathogenic enteric viruses involves the use of cell culture or molecular biological techniques. Cell culture detects only infectious viral particles, but is not usable for uncultivable viruses (e.g. Norovirus, HEV) and is very time consuming. Molecular-based methods, although very powerful (being sensitive, specific and rapid), do not give any information about the infectious state of the detected virus. This makes interpretation difficult in some cases, for example what is the actual significance of a positive result in an environmental matrix? Is there a relation between the presence of hundred base pair of genome and the presence of the whole infectious particle?

Furthermore, detection of viruses in food and environmental matrices can require extensive extraction and concentration procedures, so that the virus particles can be delivered to a final detection system. A variety of procedures exist, such as filtration, flocculation, and centrifugation, and are being applied in various European and national projects concerned with detection of viruses. It will be highly beneficial to harmonise these different developmental programmes, so that the final analytical methods conform to basic common principles (defined extraction efficiency, detection probability etc.), and that suitable approaches for specific conditions and how to interpret positive results are defined. Currently, there are no European standard methods for detection of enteric viruses in waters and foodstuffs. Some European groups (most of whom are expected to participate in the Action) are working to propose standardised methods to detect viruses in food and water matrices. Work by CEN/TC230/WG6 in respect of enteroviruses in water and CEN/TC275/TAG4 in respect of noroviruses and HAV in food, will take the science into a regulatory framework. Several anticipated participants in the Action are members of the above committees, and information obtained through the network provided by the Action will be useful to informing their activities, and avoiding contradictions within individual European methods development projects and the aims of the European standardisation committees. Proposals to validate standardised methods will be more easily formulated due to the critical mass of European scientists involved in WG2 (and especially with the approval of regulatory bodies, whose participation will be encouraged within the Action); and the WG will consider the recommendation of validation studies to the Commission.

The ideal approach, or the ideal target which can be universally used, does not exist. But the diversity of the targets available (phages, bacteria, infectious virus, viral genome) and the diversity of methods of extraction / concentration should allow to reach a more precise estimation of viral pollution in water and food matrices. In consequence the main objective of WG2 is to evaluate the potential of each target organism to indicate viral contamination, taking into account the particular characteristics of each matrix (mineral or distributed water, raw or treated food etc.). Without trying to identify a universal indicator, the WG will focus on the specific characteristics of each matrix; then, in cooperation with WG4, the resistance characteristics which the indicator should have will

be defined. The activities of WG2 will overlap with WG4, as it is very important to understand the stability of each target in each matrix, because that is a key factor in the interpretation of positive results in food or environmental analyses. The outcome will be the proposition of a target specific for each matrix and each scenario.

A subgroup within WG2 will oversee a programme of short-term scientific missions (STSMs), and exchanges between laboratories. This will have three main purposes: (a) the transfer of knowledge and technical information from the more experienced laboratories to those wishing to increase their experience in food and environmental virology and (b) to facilitate harmonisation between laboratories engaged in complementary studies; (c) to organise educational exchanges.

Transfer of knowledge and technical information

The first task of the STSM subgroup will be to compile a skills inventory of all participating laboratories in the Action. This inventory will be circulated to all partners, so that each partner may identify laboratories which possess knowledge that they would be interested in acquiring themselves. Then, a formal approach will be made from the "trainee" laboratory to the "trainer" laboratory. Exchange scenarios would be a) the trainee laboratory sends scientists to the trainer laboratory to learn new skills; b), the trainer laboratory sends scientists to the trainee laboratory to teach new skills; or c), a two-way exchange takes place. A detailed workplan with deliverables will be devised by the laboratories, to be submitted to a formally constituted subgroup, which will allocate funds to facilitate the exchange based on rigorous review procedures. WG2 may recommend scientific exchanges where there is a clear requirement for laboratories in a particular country to acquire specific skills or knowledge. The WG may also recommend exchange or dissemination of technical information (such as standard operating procedures etc), where sufficient skills exist in a particular country but technical experience of certain specific areas is lacking.

