Environment Canada National Data Management Framework Policy - Abridged Draft 4 11 April, 1997

Preface: A Message from the Deputy Minister

An important part of Environment Canada's mandate is the preservation and enhancement of Canada's natural environment. Sustainable development represents a long-term approach that will enable us to fulfill this mandate, and we have made it our mission through our ongoing programs to make sustainable development a practical environmental, social and economic reality in Canada.

Knowledge, and the capacity to use it, are the key building blocks to making sustainable development a reality in Canada and around the world. ***To this end we are adopting this national policy Framework for Data Management to ensure the environmental data we create, acquire and hold are accessible to all who need it in their endeavors to understand and manage social, economic and environmental sustainability.***

We also believe that Canada has a special global responsibility, and is uniquely positioned to play a major role in the development and delivery of that knowledge and capacity to the world. Environment Canada can contribute to meeting that responsibility, but the ongoing efforts and commitment of governments, business, voluntary organizations and individual Canadians will be needed if we are to be successful. We therefore will continue to consult and collaborate widely within the national and international community on new means for sharing of environmental data and scientific knowledge.

Environment Canada has a responsibility to demonstrate leadership in this sharing of information and pooling of expertise and resources. With the advent of new information technologies like the Internet and the scientific demands of global change modeling, the ability for efficient and effective exchange of monitoring data rests on maximizing the ability of all parties to search, find and share data rapidly, accurately and at minimum cost. *I believe the adoption of this Data Management Framework will make a significant contribution to demonstrating that leadership role and our commitment to advancing the cause of sustainable development world-wide.*

OVERVIEW OF THE DATA MANAGEMENT FRAMEWORK

Today it has become clear that a formal framework approach, with common principles, guidelines and standards for data management, is essential for efficient and effective use of resources. It will also ensure maximum returns on the investments made in scientific data across many different disciplines and organizations. A data management framework defines **what** is required and describes **how** that is to be implemented and **who** is accountable. The result will be to improve Canada's ability to make responsible decisions about the environment for present and future generations.

Simply stated, the overriding goal of the Data Management Framework is to enable EC and Canadians to know better **what** EC environmental data exists, **why and when** it was collected ,**where** it is stored and **how** to get to it.

PART I: Mandate and Vision

SECTION 1: Context

1.1 Environment Canada Mandate

Environment Canada (EC) was established as the federal government ministry responsible for matters pertaining to the environment by the government organization acts of 1970 and 1972. Its specific responsibilities are further defined by federal legislation and regulations as detailed in Appendix A. The Department shares responsibility for environmental programs federally and between jurisdictions by means of agreements between authorities as listed by example in Appendix A. These make various explicit or implicit references to the activities of systematic observation and scientific monitoring of the environment in support of the mandated policies and programs. Recent deliberations within the Canadian Council of Ministers of the Environment (CCME) support the need for continued federal leadership and coordination in the area of environmental data management.

1.2 Background to Data Management in EC

By mid-1995 concerns over data management issues in many quarters of EC resulted in the scheduling and completion of a comprehensive internal review led by the EC Review Branch. In May 1996, EC Management Board (EMB) strongly endorsed the Review's findings and recommendations to proceed with the development of a Data Management Framework and an implementation plan This decision also affirmed the requirement to have a senior "Champion" for data in EC and the Co-chairs of the Information Products and Services business line component were assigned this role initiating and overseeing the development of this Framework and its implementation.

1.3 Vision for Data Management in EC

The Review established the need for a significant reaffirmation, renewal, and redirection of many aspects of Data Management in EC. Its data resources were acknowledged to be as critical to the success of its programs and policies as were its financial and human resources. In adopting the Review's recommendations, Environment Canada

Management Board established a new Vision of Data Management in EC and for data managers at all levels in all programs:

> **"Data is a fundamental *strategic* resource of EC as is the information and knowledge derived from it. Well functioning management of this data is *critical* to enable present and future generations of Canadians to make *responsible decisions* regarding the environment."**

It will be a goal of this Framework to put into operation this Vision and to maintain a high profile, commitment and accountability for data management at all levels in the business of EC and with its partners. In particular the needs of data management will be identified and will be accounted for explicitly in the Action Plans and Performance Reports of Environment Canada and its managers. A key result will be that the data holdings of EC will become centrally registered, appropriately documented and more readily accessible.

