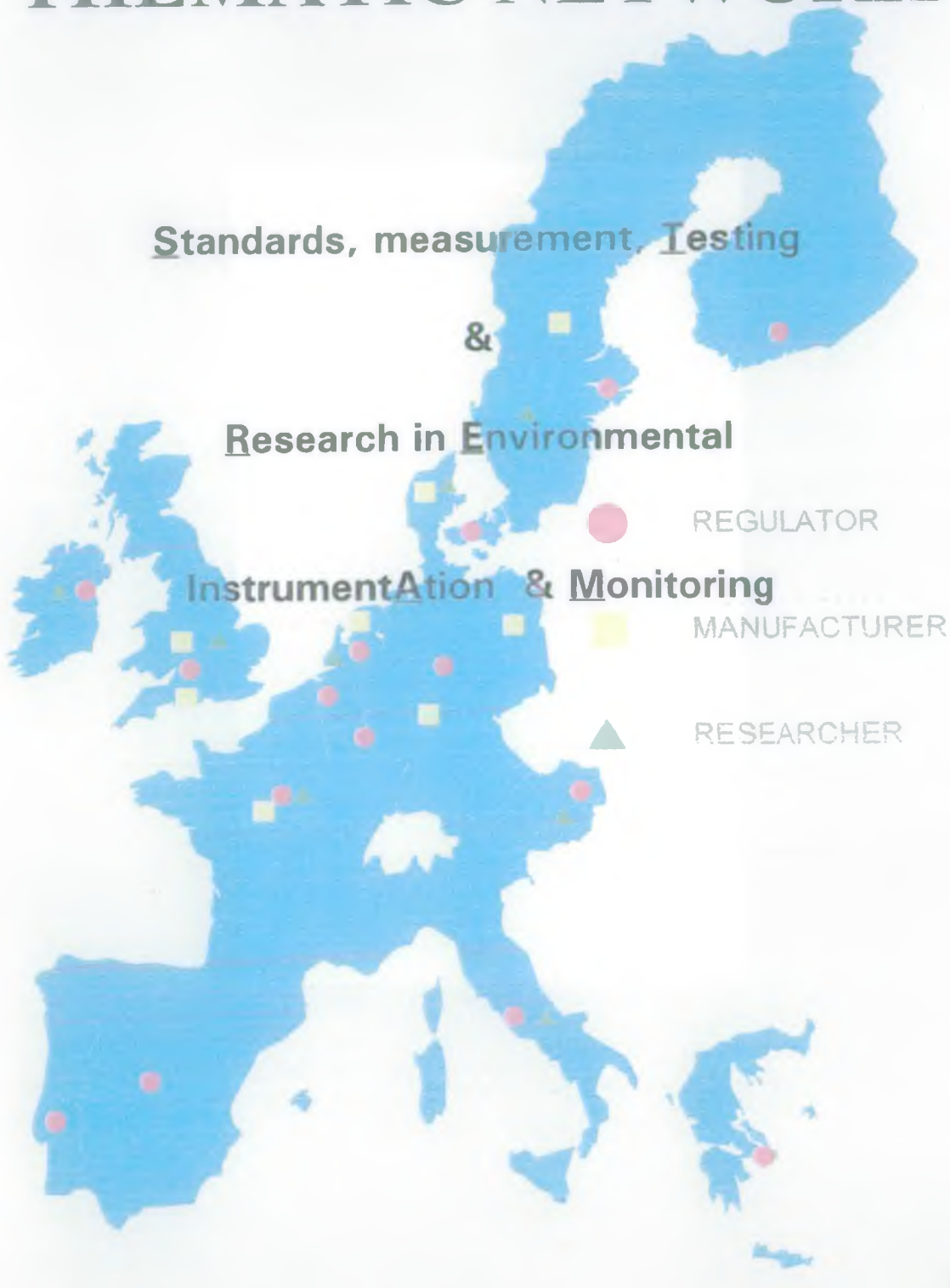
EA-NCEDS BOX 3

STREAM

THEMATIC NETWORK



EA - NCEDS Box 3

0. TECHNICAL INTRODUCTION

0.1 The need for the network

The overall objective of the STREAM network is:

> *"to bring together environmental regulators, researchers, manufacturers and users of water quality and water quantity instrumentation to increase industrial competitiveness, improve standardisation and to promote better exploitation of new science and technology."*

At present, there are no existing networks which will facilitate this, and achieve the benefits described in this proposal.

The Dobris Report of the State of the Environment has highlighted deficiencies in the available environmental information in the Community and Member States, and the almost complete absence of precise quantatitive data on human interventions and influences on the environment. Such data is necessary for meaningful modelling exercises and the optimisation of policy and large scale investment decisions.

The European Union has established a Community programme (C138) of policy and action in relation to the environment and sustainable development, the Fifth Environmental Action Plan (5EAP). The programme sets a high level of priority on filling the gaps in base-line environmental data, improving their compatibility, comparability, and the standardisation of scientific and technical aspects of information retrieval. Monitoring requirements are detailed in EC Directives covering Integrated Pollution Prevention and Control, Dangerous Substances in Water, Surface Water for Drinking and the future Water Resources Framework Directive ((COM96) 59) . In doing so, the EU has confirmed its wish to ensure that the environment is protected in a sustainable manner. The water environment is an important sector, and has been recognised as such in the above Council resolution, the Rio declaration and a wide range of other legislative requirements.

The use of water as a commodity which every person in all EU Member States relies on, has served to ensure that protection of the water environment is a major priority. However, many of man's activities have a real impact on both water quality and water quantity across the EU and the impacts are regulated and monitored by a range of organisations.

Each of the environmental regulators requires accurate and timely information from which key decisions are often made regarding action to avert pollution of rivers and streams. In the past much of this information has been gathered through spot samples taken on the river bank, and sent back to a laboratory for detailed analysis. This process has an in built delay, based on the length of time taken to transport the sample, analysis and reporting time. Expenditure on the monitoring of surface waters within the Member Sates is significant. As an example, the Environment Agency in the UK spends around ECU 50M per year on such monitoring. Extrapolated across all Member States, this could equate to over ECU 750M per annum.

ENVIRONMENT AGENCY
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A 10% efficiency improvement could save EU Member States ECU 75M per year

Many of the decisions regarding the quality of surface waters, and the loadings of chemicals within them, are therefore made on historical information. Information approaching close to 'real time' is therefore required. This dictates the need for *in-situ* instruments which can provide the information on the river bank rather than back at the laboratory. This is particularly important where particularly toxic metals and organic compounds are concerned. However, the currently available instrumentation is not capable of providing information on these most toxic compounds.

The extensive work carried on in relation to the requirements of the Oslo and Paris Commissions, and the Ministerial Declaration on the North Sea have centred around the loadings and emissions of "Red List" compounds such as hexachlorocyclohexane, mercury and cadmium, in the major rivers of many EU Member States. A similar requirement has also been applied to the Mediterranean. A list of determinands requiring monitoring for key directives is presented in Annex A.

In order to ensure that accurate information on loadings within rivers is provided to regulators tasked with improving the environment, high quality data on river flows are also required. To date, the issues of water quality and water quantity instrumentation have been seen as rather separate. It is now clear however that environmental management has to take account not only of concentrations of pollutants in rivers but also the overall loads entering and being dispersed through surface waters into the coastal zone.

Whilst the current instrumentation market cannot provide the instruments required by the end-users and regulators, high quality research in a number of areas is beginning to emerge which could improve this situation. It is important that this area is coordinated to support amongst others the European Environment Agency (EEA) in ensuring consistency of environmental information across all Member States. Equally important is the need to enhance the ability of the European market to benefit through increased competitiveness from the high quality science being undertaken, and required in the future.

It is in the interests of all parties involved in the development, design, trialing, implementation and eventual production of water-related instrumentation in this area to improve coordination.

Within this proposal, organisations with an interest in the field of environmental instrumentation are categorised as follows:

- Regulator — an organisation responsible for implementing either national or EC standards for protecting river water. Such organisations should be responsible for monitoring compliance with such standards, and therefore have an interest in adopting instrumentation;
- Researcher — an organisation funded, either through public or private sources, to undertake research into instrumentation and associated matters. Such organisations can be academic institutions, universities or private

companies;

- Manufacturer an organisation developing, producing, and marketing water quality and water quantity instrumentation. Such organisations will, in the main be private profit-making companies.

1. OBJECTIVES AND STATE OF THE ART

This section sets out the overall aims and objectives behind the proposed establishment of a network of water-related instrumentation users, researchers and manufacturers across all EU Member States. It also provides a brief assessment of the state of the art in the fields of water quality and water quantity instrumentation

1.1 Objectives of Network

The specific objectives for the STREAM network are:

- to identify the requirements of the end users and environmental regulators with respect to water-related instrumentation;
- to identify current areas of water related instrumentation expertise in all EU Member States;
- to identify why instrumentation manufacturers are not meeting the requirements of the environmental regulators;
- to determine where current research can be best exploited by manufacturers to fill any gaps in the market;
- to ensure that environmental regulators, researchers and manufacturers are aware of future environmental priorities which may require instrumentation to be developed;
- to identify gaps in the instrument market for specific products or services;
- to prepare research proposals for submission to the EC in areas where new instrumentation is required.

1.1.1 Importance to Industry

As an example of the scale of monitoring currently undertaken, the Environment Agency for England and Wales, as an environmental regulator and a competent authority for over 30 EC Directives, has an annual expenditure on water quality monitoring of around ECU 50M. At present much of this expenditure goes on the laboratory analysis of samples. Translated across all Member States, this represents and expenditure of nearly ECU 750M per year.

Whilst it is important to recognise that *in situ* and laboratory analysis are complementary, there are certainly potential savings from a further move towards *in situ* monitoring. The movement of expenditure from laboratory analyses towards the procurement of instruments will provide an important focus for industry from two points, namely:

i) industrial polluters will be monitored 24 hours per day and will therefore have to give constant attention to effluent quality;
ii) industry manufacturing instrumentation will see an increased demand where instruments meet the requirements of the end users; and
iii) organisations abstracting water for potable supply will have advanced warning of pollution.