Harmonisation between laboratories engaged in complementary studies

This activity will be closely linked with Working Groups 1, 2 and 3. Several scientific teams in Europe are working in related areas (e.g. risk analysis, development of detection methods etc.). The STSM subgroup will compile a list of the food and environmental virology projects which are being conducted throughout the Action. The leaders of WGs 1, 2, 3 and 4 will use this information to suggest where independent research activities could profitably exchange information on methods, quality systems etc. This should promote short visits and meetings between different research teams, to be facilitated by the WG.

Educational exchanges

The STSM subgroup will use existing European mechanisms such as Marie Curie and Leonardo fellowships, by preparation of proposals targeted to specific exchanges to enhance the training of food and environmental virologists.

Methods for virus detection are approaching a sensitivity and specificity appropriate for quality control. Several anticipated ENVIRONET participants have well-established methods and quality assurance procedures for infectious enterovirus detection methods in many aquatic matrices, and some belong to CEN committees on quality assurance and quality control of molecular assays. A second subgroup within WG2 will review quality issues (reference materials, controls etc.), and guidelines on method development. Molecular techniques for the virological analysis of food and environmental samples have unique or additional quality assurance and quality control requirements to ensure that the data generated are useful and reliable. Some laboratories have their own internal criteria for quality assurance but a consistent set of quality assurance procedures is vital in order to generate data that are comparable and reliable. This will also facilitate acceptance of molecular techniques by regulatory agencies.

To achieve mutual acceptance, the participation of end users and regulators will be encouraged in this activity. Invitations to join the Action will be sent out on a member state basis, by participants who have existing contact with their country's relevant regulatory bodies. Invitations will likewise be sent to end-users.

Deliverables of WG2:

- The identification of at least one method for each target and each (group of) environmental matrices.
- A guideline on internal and external quality controls, to be used both for the conduct of research projects and sample analysis.
- A series of reports from short-term scientific exchanges

WG3 Data Analysis

This Working Group will gather the information and knowledge on identification of environmental viruses and the implications of their presence for public health, and formulate systems to acquire optimal information from data on the prevalence of viruses in foodstuffs and environmental matrices.

Pathogenic viruses enter the environment in waste originating from infected persons or animals. Fresh and marine waters may be contaminated through sewage discharge or run-off from agricultural land, and soils may be contaminated through application of organic waste or via deposition of animal excreta. Transmission of viral agents through the environment to foodstuffs forms a significant part of the cycle of disease. Outside a host, viruses will not multiply, but they can persist in an infectious state until contact with a new host, and they have been shown to be capable of prolonged survival in various environments such as water and soil (Rzeżutka and Cook, 2004). Several outbreaks of foodborne viral disease have been attributed to the growing of shellfish in polluted waters, irrigation of crops with contaminated water, and growth of crops in contaminated soils. After environmental contamination, shellfish, soft fruit and salad vegetables are the foods which are at most risk of mediating transmission of viruses, as they are either minimally processed before consumption or eaten raw (Vasickova et al., 2005).

Environmental data may comprise of virus typing data and (semi) quantitative measurements of viruses in the environment and foods. Viruses should be typed to identify strains persisting in the environment which have the potential to lead to new infections. Moreover, in contrast to person-to-person transmission, exposure to contaminated environments and foods may lead to recombination possibly increasing persistence and pathogenicity. Indeed large outbreaks with norovirus recombinants have been observed resulting from consumption of contaminated drinking water or shellfish (Buesa et al., 2002). With regard to (semi-) quantitative data, viruses should be enumerated to establish the infectious risk from exposure to the contaminated environment and foods by consumption or otherwise.

Through the assembly of the expertise possessed by the participants, WG3 will devise appropriate statistical and modelling tools for assessment of both virus concentrations in the environment and of risk for viral diseases contracted via the environment and foods. These tools

will be disseminated throughout the network of partners in the Action. They will be indispensable in assessing the viral reduction during water and food treatment processes (WG3).

In liaison with WG4, short scientific studies will be performed to gather prevalence data in selected areas in Europe, and to test and demonstrate the effectiveness of the statistical and modelling tools. Concept notes on wider testing and use of these tools will be formulated and submitted to the Commission for appropriate consideration (e.g. in Framework Programme Strategic Research Reviews).

Deliverables of WG3:

- A statistical tool for evaluation and interpretation of environmental data;
- A modelling tool for quantitative assessment of risk of viral diseases contracted via the environment and foods.

WG4 Stability of viruses

This Working Group will evaluate the survival, elimination and degradation characteristics of indicator targets able to model viral behaviour in different environmental matrices.

Transmission of a virus is dependent not only on its interaction with a host, but also on its interaction with the environment outside the host. Viruses possess a degree of robustness which allows them to remain infectious during the various conditions that they may encounter between one host and another (Rzezutka and Cook, 2004). Although some information on virus survival exists, particularly for the aquatic environments, much is lacking. The persistence of viruses may be challenged by various disinfection techniques, but again, more studies are necessary to acquire this information comprehensively on all enteric virus types. No survival or disinfection study has comprehensively included all enteric virus types, and there is no hard information on such important viral agents as noroviruses or hepatitis E virus. Also, several questions remain such as what is known about viral inactivation in water and food? What is known about the mechanisms of inactivation? What is the relative resistance of different pathogenic virus models and bacteriophages or bacterial indicators? Different degradation or elimination characteristics are the main reason why faecal bacteria indicators underestimate viral pollution (Skraber et al. 2004). In some cases, indicators are not detected when infectious pathogenic virus is present in water or food and can initiate an outbreak. This argues in favour of the proposal of new tools to estimate viral pollution but does not justify a too high overestimation, as sometimes seems the case with molecular-based detection. For example, poliovirus infectivity can decrease about 5 log units after 1 minute exposure to 5 mg L^{-1} ClO_2, whereas part of its genome (detected by nucleic acid amplification) shows only a decrease of 2 log in 60 min (Gantzer et al., unpublished data). Thus, where only molecular detection of viruses can be used, such results might encourage the use of higher doses of disinfectant to try to eliminate the pathogens, but this may in itself have other risks. Consequently, for studies on virus degradation, infectivity is very important to demonstrate.

Based on the characteristics of each matrix, what is needed for a target organism in terms of resistance to act as a viral indicator? WG4 will investigate this in two phases. A first meeting will focus on the definition of the groups of matrices under interest for viral control (based on epidemiologic data or viral detection), and definition of the key questions to submit to end users and industries to whom these matrix groups are appropriate (e.g. What are the viral pollution risks of the raw product? What kinds of treatments are applied? What is known about the effect of this treatment on viruses?). Each participant will then act in their own country to interview end users and industries. Discussion about the limits of the use of molecular -based methods for the evaluation of viral pollution will be initiated. More generally, discussion will focus on the

advantage and limits of each target in terms of viral pollution indicators based on their resistance in environmental matrices and during treatment. A second meeting will summarise the overall European point of view. In cooperation with WG2, the best target for each matrix will be proposed and submitted to the end-users and industries during a final meeting.

What is known about the relative presence of each target (phage, infectious virus, viral genomic RNA or DNA) in environmental or food matrices and their resistance to the selected treatments? On one hand, evaluation will focus on the criteria needed to estimate viral inactivation and the impact of an elimination treatment). Based on these criteria, WG4 participants will review data on resistance from their previous and current projects, and make a state of the art report to the WG concerning what is known about the virucidal effect of each treatment adapted for each matrix. With the incorporation of data from publications and reports produced outside Europe, consensus D-value calculations (time to decrease viral titer by 90%) will be performed, and models of inactivation will be produced. Proposals to test these models in large scale European research studies will be formulated, and submitted to the Commission at appropriate opportunities.

Deliverables of WG4:

- A definition of the relative resistances of each target (phages, infectious viruses, RNA / DNA viral genomes).
- A definition of the resistance characteristics of viral indicators for each group of environmental matrices.
- The proposition to end-users and industries of a target or a group of targets for detection of virus contamination (with WG2).
- A definition of the critical points for the estimation of viral inactivation, based on a HACCP-style approach

E. ORGANISATION

The network will be coordinated by a Management Committee, comprised of two members per signatory state. The Management Committee will elect the Action Chair and Vice-Chair and the Leaders of the individual Working Groups. The Chair, Vice Chair, and the WG leaders will form the Executive Group of the Action, along with a Dissemination Coordinator and a Coordinator of the short-term scientific missions.
The Management Committee will have the following responsibilities:

- Oversee and evaluate the progress of the Action
- Oversee and evaluate the progress of the Working Groups.
- Promotion and approval of Short-Term Scientific Missions, according to the recommendations of WG2.
- Promotion of co-operation and of data exchange between the Working Groups.
- Assessment and approval of the deliverables, particularly the reports and reviews, of the Working Groups.
- Planning of Network meetings and Symposia.
- Establishment and update of a Website for communication and results dissemination.
- Preparation of the Annual and Final Reports.
- Appropriate financial management.