Probably more important, is the introduction of Ministerial Agreements such as Paris and Oslo Commissions, where loads of specific chemicals entering rivers will be reduced within the agreed period. The monitoring of progress in reducing such loadings can only be assessed if monitoring is carried out *in situ* and on a continuous basis. This will therefore require scientifically sound, robust and cost effective instrumentation if improvements in industrial inputs are to be monitored effectively.

1.1.2 Importance to Community Policy

The guiding principles of EU environmental policy are set out in the Council Resolution on a *"Community programme of policy and action in relation to the environment and sustainable development"*. (C138). This document provides an overview of those areas where there is a requirement for scientific, research and technological development to support the implementation of EU environmental policy.

In particular, the Fifth Environment Action Programme, as it is known, states that EC-level R&D must provide direct support to :

> *"provision of a scientific basis for evaluating the state of the environment and improved early warning of environmental problems, and... the development of... advanced monitoring and assessment systems*".

On a more specific level, the EC Directive on pollution caused by certain dangerous substances discharged into the aquatic environment of the Community (76/464/EEC), and the related daughter directives, list the families and groups of substances entering surface waters that are to be controlled by Member States. The monitoring of substances such as Cd, Hg, HCH, and other trace metals and organics, is currently carried out through laboratory analyses. The move towards more automatic and real-time monitoring through field instrumentation will improve the assessment of compliance with this Directive.

Another EC Directive, this time concerning urban waste water treatment (91/271/EEC), requires the introduction of automatic sampling equipment. This illustrates the move towards more automatic, remote monitoring of effluent and receiving waters.

The establishment of the Single Market will strengthen the ability of the EU to develop its expertise in instrumentation technology. Through mechanisms such as STREAM, the EU will be able to coordinate its efforts in the world market for this area of technology.

1.1.3 Links with European Environment Agency

The establishment of the European Environment Agency and their recently appointed Topic Centre on Freshwater will provide another focus for STREAM. In the multi annual work programme, the EEA identify a priority of identifying monitoring networks, and state that work will be carried out with Joint Research Centre (JRC) and the Topic Centre on the development of new environmental instruments. In this respect, the formation of the STREAM network will assist in building strong links between DG XII (Science, Research and Development) and EEA.

1.2 State of the Art

Existing Products

Many hundreds of different water quality monitoring (WQM) products are available in the EU From over 500 European, US and Japanese manufacturers. Broadly speaking, these fall into three distinct classes: portable instruments; fixed instruments; and test kits. Portable instruments invariably employ one or more sensors, which are mostly based on conventional and well tried technologies; fixed instruments use either sensors or analytical techniques such as automated wet chemistry etc; and test kits, which usually measure a single determinand, employ colour chemistry of immunoassays, and are usually used in conjunction with simple photometers. The sensing techniques and technologies adopted in WQM instruments vary widely. Some of the many analytes that can be determined with these three classes of products are listed below.

Portable instruments	Fixed instruments	Test kits
pH, temperature, DO, conductivity, turbidity, salinity, TDS, nitrate, ammonia/ammonium, lead, copper, salinity, redox, physical quantities (e.g. flow, level, depth)	TOC, TOD, BOD, COD, nitrate, phosphate, pH, DO, turbidity, metals (many) oils, chlorine, organics, fluoride, phenols, cyanide, ammonia, VOCs, ozone, etc	Metals, many other species as for portable instruments, many pesticides and herbicides other organics (PCBs, dioxins etc), bacterial numbers, AOC, sulphate, sulphite, cyanide, etc

Table 1: Analytes measurable by *in situ* techniques

Of the List I and II metals (Hg, Cd, As, Cr, Cu, Pb, Ni, Zn, V) all can be determined on-line by anode stripping voltammetry, although the equipment is at present costly and complex and has not been sufficiently tested in field trials. It is in precisely this area where increased cooperation across Member States will reduce the costs of environmental regulation. Colourimetric test kits can also determine all of these but not generally at particularly low levels, e.g. Cu: 0.02 mg/l, Pb; around 2 ppb, Ni: 0.09 mg/l, Zn: 0.01 mg/l. However, some kits have resolutions that allow the monitoring of metal levels as stipulated by the EC's Surface Water for Drinking Directive and discharge limits. Portable, metal-responsive instruments are emerging. Palintest's thick-film sensor-based product can determine Pb and Cu with resolutions of 2 ppb and 70 ppb, respectively. Other similar and additional sensors are under development.

Instrumentation Research: Expertise and Activities

Although the use of state-of-the-art microelectronics has enhanced, and will further enhance, the capabilities of field instrumentation, for instance, in terms of data storage, processing and communications, most major innovations will arise from developments in sensor technology. Key technologies include: open-path, fibre optic and integrated optical sensors; biosensors; silicon ISFETs; thick- and thin-film sensors; and, perhaps, micro miniaturised field analytical instruments. Such developments will facilitate a number of major advances in water quality monitoring practices, e.g.:

- the determination of a greater range of analytes in the field;
- improved sensitivities and selectivities; and
- reduced cost of ownership and improved reliability (fixed instruments).

Most water quality instrumentation product manufacturers have on-going R&D programmes and many collaborate closely with universities or other centres of expertise. Numerous smaller companies are attempting to commercialise novel water quality instrumentation products, mostly through the use of advanced sensor technologies. Western Europe has an exceedingly strong resource in sensor and instrumentation research which is of global standing. The UK and Germany have the most significant and widespread activities. Several hundred establishments across the Community are actively engaged in this work.

Research aims to develop new or improved sensors and instruments for determinands such as: ammonia, BOD, chlorine, pH, DO, numerous pesticides and herbicides, halogenated organics, phosphates, nitrates, metals (Cd, Cu, Pb, Ag, Ug, Zn, etc), bacteria, PCBs, PAHs, algal blooms, dissolved gases, hydrocarbons, toxicity, phenols etc. Numerous collaborative R&D projects aim to yield improved or novel water quality monitoring (WQM) products and although some just involve a single country, many involve partners from different countries. No other networks are known to exist within the EU at present, and there is therefore a strong need to establish one in this area.

It is also worthwhile noting the competition posed by organisations in the USA and Japan in this field. This is particularly importance in the context of improving the position of the EU in the world market.

Markets for, and users of, Water Quality Instrumentation

The Western European markets for field water quality instrumentation has been surveyed recently. The report states that the market for field instruments (portable and fixed but excluding test kits) was worth US$376.5 million in 1992, rising to US$707.5 million by 1997. The split between the major classes of end users is illustrated below. (Note: "Other" comprises uses in research and by environmental pressure groups etc).

	1992		1997	
	Value (US$m)	%	Value (US$m)	%
Water utilities	199.1	52.9	345.0	48.8
Industry	94.1	24.9	188.2	26.6
Regulatory agencies	71.0	18.9	150.9	71.3
Other	22.5	3.3	23.4	3.3

Note the forecasted doubling of the value of equipment consumption by the regulatory agencies between 1992 and 1997. The table below illustrates a market breakdown according to the three dominant areas of application.

	1992		1997	
	Value (US$m)	%	Value (US$m)	%
Discharge monitoring	170.1	45.2	378.3	53.5
Potable/abstracted water mon.	154.3	41.0	228.6	32.3
Ambient WQ monitoring	52.1	13.8	100.6	14.2

1.2.2 Water Quantity Instrumentation

The physical diversity of Europe (in terms of its climate, topography, geology, land use, population density and patterns of water utilisation) is justification for what in global terms is a dense network of flow measurement stations. The characteristics of European rivers also vary greatly, presenting very different flow measurement and hydrometric data acquisition challenges - from the difficulties of monitoring low flows in ice-bound Scandinavian rivers to the exceptional flow ranges encountered in the Mediterranean regions. However, the many agencies responsible for flow measurement have the common need to exploit the basic flow measurements as fully as possible in order to address the increasingly complex problems of catchment and river management.

Numbers of environmental water quantity and quality measurement sites

	Europe	% global	No./100 km^2	UK	% Europe	No./100 km^2
Non-recording rainguages	42962	28	0.37	5793	13	2.37
Recording rainguages	7714	19	0.07	1007	13	0.41
Evaporation pans	1210	11	0.01	4	<1	<0.01
River flow	18956	31	0.16	906	5	0.37
Observational groundwater wells	65793	66	0.56	940	1	0.38
Sediment Suspended	2850	20	0.02	0	0	0
Bed load	188	20	<0.01	0	0	0
Water quality	18761	37	0.16	250	1	0.10

Source: Infohydro manual, WMO Operational Hydrology Report No.28

1.2.2 Previous Multinational Collaboration

Previous experience with the EurAqua network of research institutions, and TechWaRe has shown that collaboration of this form can be extremely beneficial and productive.

TechWaRe for instance has been involved in the SAST programme undertaken for DGXII as well as a range of projects including capital and mobility across European laboratories through the WEEL programme. TechWaRe has in excess of 300 member across the EU, and will assist greatly in starting up the STREAM network.

EurAqua has recently been established to provide a focus for freshwater research issues across the major European research institutions. It has been responsible for coordinating work on the impact of land use on freshwater quality. Its large number of member organisations means that EurAqua will be a useful source of assistance in establishing the network.

The Sensors in Water Industry Group within the UK provides a forum for users of water quality instrumentation to discuss priorities. Many of the organisations involved in SWIG will have counterparts in other Member States which will greatly assist in the network.

2. CONSORTIUM

Table 2 shows the list of organisations under the three category headings invited to join the STREAM network. A portfolio of the researchers, manufacturers and regulators is listed in Annex B. It is anticipated that the STREAM network will be organic and its composition will change over time. The initial membership is expected to include;

Researcher	Country	Manufacturer	Country	Regulator (from each EU *Member State*)
VKI	Denmark	Danfoss	Denmark	Austrian Ministry of the Environment
WRc	UK	Contromic	Sweden	Brussels Institute for Environment
Dublin University	Ireland	Hydro Environnement	France	Danish Environmental Protection Agency
TNO	Holland	ABB	UK	UK Environment Agency
University Lund	Sweden	WTW	Germany	Finnish Environment Agency
Tubingen University	Germany	Bran & Leubbe	Germany	French Ministry of the Environment
Karl Franzens University	Austria	Applikon	Netherlands	German Federal Ministry for the Environment
University of Rome	Italy	Siemens	UK	Greek Ministry of Environment
				Irish Environmental Agency
				Luxembourg Administration de l'Environment
				Dutch Inspectorate for the Environment
				Portuguese Ministry of the Environment
				Spanish Ministerio de Obras Publicas
				Swedish Environmental Protection Agency
				Italian Ministrio dell Ambiente

Table 2: List of Core Members

2.1 Core and Affiliated Members

The number of manufacturers and researchers in the field of water resource quality and quantity is rapidly expanding both in Europe and overseas. Investigations identified a large number of suitable candidates. Rigorous criteria were applied to select the core members. In order not to preclude any potential candidates in the three year period of STREAM, there will be two categories of membership. Due to the limitation of resources it was decided to fund a core membership and invite affiliated non-funded members to participate at their own expense at the key events organised by STREAM.