The Working Group Leaders will have the following responsibilities:

- Coordinate the activities of their Working Group
- Set the Agenda for each Working Group meeting.
- Chair Working Group meetings.
- Providing reports from the Working Groups to the Management Committee.
- Oversee the preparation of reports concerning the deliverables of their Working Group.

F. TIMETABLE

The Action will have a duration of four years.

The Action will commence with a Management Committee Planning Meeting, at the beginning of Year 1. At this meeting, the Chair and Vice-Chair, and the composition of each Working Group will be confirmed. The Management Committee will hold a review meeting at the beginning of each subsequent year, and finally meet in the last month of the Action The Executive Group will meet mid-way through each Action year. Each Working Group will meet separately once a year. During the second and the fourth year of the Action, an international scientific symposium will be held. Within these symposia, there will be workshops where all participants, including scientists from non-signatory countries, can liaise and interact. In particular, liaison will be encouraged with representatives of Public Health bodies. Representatives from non-participant networks and organisations will be eligible to participate, at their own expense. The Short-Term Scientific Missions will be held between month 13 and month 40 of the Action. At the last Management Committee meeting, the Working Group deliverable reports will be approved, and the Action Final Report prepared. The following table illustrates the Action's Timetable.

ENVIRONET Timetable

YEAR	**Management Committee (and Executive Group)**	**Working Groups**	**Short-Term Scientific Missions and Exchanges**	**Symposia and Workshops**
1	Planning Meeting Executive Group meets (mid way in year)	1st meetings		
2	1st Annual Review Meeting Executive Group meets (mid way in year)	2nd meetings	STSM Programme commences	1st Symposium "Current Developments in Food and Environmental Virology"
3	2nd Annual Review Meeting Executive Group meets (mid way in year)	3rd meetings		

4	Executive Group meets mid way in year Final MC meeting	4th meetings	End of STSM Programme	2nd Symposium "Future Challenges in Food and Environmental Virology"

G. ECONOMIC DIMENSION

The following 16 COST countries have actively participated in the preparation of the Action or otherwise indicated their interest: Cyprus, Czech Republic, Denmark, Finland, France, Germany, Greece, Ireland, Italy, The Netherlands, Norway, Poland, Serbia and Montenegro, Spain, Switzerland, and the United Kingdom.

On the basis of national estimates provided by the representatives of these countries, the economic dimension of the activities to be carried out under the Action has been estimated, in 2005 prices, at roughly Euro 30 million

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.

The following non-COST country has also actively participated in the preparation of the Action: Ukraine.

H. DISSEMINATION PLAN

Dissemination of the results and outcomes of the Action are recognised as being critically important, and will be an objective of the Action's MC. There are a number of ways to communicate the findings. These may be regarded as communication with (a) the scientific community, the Commission and regulatory bodies including CEN/ISO and (b) the citizens of the Member States. The categories are of course not mutually exclusive.

There will also be exchange of information, where appropriate, with similar on-going projects within and outwith the EU. A number of anticipated participants are engaged on other projects on waterborne or foodborne viruses and liaison with these areas will be made where it does not breach confidentiality.

Links with the EU policy development process will be ensured via (i) the appropriate DG ENV desk officer being involved in Meetings; this will ensure that findings are rapidly communicated to the EU policy community, (ii) many of the anticpated participants act as advisers to their own governments, which will provide further communication routes. Further, anticipated participants in the Action serve as technical advisers to the relevant WHO Working Groups on environmental issues and transmission of findings to WHO will be via this route.

Website

The Internet is a powerful tool for communication, and it will be used to disseminate the results in a 'user-friendly' fashion. An Action website will be produced and will either be made available as a micro site of an existing website (URL), or have its own domain name. It will contain all relevant information relating to the Action including participants contact details, protocols, meeting schedules and minutes, an online discussion forum etc. The website will give all interested parties information about the activities of the Action, and access to non-confidential material e.g. progress updates, details of meetings etc. The website will contain public-accessible and password-protected areas. The first will include reports and general activity information; the second will hold details of (e.g.) surveys, unpublished work, and non-verified sequence data. Data will be posted on the site immediately after confirmation so all participants can see the progress of the Action.

The public access website will set out the background to the Action, the need for research in the area, the participant Member States and Institutions and, in summary, deliberations after Annual Meetings. There will be links to other sites including to the partners' own Institution sites should they wish. An on-line questionnaire will be posted as part of the site which will invite subscribers to comment on the Action and to highlight areas of their own concerns, though this will be designed in such a way that it is not overwhelmed with irrelevant contributions.

Participants will ensure that a link to the Action is provided on their own home websites, so visitors to each Participant's site can be easily directed to it.

Symposia

Two Symposia will be held during the Action. The Symposia will allow researchers from non-signatory countries, representatives of national government and European departments and agencies, and representatives of standardisation bodies to have the opportunity to acquire information about the progress and results of the Action's scientific programme, and to interact and directly communicate with the scientists participating in the Action.

The first Symposium will highlight issues developed by the WGs. This will be done by keynote addresses by WG Leaders and by invited Experts from outside the Action. Papers will also be given by WG members. Communication will be encouraged at this stage by producing hard copy and electronic standard operating procedures.

The second Symposium will be dedicated to informing the general scientific community and those interested in policy–making of the Action's findings. It will be held at a central European venue (for ease of access) and about 25 guests will be invited in addition to those supported by the COST budget. Invitees will be included from regulatory agencies as well as scientists. The Symposium will be open to any interested parties, at their own cost. It is intended to make this a two-day event with considerations not just of the findings but how they could be extended to other areas of interest such as other viruses, so that as wide a debate as possible can be generated.

Workshops

Two Workshops on specific themes will be held concurrently with the Symposia. The first Workshop will be on harmonisation of methods in food and environmental virology and will reflect the activities of WGs 2 and 4. The second will be on future challenges in food and environmental Virology and will primarily reflect the activity of WG 1. A report of each Workshop will be prepared and posted on the Website.

Publication in the scientific press

Acquisition of knowledge about the detection and health impacts of environmental viruses demands high quality science and it will be discussed where collaborative expertise will result in quality research and publication in high impact factor journals. The Action is committed to produce papers for peer reviewed and professional journal articles to ensure the international assessment and dissemination of the work.

Electronic Newsletter

A list of contacts will be drawn up. Each Participant will provide six – eight email contacts to receive the e-newsletter which will go out to those contacts twice a year. Contacts will provide details of regional and national activities in the area of environmental virology as well as their own laboratory's or institute's responsibilities

Professional bodies

A wider scientific audience will be reached by promulgating the findings through the professional bodies associated with the participants. Each Member State has a professional Microbiology Association and there is also the Federation of European Microbiology Societies. Each organisation has a Professional Affairs Office and a Press Office, and representatives of these offices will be kept informed of the activities and results and will be invited to the Workshop. In this way dissemination will take place not just to scientists interested in the relatively focused aspects of viruses in the environment but also to many other informed scientists who may have a general knowledge of the topic but whose expertise lies in related areas, such as food microbiology, infectious diseases epidemiology, health protection, or sewage treatment and engineering.

Public participation and awareness

The public understanding of science is very topical. Many members of the public are naturally sceptical about the implications of new scientific discoveries and regulations based on scientific investigations. Many Member States have initiatives aimed at educating the public and working with interested but non-scientific organisations to help in the communication of scientific issues.

The public access area of the website will set out the background to the Action, the need for research in the area, the participant Member States and Institutions and, in summary, deliberations after Annual Meetings. There will be links to other sites including to the partners' own Institution sites should they wish. An on-line questionnaire will be posted as part of the site which will invite subscribers to comment on the Action and to highlight areas of their own concerns, though this will be designed in such a way that it is not overwhelmed with irrelevant contributions.

A public-access website will be set up and an electronic newsletter (updated monthly or whenever there is significant progress to report).