2.1.1 Core Members

These are to be invited to join the network by the original three members of STREAM. The core members are considered to be experts in their field and are expected to be able

contribute knowledge, skills and resources to the network. These members will be funded by the network to cover costs such as attending workshops and brokerage events, travel and inter-network communications.

2.1.2 Affiliated Members

The affiliated members will be selected by each of the core members. These members are not funded by the network and any attendance at brokerage events must be self financed. Affiliated members will have access to the information generated by the network and can participate with any of the core members

The network will be organic in its nature and a cross migration between the two groups will be encouraged over the network's life span. The network membership will be audited on an annual basis and if necessary the core and affiliated status of members may be reviewed. The overall number of core funded members is not expected to rise.

2.1.3 Membership Numbers

The network has been restricted to a maximum number of 30 core funded members and a network manager. Theoretically the network membership can be limitless, however in reality the number will have to be capped due to the limitation of resources. The core members are expected to introduce 4 affiliated members, bringing the network membership (core and affiliated) to a total of approximately 150. This was felt to be the largest number an event could accommodate and be managed successfully without extra resourcing.

3. WORK CONTENT

This section covers the work programme to investigate the feasibility of STREAM, the proposed option, and how it will be managed and financed The purpose of this study was to assess the feasibility of establishing the STREAM thematic network and to take into account the costs and benefits of so doing. The study aimed to address the viability of geographically balancing the network across all Member States, and investigate the applicability to EU environment programmes and priorities set out in the Standards, Measurement and Testing Work Programme.

3.2 Method of Approach

The three partners responsible for this feasibility study were balanced across the three categories likely to constitute the Thematic Network, and included :

Environment Regulator	Environment Agency (UK)
Instrumentation Organisation	VKI (Denmark)
Researcher	WRc (UK)

The lead organisation was the Environment Agency's National Centre for Environmental Data and Surveillance which is involved in the development of water quality instrumentation.

3.2.1 Network Assessment Criteria

Selection criteria were established for the three core member categories and these used to select suitable candidates for membership. The criteria, once established, were used commonly across all three area.

Assessment Criteria for Researchers

- strong reputation in R&D on sensors and instrumentation for water quality and / or limited extent water quantity;
- involvement in collaborative R&D with industry;
- should be Universities, Private Research Organisations, Government laboratories;
- involvement with EU Networks / Collaborative research.

Assessment Criteria for Manufacturers

- appropriate manufacturing skills;
- involvement in collaborative R&D;
- experience in selling instruments in more than one EU Member State;
- experience in Water Quality and Water Quantity instruments;
- experience in using new technology;
- innovative development work.
- European Manufacturing base

Assessment Criteria for Regulators

The feasibility study identified the Environmental Regulator as the most appropriate representative of each EU Member State as the body influencing end users in their instrument requirements.

- competent authority for EC Directives;
- ability to influence other end users;
- directing self-monitoring requirements;
- experience in operating collaborative R&D programmes;
- responsibility for water quality and / or quantity monitoring.

3.1.2 Existing Networks

Investigations were undertaken to determine the current networks active within the European community relating to water issues. A number of networks were identified with which the STREAM network can interrelate with. The lead organisation for each network was identified, contacted, and the aims and objectives of STREAM discussed. The networks approached were;

EURAQUA
TechWaRe
IMPEL
EUREAU

Following the initial discussions regarding STREAM, most networks were very positive and keen to support this feasibility study and supplied information regarding membership of their networks. As well as networks there are databases which have significance to STREAM, such as the Community Research and Development Information Service (CORDIS).

3.1.3 Manufacturers of Instrumentation

To determine the manufacturer membership of STREAM, a number of databases were searched. Using the evaluation criteria, an assessment of the skills, experience, remit and area of interest of each manufacturer was undertaken. The results were tabulated and ranked according to the criteria in Section 3.1.1.

3.1.4 Researchers in the field of instrumentation

Each member of the feasibility report team nominated ten candidates for this category. Examinations were undertaken of the membership of other water instrumentation events such as Environmental Monitoring Brokerage Event (UK event organised under the EUREKA/EUROENVIRON initiative), Standards Measurement and Testing (NANCIE and Lisbon Events, organised by DGXII). Independent water industry consultants were also approached for their views on this topic.

3.2 Conclusion

From the investigations undertaken there is a significant wish amongst environmental regulators, manufacturers and researchers alike to establish such a coordinating network which will stimulate both the research and the market in their area.

3.3 Proposed Thematic Network

The thematic network will comprise of 30 core funded members and a full time network manager. It is anticipated that 120 affiliated members in the fields of regulation, research, manufacturing and other instrumentation users will be invited to participate in events organised by STREAM. The expected outputs from the network will be collaborative research and R&D proposals submitted for EC funding so as to meet any identified monitoring requirements. There will be opportunities for networking and discussions at a series of workshops and brokerage events.

3.4 Benefits of STREAM

The benefits to be realised from a network such as STREAM can be looked at in the short term, long term, tangible and intangible benefits.

3.4.1 Short Term Benefits

- increased awareness of enduser's needs by manufacturers and researchers;
- instrumentation users will be more aware of what science & technology can deliver;
- manufacturers will be able to identify gaps in the instrumentation market;
- increased awareness within STREAM membership of EC funding programmes;
- increased submissions of R&D proposals to the EC on instrumentation.

3.4.2 Long Term Benefits

- increased competitiveness of European manufacturers within world markets;
- improved capability of regulators to meet EC directives;
- improvement in the speed, quality and harmonisation of the data collected for the EEA;
- technology transfer;
- encourage greater collaboration/communication between European networks.

The tangible benefits can be measured by the number of collaborative projects which successfully achieve EC funding, and the subsequent products which are brought to market. However the intangible benefits are less easily measured, perhaps most important is the informal network amongst all the key members in the area of water instrumentation development which may lead to collaboration far beyond the remit and life span of STREAM. A thematic network such as STREAM has the ability to bring together all the key players in the field of environmental protection for the first time.

3.5 Structure of Network

The network will be constructed of 30 core funded members, these core members are an amalgamation of environmental regulators, researchers and manufacturers. The composition of the members comprises a regulator from each Member State and the UK's Environment Agency, eight Research Universities or Research Organisations and eight Instrument Manufacturers.

There is a bias in the compilation of the membership of STREAM. The bias has been positively placed with the regulator, and was decided by the proposal members for five reasons, namely;

- to create a balanced pan European network, there is a need for at least one member from each European Member State. The national environmental regulator sets the standards and monitoring requirements, and as such is often the largest user of water related instrumentation;
- in the experience of the authors, "networks" whose purpose is to encourage R&D proposals are most successful when driven by the end user's requirements;
- the regulators are the primary users of water related instruments and specifiers of data requirements. As such, they, through the affiliated membership scheme will introduce to the network, manufacturers and researchers relevant to their particular needs;
- some regulators already undertake collaborative R&D and as a result are aware of the key players specific to the fulfilment of their national requirements;
- the experience in the UK is that non-regulatory users of instrumentation are to some extent guided by the regulator in its use of environmental instrumentation.

3.5.1 Geographical Balance

3.5.2 Balance across areas

As was expected the investigation of the instrumentation market confirmed that the majority of high quality market leaders in instrumentation are centred around northern Europe, unsurprisingly the main researchers are to be found in the same geographical location. To maintain the high calibre of the core members necessitated sacrificing the criteria to geographically balance the network across all EU Members States. A disproportionate number of the core members in the fields of manufacturing and research will be positioned in northern Europe. It is intended that this inequality will become more equitable with a bias on the uptake in affiliated membership from southern European members. Once the full complement of members is established it is expected to have a balanced network both in the relevant areas of members and geographic location.

3.5.3 Response from other networks

One of the identified objectives of STREAM is to forge links with other European networks. From the searches undertaken several networks were identified and the lead organisation for each were asked for their views regarding the proposed STREAM work programmes, these are listed below.

TechWaRe

"...STREAM is a new European water related network with the objectives of identifying user needs relating to instrumentation for water quality and quantity measurements, reviewing the current status of existing instrumentation and assessing the commercial opportunities for their further development. Many TechWaRe members would have an interest in the work of STREAM. It is likely therefore that cooperation between TechWaRe and STREAM would be of mutual benefit to both association and therefore TechWaRe is pleased, as far as is practical to use its networking facilities to provide contacts with relevant members in order to assist the objectives of STREAM..."

EURAQUA

"...The outline of the project STREAM is to be seen as striving into the noteable direction to evaluate water as a highly economical as well as ecologically unique and exceptional value. Therefore the intention of the proposed action by STREAM is being clearly supported by EURAQUA and the EURAQUA network membership have indicated that they will support any endeavours toward the success of STREAM..."

IMPEL

"...IMPEL is a network of the environmental enforcement bodies throughout the European Community. The network allows the regulators who deal with industrial pollution to meet and discuss relevant issues. Strong links have been forged with IMPEL by inviting a member of IMPEL from each Member State as a core member of STREAM. This will ensure the STREAM network is addressing issues at the source and will contribute towards promoting a more consistent approach between countries. The strong

uptake in membership from the IMPEL has ensured a strong link is forged between the two networks..."

3.7 State of the art review

It is anticipated that the first annual workshop will be used to identify and agree the priority issues to be addressed by STREAM. The workshop will also agree the topics of interest that will be the focus for the brokerage event. A list of the identified instrumentation for development will be collated after the first core member workshop. This will form the basis of subsequent research and development proposals to be submitted by STREAM members ensuring that the main issues of concern to the environmental regulators across Europe are addressed.

4.0 MILESTONES AND REPORTS

This section lays out the expected outputs from the STREAM network and the work programmes for years 1, 2 and 3. Gantt charts for the anticipated work programmes are laid out at the end of this section. Year 1 lays out the start up requirements for the network, years 2 and 3 are the anticipated work programmes subject to the end of year review by DGXII and the Management Group.

4.1 Identification of EU and National requirements for monitoring.

Much of the information on surface water quality and quantity monitoring has been collated by the EEA through the European Topic Centre on Inland Water (ETC/IW). These reports (Topic Report 1,2,3 1996 Inland Water published by the EEA) will be used as source documents for the identification of priority areas for the thematic network to address. The information available in these reports contains statutory monitoring requirements for the EU, bi-lateral and multi-lateral programmes. In addition country specific monitoring information is also available.

It is anticipated that the relevant information from these reports will be distributed to the core members prior to the first workshop. Following the workshop the priority list of deteminands and monitoring requirements will be identified and agreed. This will form the basis of subsequent research and development proposals to be submitted by STREAM core and affiliated members ensuring that the main issues of concern to the EEA and national environmental regulators across Europe are addressed. The determinands required by for example EC directives are presented in Annex A.

The work programme will concentrate on making instrumentation available for monitoring in the Member States. Several EC directives are agreed in this area, each of these specify the required monitoring in order to comply with the directive.. The directives of interest to the network all include a brief description of the method recommended to be used for analysis of the determinands prescribed. The use of a standard for each of the determinands is not demanded, in additon there are no special requirements for the sampling method. However, all methods described are based on manual sampling and analysis in the laboratory, so the need for instrumentation is obvious, if the monitoring is to be based on timely information.

4.2 Identification of high priority list of instruments

A list of the identified instrumentation for development will be collated after the first core member workshop. The terms used in the specification of instrumentation are presented in Annex C to ensure a common understanding.

4.3 Outputs

Listed on pages 22, 23 and 24 are the proposed work programmes following agreement of the next phase of the STREAM network. All timescales are from the network start date. Year 1 will be the start up year and activities and costs have been allocated

accordingly. Year 2 and 3 programmes are shown, however these will be subject to the annual review and audit by DGXII and the Management Group.

4.5 Workshops/Brokerage Events

This section lays out the philosophy of the workshops and brokerage events. It is proposed to have two high profile events per year.

4.5.1 Workshops

OUTPUT:	Identification of monitoring requirements, agreed specifications and areas of interest for instrument development.

The first workshop which will bring together all the core members for an introduction to STREAM, and discussions on members involvement in the network. Representative organisations such as the EEA, ETC/IW, DGXI, DGXII, EURAQUA and TechWaRe will be invited to attend the launch and any subsequent events where appropriate. It is anticipated that the annual workshops will be used to identify and agree the priority issues to be addressed by STREAM. The outputs from the workshops will be presented on the world wide web (see Section 4.5.4). The workshops will also agree the topics of interest that will be the focus of interest for the brokerage event.

4.5.2 Brokerage Events

OUTPUT:	Collaborative research and agreed R&D proposals for submission to the EC for consideration for funding.

It is intended that a brokerage events will be held each year for all members of STREAM, experience has shown that these events if run correctly can be successful for brainstorming, networking and generation of new ideas. It is vital that end users are highly represented at these events as it is they who have the requirements for research proposals. The researchers and manufacturers provide the theoretical and practical technical expertise to support the proposal. The brokerage event will be organised three months after the workshop to enable the topics of interest to be disseminated. The organisation of the brokerage event will be of critical importance to ensure a good balance of participants. The organisation of these events will draw on previous similar events organised under EUREKA/EUROENVIRON. Attention will be given to ensure that end user requirements are prioritised prior to the brokerage events.

4.5.3 Newsletter

OUTPUT:	Bi-annual newsletter publicising topics of interest, calls for proposals and ongoing work.

The STREAM Management Group will produce a bi-annual newsletter outlining the work programme of STREAM, areas of interest and current work programme being undertaken. The newsletter will be available to members and non members alike. The newsletter will act to promote STREAM and further its objectives of accomplishing a truly pan European network. Core members, affiliated members and other water related groups will be encouraged to contribute to the newsletter.

4.5.4 World Wide Web

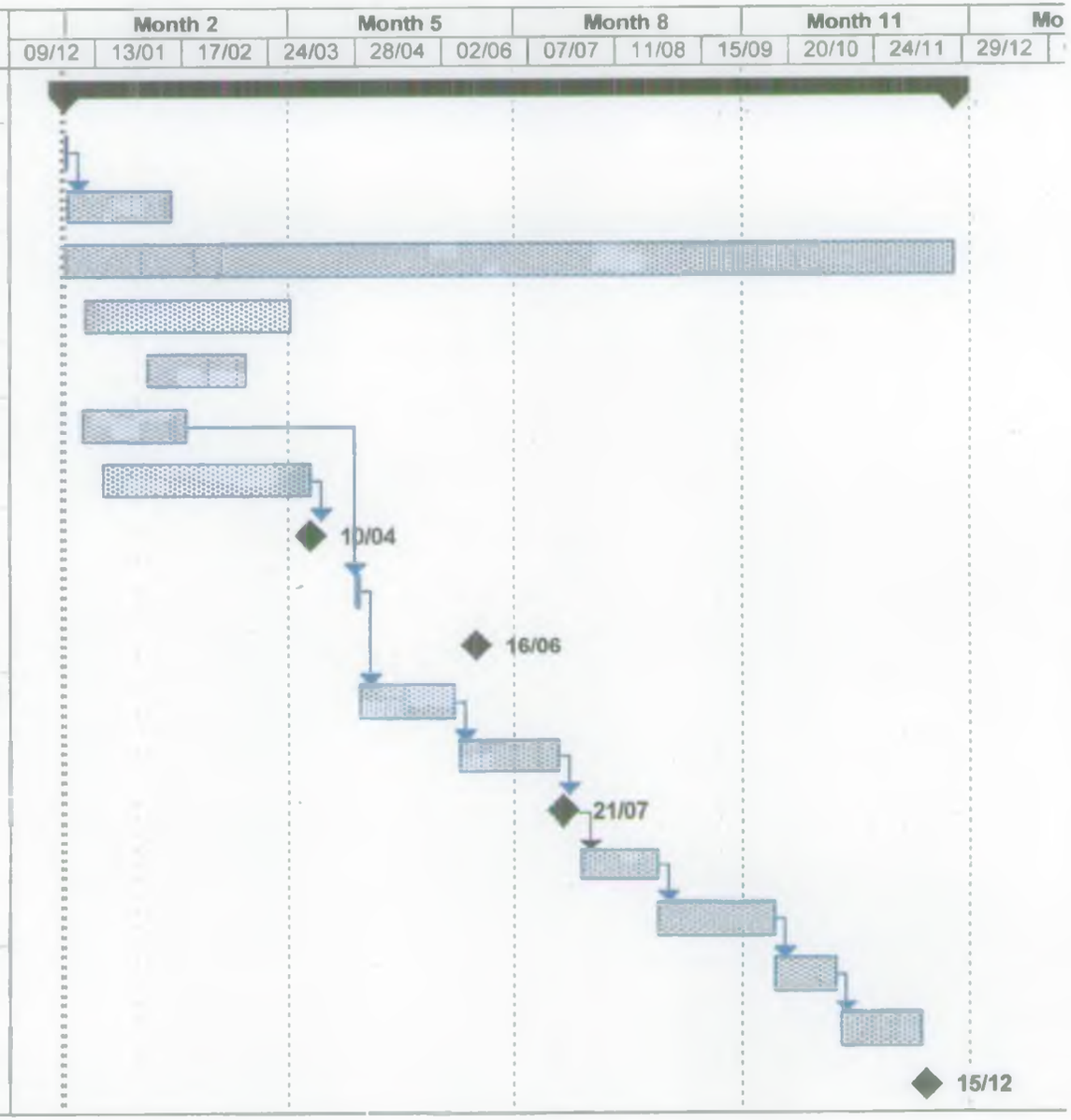
OUTPUT:	STREAM membership lists, contacts and areas of interest and hot links to EU sites of interest.

The STREAM network will produce and manage its own WWW site. The INTERNET will be the backbone of all communications for all STREAM core and affiliated members. The STREAM web site will be dynamically linked to relevant European web sites such as the DGXII, DGXI, EEA, ETC/IW and CORDIS.

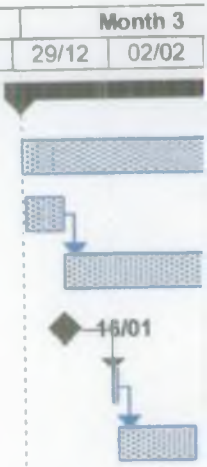
4.6 Long Term Sustainability

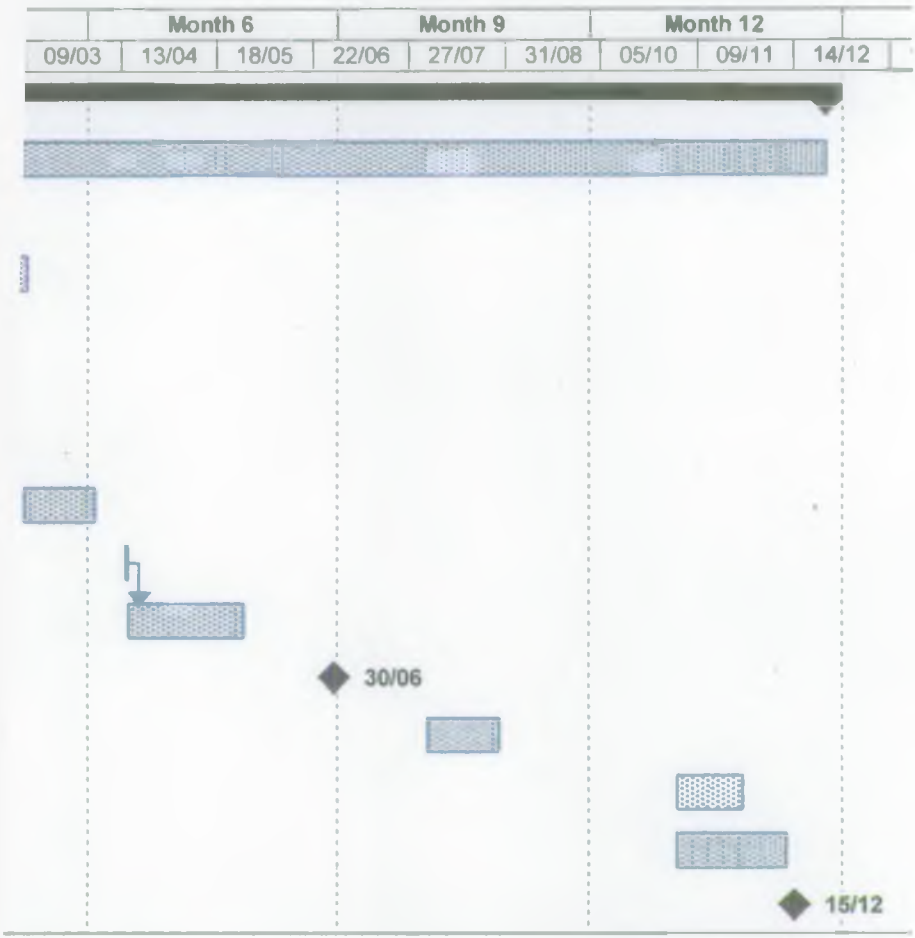
This will be determined by the success of the network. In the final quarter of year 3 of the network, the management group will undertake a review of the membership and outline the projected costs for establishing a self funding sustainable network. These findings will be presented to DGXII as part of the annual review for that year.

ID	Task Name
1	**STREAM Thematic Network**
2	Project Approval
3	Review of membership
4	Promotion and coordination of STREAM
5	Draft and publicise membership list
6	Meeting with relevant organisations
7	Publicise the start of the network
8	Tender and appoint web site developer
9	Web site operational
10	Meeting of Core Members Workshop
11	Half Yearly Report
12	Promotion of network and appointment of Affiliates
13	Meetings of Affiliated Members
14	First Brokerage Event
15	Post brokerage Review
16	Publication of newsletter
17	Audit of network
18	Review of future years programme
19	Annual Report to the Commission

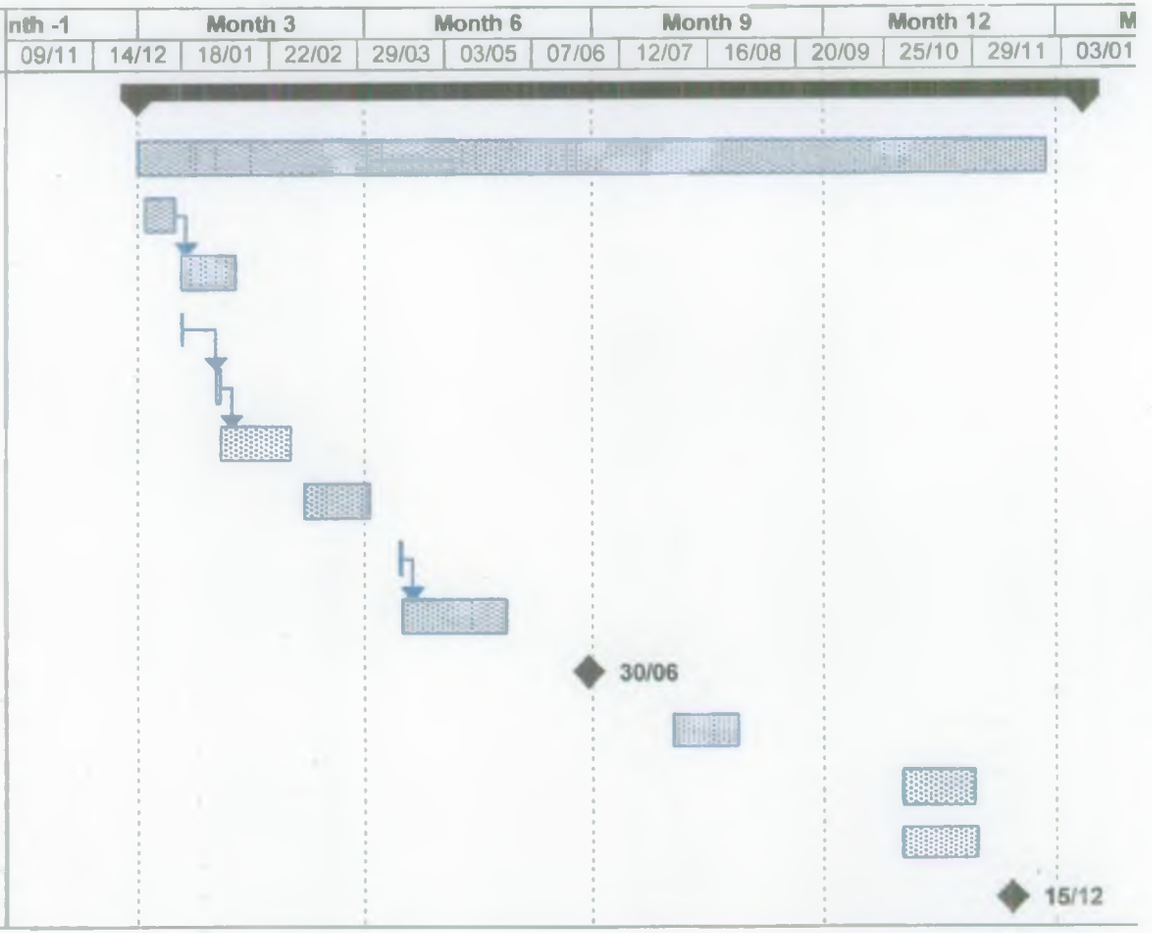


ID	Task Name
1	**STREAM Thematic Network Year 2**
2	Promotion and coordination of STREAM
3	Review of membership
4	Draft and publicise membership list
5	Call for proposals
6	Meeting of Core Members Workshop
7	Publication of newsletter
8	Meeting of Affiliated members
9	Brokerage Event
10	Post brokerage Review
11	Half Yearly report to the Commission
12	Publication of newsletter
13	Audit of network
14	Review of future years programme
15	Annual Report to the Commission




Month 6
Month 9
Month 12
09/03
13/04
18/05
22/06
27/07
31/08
05/10
09/11
14/12
30/06
15/12

ID	Task Name
1	**STREAM Thematic Network Year 3**
2	Promotion and coordination of STREAM
3	Review of membership
4	Draft and publicise membership list
5	Call for Proposals
6	Meeting of Core Members Workshop
7	Publication of newsletter
8	Meeting of Affiliated members
9	Brokerage Event
10	Post brokerage Review
11	Half Yearly report to the Commission
12	Publication of newsletter
13	Audit of network
14	Review of sustainability of network
15	Annual report to the Commission



5. NETWORK MANAGEMENT

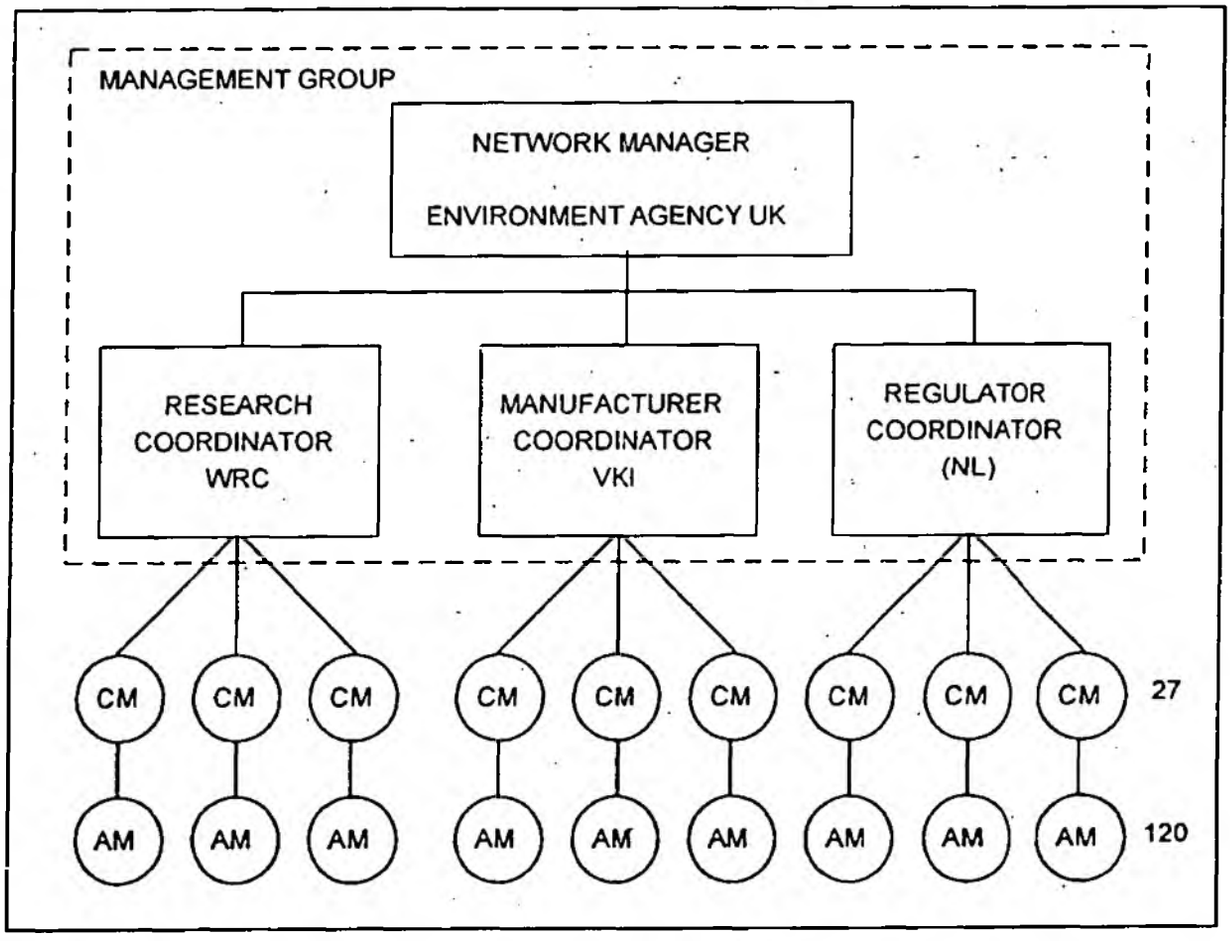
This section covers the organisational structure of the STREAM network and the roles and responsibilities of its membership.

5.1 Responsibility of the Manager

The management of the network will be undertaken by the Environment Agency who will control the running of the network. The Manager of the network will be funded entirely by STREAM as it will necessitate a full time post. The Manager's duties will involve;

- liaison with EC (DG XII and DGXI);
- coordinating all communications;
- control of budget;
- annual audits of the finances and performances of members;
- coordinating workshop and brokerage events;
- publication of bi-annual newsletter;
- promotion, direction and remit of the thematic network;
- editor of the World-Wide Web site;
- liaison with other relevant, interested organisations.

5.1.1 Network Structure



5.2 Responsibilities of the Management Group

It is proposed that a small management structure will be necessary to assist the Manager in the "operation" of the network. These sub Group Managers will act as support and topic advisors to the Manager and as focus for their specific group, and as a point of contact at workshops and brokerage events, their specific tasks have been identified as;

- focus point for affiliated members;
- coordination of the nomination of proposals for affiliated membership;
- coordinating at least one sub group meeting.

Because of the extra duties expected of them, such as travel and administration costs, the three members who form the sub-management group will have a larger annual budget than ordinary core members and this is detailed in Section 6 of this proposal.

5.3 Responsibility of the Core Members

The core funded members will have specific responsibilities, such as the attendance at workshops and brokerage events. Each of the core members will be expected to carry out certain activities which are to be drafted into a "contract"; some of the specific activities are listed below;

- attendance at all Workshops/Brokerage Events;
- detailed accounting of STREAM network expenditure;
- report on end user's needs;
- production of at least two articles/annum for the network magazine/journal;
- promote integration/communications with other EU networks;
- nomination and coordination of affiliated members.

5.4 Audits of Membership

The membership of the network will be reviewed annually by the three core members who form the Management Group and the network Manager. The audit criteria will be based upon the "contracts" specified up by Management Group. Auditing the network is crucial if the network is to remain flexible and adapt to the changing environmental demands. It is expected that the membership of the network will be organic and change as the work programmes and priorities develop over the three year span of STREAM. Requirement for the membership will be driven by changes in environmental legislation relevant to the aquatic environment. It will be the responsibility of the Management Group to ensure that the membership best reflects the demands placed upon it. Details of the annual audit of the members are to be reported to DGXII as a function of the annual review.

5.5 Communications

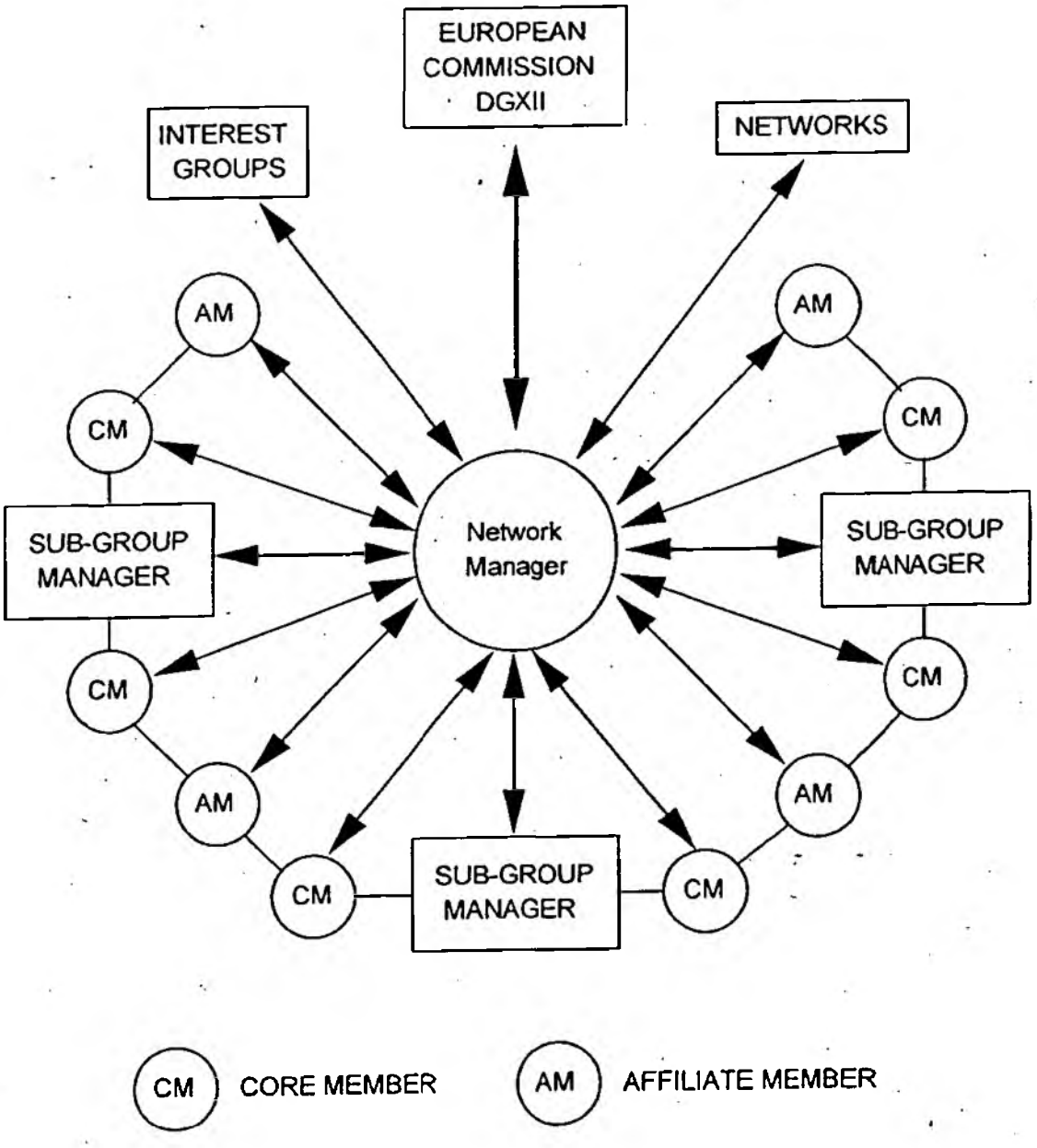
The main communication of the network will take place on the INTERNET, investigations have taken place as to the cost and management of this option and are included in Section 6.1. The costs and implications of using a paper system were

investigated and considered unsuitable for a thematic network operating on a pan European scale. The EEA, JRC, Environment Information Observation Network (EIONET) and the ETC/IW all utilise the World Wide Web, for a network of this scale the INTERNET is the only practical option. A formal newsletter will be produced, published and distributed via the INTERNET. The newsletter will not be restricted to the core members, affiliated members and other interested groups will be encouraged to actively participate and contribute. It is proposed that we will have direct links to the major EC web sites, ETC/IW and CORDIS.

5.5.1 Communications Structure

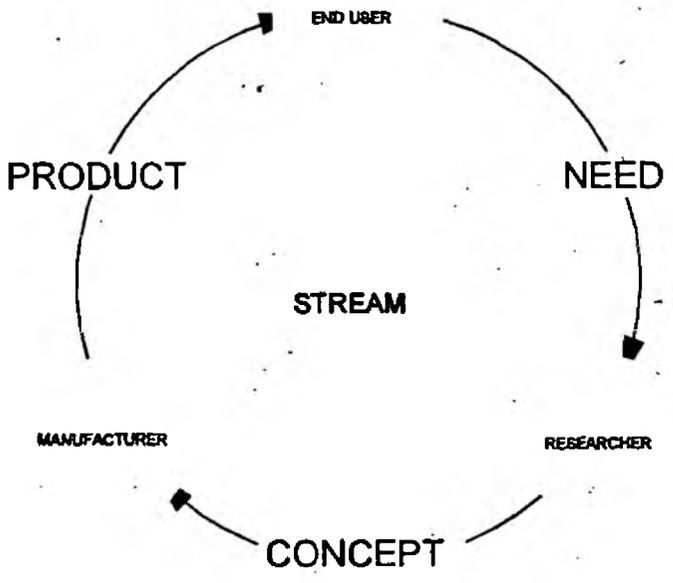
The network Manager will be accessible to all those involved with the thematic network, he will also act as the focal point for enquiries outside the network. A model of the proposed communications structure is shown below. The Manager will be responsible for the running of the web site and inter-network communications.

Network Communication Structure



5.6 STREAM Logo

During the investigative phase of this proposal publicity material for STREAM was designed and displayed at relevant water related instrumentation events to gauge the reaction to the proposal. Examples of the posters displayed at the EMBE event are in Annex D. A STREAM logo was developed and it is recommended that all future documentation relating to STREAM carry this identifier. The logo shown below simply but effectively outlines the main objective of STREAM.



6. FINANCIAL INFORMATION

This section covers the financial costs of running the STREAM network over a three year period.

6.1 Costings

The cost of running a pan European network is not inconsiderable. Drawing upon previous experience such as the EMBE event, the running costs of the network for three years has been laid out below. It is assumed that all the members of the network will have the neceesary hardware to enable them to access the WWW site.

	Year 1	Year 2	Year 3	Total
	ECU(k)	ECU(k)	ECU(k)	
Manager Expenses				
salary	48.24	50.92	53.6	152.76
travel	6.7	6.7	6.7	20.1
accommodation	1	1.34	1.34	3.685
administration	4.02	4.02	4.02	12.06
publications	2.68	2.68	2.68	8.04
sub group managers	12.06	12.06	12.06	36.18
Events				
workshops	13.4	13.4	13.4	40.2
brokerage events	13.4	13.4	13.4	40.2
Communications				
world wide web site setup	6.7	3.35	2.01	12.06
sub-total	108	108	109.21	319.925
Core Members				
travel	40.2	40.2	40.2	120.6
accommodation	16.08	24.12	24.12	64.32
core member funding	145.51	137.81	136.47	419.8
Total	310	310	310	930
Cumulative Total	310	620	930	

7. EUROPEAN DIMENSIONS

It is important that this area of water related instrumentation is coordinated to support amongst others the European Environment Agency in ensuring consistency of environmental information across all Member States. Six EC Directives are of relevance to the STREAM thematic network and these are briefly summarised below.

EC Directive 91/271/EEC: Urban waste water treatment.

The wastewater directive specifies actions to be taken towards municipal and industrial wastewater discharges and the handling of sludge from the treatment plants. The actions to be taken (in terms of required treatment efficiencies and time schedule of implementation of treatment) depend on the size of the load (the number of person equivalents).

The authorities responsible are required to monitor:

- discharges from sewage treatment plants according to specified control procedures;
- the amount and quality of sludge (for registration);
- the surface water receiving the treated sewage;
- the effects of discharge of sludge on soil.

On a biannual basis, the authorities are to publish a situation report on disposal and treatment of wastewater and sludge.

EC Directive 78/659/EEC: Quality of fresh waters needing protection or improvement in order to support fish life.

The Directive applies to those waters designated as needing protecting or improvement in order to support fish life. Two categories of waters must be designated:

- salmonid waters, for salmon, trout and whitefish;
- cyprinid waters for cyprinids and other species (pike, eel).

The Directive sets out imperative (I) and guide (G) values for 14 physical and chemical determinands for both categories of waters. Member States must set values no less stringent than the I values, and must "endeavour to respect" the G values. The Directive also lays down sampling procedures.

Member States must establish pollution reduction programmes designed to ensure that the waters are brought into conformity with the set values within five years of designation. Also Member States must consult each other formally concerning the fresh waters that cross or form national borders - the Commission may participate in such consultations.

EC Directive 76/160/EEC: Quality of bathing water

The Directive lays down 19 physical, chemical and microbiological determinands for the quality of bathing waters, 13 of which are imperative (I) or guide (G) values, the most important being micro biological.

The Directive lays down conditions for sampling and the Directive Annex lays down minimum sampling frequencies and reference methods of analysis and inspection. 95 percent of samples for 1 value determinands must be met. At regular intervals Member States must submit a report to the Commission on their bathing waters.

EC Directive 75/440/EEC: Quality required of surface water intended for the abstraction of drinking water in the Member States.

The Directive shall ensure that surface water abstracted for use as drinking water meets certain standards and is treated adequately before being introduced to the public supply, and that the quality of rivers and other surface waters used as sources of drinking water are improved.

Member States must classify sources of surface water for the abstraction of drinking water by their existing quality into three categories, A1, A2, and A3, according to three standard methods of treatment given.

The Directive contains the physical, chemical and microbiological characteristics used to define the three categories of water. Imperative (I) and guide (G) values are given for 46 determinands covering each of the three categories. Surface water having a quality worse than category A3 is prohibited from being abstracted for drinking water, except under exceptional conditions and with prior notification to the Commission.

The Member States must draw up a plan of action containing deadlines for the improvement of these surface waters, especially A3 water, for the achievement of "considerable improvements" over a ten year period.

EC Directive 79/869/EEC: Methods of measurement and frequencies of sampling and analysis of surface water intended for the abstraction of drinking water in the Member States.

The Directive supplements Directive 75/440 by recommending methods of measuring the determinands for surface water quality, and setting the frequencies for such measurements.

8. BIBLIOGRAPHY

The following references were used in compiling this document.

NRA (1993), NRA Water Quality Strategy, National Rivers Authority, Bristol

EC (1994a), Standards, Measurements and Testing - Information Package, European Commission

EC (1994b), Standards, Measurements and Testing - Work programme, European Commission

EC (1993), Community programme of policy and action in relation to the environment and sustainable development, in Official Journal C138 Volume 35, European Commission

European Environment Agency (1994) Annual Work programme mid 1994-1995

EC Directive 91/271/EEC: Urban waste water treatment.

EC Directive 78/659/EEC: Quality of fresh waters needing protection or improvement in order to support fish life.

EC Directive 76/160/EEC: Quality of bathing water

EC Directive 75/440/EEC: Quality required of surface water intended for the abstraction of drinking water in the Member States.

EC Directive 79/869/EEC: Methods of measurement and frequencies of sampling and analysis of surface water intended for the abstraction of drinking water in the Member States.

European Environment Agency Annual Report, 1995.

European Topic Centre on Inland Waters. Annual Summary Report, 1995.

Eurowater Reports (produced through DGXI)

The following reports produced through the Eurowater project co-funded by the European Commission (DGXI) and the National Rivers Authority have proved useful background to this feasibility study.

Barraque.B, Berland.S, JM and Cambon.S, (1994 Institutional mechanisms for water management in the context of European environmental policies -n Vertical report on France, LATTS-EPNC Genie de l'environment, January 1994.

Kraemer.AR, and Jaeger.GF, (1995) Institutional mechanisms for water management in

the context of European policies - Vertical report on Germany, Institute fur Europische Umweltpolitik eV, May 1995.

Nunes Corcia. F, Bejas, Nevas. E, Alzira Santos. M , and Evaristo da Silava. J, (1995) Institutional mechanisms for water management in the context of European environmental policies - Vertical report on Spain, Instituto Superior Tecnico, June 1995.

Rees.Y, And Zabel. T (1995) Institutional mechanisms for water management in the context of European environmental policies - Vertical report on UK, WRC, July 1995.

Annex A : The determinands and methods described in the EC directives

Determinands listed in EC directives

Tables 1 to 4 list the determinands included in the EC directives detailed Section 7 and indicate the methods, prescribed together with identified standards which can be used for the determinands. The standards have been identified according to CEN (prefix for the standard no. is EN) and ISO. Both standards implemented and standards included in the workplans from these organisations have been identified. As can be seen, quite a substantial work is going on related to standards for manual methods, whereas the work for development of in-situ instrumentation is very limited.

Determinand	Method	CEN	ISO
BOD, (without nitrification) (mg/l O_2)	Determination of dissolved oxygen before and after five-day incubation	-	5815
COD (mg/l O_2)	Potassium Dichromate method	-	6060
SS (mg/l)	Filtering/centrifuging, drying, weighing	pr870	-
Tot-P (mg/l)	MAS	pr1189	-
Tot-N (mg/l)	MAS	-	-

Table 1: Determinands and methods given in EC Directive 91/271/EEC: Urban Waste water treatment, and identified possible standards.

The following abbreviations have been used in the tables:

MAS: Molecular Absorption Spectrophotometry
AAS: Atomic Absorption Spectrophotometry
pr: preliminary CEN standard (example prEN870)
DIS: preliminary ISO standard (example ISO/DIS10523)
R: recommended (preliminary) DS standard (example R254)
-: No standard identified

Determinand	Method	CEN	ISO
Temp. (°C)	Thermometry	-	-
Dissolved O_2 (mg/l)	Winkler or electrochemical	25813 24814	5813 5814
pH	Electrometry	-	DIS 10523
SS (mg/l)	Filtering/centrifuging, drying, weighing	pr870	-
BOD, (mg/l O_2)	Determination of dissolved oxygen before and after five-day incubation	-	5815
Tot-P (mg/l)	MAS	pr1189	-
Nitrite (mg/l NO_3^-)	MAS	26777	6777
Phenolic compounds (mg/l C_6H_5OH)	By taste	-	6439
Petroleum hydrocarbons	Visual, by taste	-	-
Ammonia (mg/l NH_3)	MAS	-	7150-1
Ammonium (mg/l NH_4^+)	MAS	-	7150-1
Total residual chlorine (mg/l HOCl)	DPD-method	-	7393-1

Determinand	Method	CEN	ISO
Total zinc (mg/l)	AAS	-	8288
Dissolved copper (mg/l)	AAS	-	8288

Table 2: Determinands and methods given in EC Directive 78/659/EEC: Quality of fresh waters needing protection or improvement in order to support fish life, and identified possible standards.

Determinand	Method	CEN	ISO
Tot-coliforms (/100 ml)	Culturing/subculturing and counts	pr29308 -1 or 2	9308 -1,2
Faecal coliforms (/100 ml)	Culturing/subculturing and counts	-	-
Faecal streptococci (/100 ml)	Litsky method	-	7899 -1,2
Salmonella (/1 litre)	Concentration, culturing, identification	pr26340	DIS 6340
Entero viruses (PFU/10 litres)	Concentration and confirmation	-	-
pH	Electrometry	-	DIS 10523
Colour	Visual inspection or photometry	pr27887	7887
Mineral oils (mg/l)	Visual and olfactory inspection or extraction/drying/weighing	-	-
Surfactants (mg/l laurylsulfate)	Visual inspection or MAS	903	7875-1
Phenols (mg/l C_6H_5OH)	MAS	-	6439
Transparency (m)	Secchi's disc.	-	-
Dissolved Oxygen (% saturation O_2)	Winkler	25813 25814	5813 5814
Tarry residues and floating materials	Visual inspection	-	-
Ammonia (mg/l NH_4^+)	MAS	-	7150-1
Kjeldahl-N (mg/l)	Kjeldahl	25663	5663
Pesticides (parathion, HCH, dieldrin) (mg/l)	Extraction and chromatography	-	-
Heavy metals (As, Cd, Cr(VI), Pb, Hg) (mg/l)	AAS	pr1233 25666-2	8288 5666-2
Cyanides (mg/l CN^-)	MAS	-	6703-1
Nitrates and phosphates mg/l NO_3^-, mg/l PO_4^{3-})	MAS	pr1189	6776 6878-1

Table 3: Determinands and methods given in EC Directive 76/160/EEC: Quality of bathing water and identified possible standards.

Determinand	Method	CEN	ISO
pH	Electrometry	-	DIS 1053
Coloration (after filtration) (mg/l Pt scale)	Photometry	pr27887	7887
SS (mg/l)	Filtering/centrifuging, drying, weighing	pr870	-
Temp (°C)	Thermometry	-	-
Conductivity $\mu s/cm^{-1}$ at 20°C	Electrometry	27888	7888
Odour (dilution factor at 25°C)	By successive dilution	-	-
Nitrates (mg/l NO_3)	MAS	-	6776
Fluorides (mg/l F^-)	MAS or Ion selective electrodes	-	10359
Tot-extractable organic Chlorine (mg/l Cl)	-	-	-
Dissolved iron (mg/l Fe)	AAS or MAS after filtration	-	6332
Manganese (mg/l Mn)	AAS	-	-
Copper (mg/l Cu)	AAS or Polarography	-	8288
Zinc (mg/l Zn)	AAS or MAS	-	8288
Boron (mg/l B)	MAS or AAS	-	-
Beryllium (mg/l Be)	-	-	-
Cobalt (mg/l Co)	-	-	8288
Nickel (mg/l Ni)	-	-	8288
Vanadium (mg/l V)	-	-	-
Arsenic (mg/l As)	AAS or MAS	26595	6595
Cadmium (mg/l Cd)	AAS or Polarography	-	8288
Tot-Chromium (mg/l Cr)	AAS or MAS	pr29174	9174
Lead (mg/l Pb)	AAS or Polarography	-	8288
Selenium (mg/l Se)	AAS	-	9965
Mercury (mg/l Hg)	Flameless AAS	pr25666	5666-2
Barium (mg/l Ba)	AAS	-	-
Cyanide (mg/l CN^-)	MAS	-	6703-1
Sulphates (mg/l SO_4^{2-})	Gravimetry or EDTA complexometry or MAS	-	9280
Chlorides (mg/l Cl^-)	Titration (Mohr) or MAS	-	9297
Surfactants (mg/l laurylsulphate)	MAS	903	7875-1
Phosphates (mg/l P_2O_5)	MAS	pr1189	6878-1
Phenols (mg/l C_6H_5OH)	MAS or Paranitraniline method	-	6439
Dissolved or emulsified hydrocarbons (mg/l)	Infrared spectrometry or gravimetry after extraction	-	-
Polyclic aromatic hydrocarbons (mg/l)	UV-fluorescence after thin layer chromatography	-	-
Total pesticides (para-thion, HCH, dieldrin) mg/l	Gas or liquid chromatography after extraction	-	-
COD (mg/l O_2)	Potassium dichromate method	-	6060

Determinand	Method	CEN	ISO
Dissolved oxygen (% saturation O_2)	Winkler or Electrochemical	25813 25814	5813 5814
BOD, (without nitrification) (mg/l O_2)	Determination of dissolved oxygen before and after five-day incubation	-	5815
Kjeldahl-N (mg/l N)	Kjeldahl	25663	5663
Ammonium (mg/l NH_4)	MAS	-	7150-1
Substances extractable with Chloroform (mg/l)	Extraction, evaporation, weighing	-	-
TOC (mg/l C)	-	-	8245
DOC (mg/l C)	-	-	-
Tot-coliforms (/100 ml)	Culturing, sub-culturing and counts	-	9308 -1 or 2
Faecal coliforms (/100 ml)	Culturing, sub-culturing and counts	-	-
Faecal streptococci /100 ml	Litsky method	-	7899 -1 or 2
Salmonella	Concentration, culturing, identification	pr26340	DIS 6340

Table 4: Determinands and methods given in EC Directives 75/440/EEC: Quality required of surface water intended for the abstraction of drinking water in the Member States, and in the adjacent directive 79/869/EEC and identified possible standards.

Annex B: Members of STREAM

Annex C: Terms for specification of required instrumentation.

Terms for the specification of required instrumentation.

The specification of the required instrumentation can be defined according to Section 15, Validation, in the explanatory guide for the standard EN45001. This section specifies the performance characteristics of a laboratory instrument and includes:

- Selectivity & specificity
- Range
- Linearity
- Sensitivity
- Limit of detection
- Limit of quantitation
- Ruggedness
- Accuracy
- Precision, repeatability, reproducibility
- Response time

The response time has been added to the list from the guide, because of the importance of this for sensors used in on-line instruments.

Selectivity of an instrument refers to the extent to which it can determine particular determinand(s) in a complex mixture without interference from the other components in the mixture. An instrument which is perfectly selective for a determinand or group of determinands is said to be **specific**. The applicability of the instrument should be studied using various samples, ranging from pure standards to mixtures with complex matrices. Any known interferences to the measurement technique and restrictions in the applicability of the technique should be documented for the instrument.

Range: For quantitative measurements the working range for an instrument is determined by examining samples with different determinand concentrations and determining the concentration range for which acceptable accuracy and precision can be achieved. The working range is generally more extensive than the linear range, which is determined by the measurement of a number of samples of varying determinand concentrations and calculating the regression from the results, usually using the method of least squares. The relationship of determinand response to concentration does not have to be perfectly linear for a instrument to be effective. For instruments showing good linearit, five different standards (plus a blank) are usually sufficient for producing calibration curves. More standards will be required where linearity is poor. In qualitative measurements, it is commonplace to examine replicate samples and standards over a range of concentrations to establish at what concentration a reliable cut-off point can be drawn between detection and non-detection.

Linearity is determined by measurements of samples with determinand concentrations spanning the claimed range of the instrument. The results are used to calculate a regression line against determinand concentration using the least squares method.

Sensitivity is the difference in determinand concentration corresponding to the smallest difference in the response of the instrument that can be detected. It can be calculated from the slope of the calibration curve or, experimentally, using samples containing various concentrations of the determinand.

The **Limit of detection** of a determinand is determined by repeated measurement of a blank test portion, and is the determinand concentration whose response is equivalent to the mean blank response plus three standard deviations.

The **Limit of quantification** is the lowest concentration of determinand that can be determined with an acceptable level of accuracy and precision. It should be established using an appropriate standard or sample, i.e. it is usually the lowest point on the calibration curve (excluding the blank). It should not be determined by extrapolation.

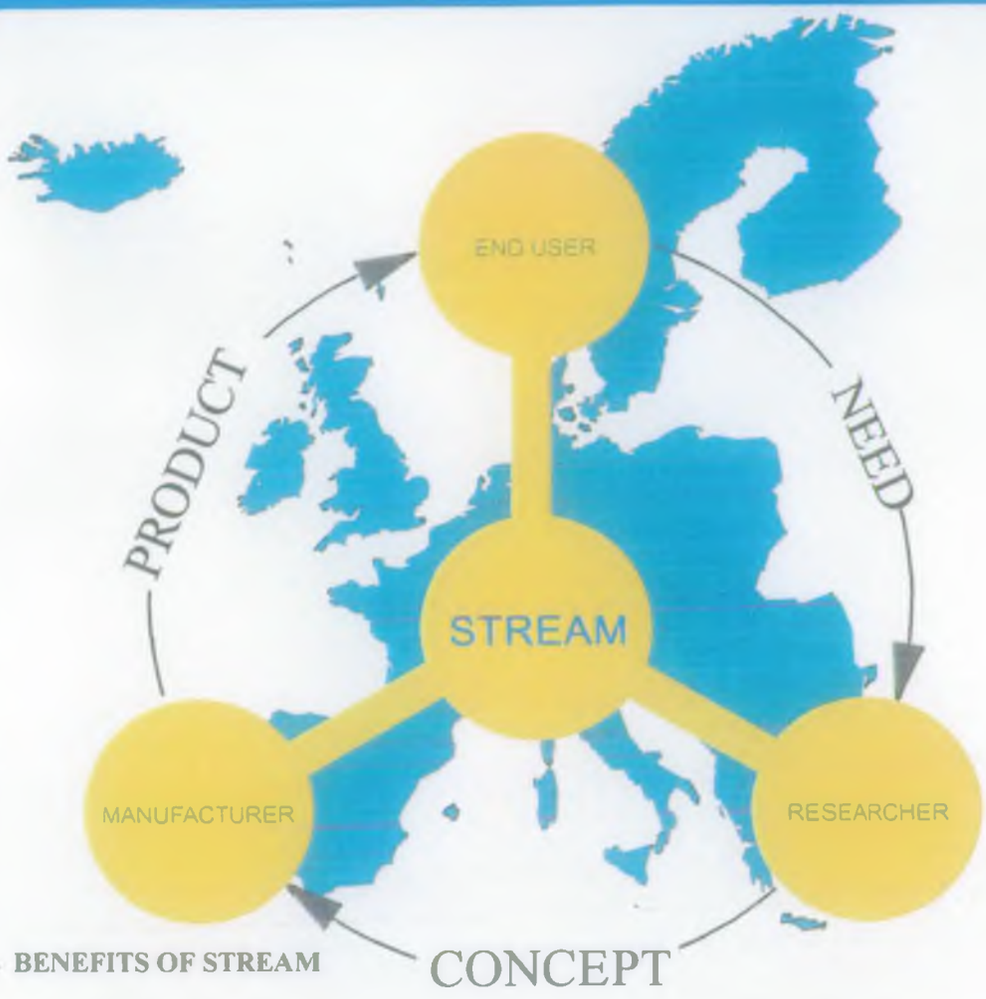
Ruggedness: Where different operatorss use the same instrument they inevitably introduce small variations in the procedure, which may or may not have a significant influence on the performance of the instrument. The ruggedness of a instrument is tested by deliberately introducing small changes to the instrument and the use of it and examining the consequences. A large number of factors may need to be considered, but because most of these will have a negligible effect, it will normally be possible to vary several at once.

The **accuracy** of an instrument can be established by measuring a suitable reference and is the closeness of the obtained determinand value to the certified determinand value.

The **precision** of an instrument is a statement of the closeness of agreement between mutually independent test results and is usually stated in terms of standard deviation. It is generally dependent on determinand concentration. It may be stated in different ways depending on the conditions in which it is calculated. **Repeatability** is a type of precision relating to measurements made under repeatable conditions, i.e.: same instrument; same operator; same environment; narrow time period. **Reproducibility** is a concept of precision relating to measurements made under reproducibility conditions, i.e.: different instruments of the same type; different operators; different environments; long time period.

The **response time** of an instrument is the time the instrument uses to respond to 90% of a step change in the determinand concentration.

Annex D: Promotional Material



BENEFITS OF STREAM

- Increased awareness of end users needs by Researchers and Manufacturers
- End users will be more aware of what science & technology can deliver
- To assist Manufacturers identify gaps in the market
- To encourage submission of R&D proposals to the EU on instrumentation

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STREAM

A European Thematic Network for **S**tandards, Measurement, **T**esting and **R**esearch in **E**nvironmental Instrumentation and **M**onitoring

OBJECTIVES OF STREAM

"...to bring together environmental regulators, researchers, manufacturers and users of water quality and quantity instrumentation to increase industrial competitiveness, improve standardisation and to promote better exploitation of new science and technology."