1.4 Federal and National Roles

Although initially designed as an EC initiative, the Data Management Framework may form the basis for a national framework and in fact will support the development of an international framework. Various organizations identify the need for *integrated and readily accessible* environmental data sets on a range of scales from local to regional to global under such initiatives as the Global Change Program[1], Canadian Climate Program[2], Bio-diversity Conservation Information System of IUCN, the Commission for Sustainable Development, NAFTA Environment Commission, etc. Within Canada the provinces, municipalities, businesses, industries, universities and environmental organizations all seem to agree on the need for a national framework to facilitate closer cooperation and collaboration on the integrated management of the environmental data and information holdings of the country. This is necessary to avoid overlap and duplication, while at the same time to increase the opportunities for strategic alliances in policy development, service programs and scientific investigations.

SECTION 2: Scope

[1] "*Data Policy Barriers to Data Access in Canada: Issues for Global Change Research*" a Discussion Paper by the Data and Information Systems Panel of the Canadian Global Change Program, Royal Society of Canada, 1996.
[2] "*Report of the Workshop on the Canadian Climate System Data*" National Climate Advisory Committee on Data and Applications, Climate Program Board, Quebec, 1993.

2.1 Purpose and Application

The purpose of this document is to establish the policies, principles, guidelines and standards of Environment Canada as they shall be applied to the work of managing our environmental data holdings, whether created or acquired by EC, regardless of their specific purpose.

Good data produces good science produces good services and policies. The degree of "goodness" is related to a number of technical and human factors. But it is clear from both the EC Review and the international literature that, without good data management practices, achieving good results becomes unnecessarily expensive and difficult, if not impossible. This Framework then focuses on the principles and the activities of good data management.

This document is not intended to be, or to replace, the manuals used to establish operational procedures, practices and standards for specific data sets such as meteorological surface and upper air data, hydrometric data, wildlife surveys, etc. Rather it provides the overall policy framework within which all such activities must operate in order to improve *consistency and comparability* of practices across the wide range of data management activities and environmental programs.

Activities covered by the Framework include various areas of the monitoring endeavor:

Data Collection (observing, monitoring, surveying, sampling, etc.);

Data Management (planning, directing, quality assuring, documenting, controlling, reporting, reviewing, disposing, etc.);

Data Access (searching for, looking at, retrieving, copying, editing, transforming, deriving, etc.);

Data Archiving (storing regardless of medium, transferring between media, publishing, preserving, warehousing, etc.); and

Informatics Support (supplying hardware, software, and operating expertise and resources).

At the present time there are already a large number of data sets or holdings in a wide range of states and conditions relative to their management. *To the greatest extent feasible and practical all existing data should be brought under this Framework policy as soon as possible. All present and planned future data activities shall be subject to this policy immediately.* The implementation shall be the responsibility of all EC managers as part of normal program management responsibility.

2.2 Defining the Data

For the purposes of this policy and its implementation, "data" refers to, and is limited to specifically:

> "all representations of physical, biological or chemical facts or observations as created, acquired or used by EC. These are normally in a numeric, Geo-referenced, computer-readable format. They include related socio-economic and cultural representations. "

By virtue of the fact that many environmental effects are detected or diagnosed serendipitously from historical data sets gathered for other purposes, *managers should endeavor to recover, transform and protect all systematically collected environmental data amenable to further comparative analysis.*

Part II : Policy and Principles

SECTION 3: Policy

3.1 Government

The latest policies of the Treasury Board of Canada on the management of government Information Holdings are set out in the draft Review Guide (1995). These are written so as to apply broadly across the wide field of "all government information" in its many forms including reports, policy documents, regulations, publications, brochures, financial and administrative data, etc. However they clearly include and apply to environmental data and derived information holdings as defined within this framework. They make explicit reference to the requirement that there be departmental policies and frameworks on data management with particular emphasis on documenting and securing all data resources on behalf of the government and all Canadians.

This Data Management Framework is intended to extend these TB guidelines into operating policies, principles, guidelines and standards as they are to be applied to the

environmental and related data sets managed by Environment Canada. It is also intended to identify and clarify ministerial and managerial accountabilities for these resources which parallel in many respects those which exist for the financial, human and material resources allocated to the department.

3.2 Environment Canada Policies

Prior to this Framework, EC has not had an explicitly stated, department wide policy on data management. It is therefore important to make a concise statement of the policy of the department that comes into force with the adoption of this Framework by the Management Board of Environment Canada.

It is the policy of Environment Canada that:

- environmental information be relevant, accessible, and responsive to the needs of Canadians.
- environmental data created, acquired and held by EC be credible and secure.
- data be held in trust and in respect of all laws , policies or agreements
- managers be explicitly accountable for their data management activities

SECTION 4: Principles

In the fall of 1996 the department "Champions" appointed a Team of managers from across the department to create and foster the Data Management Framework as identified by the Review and approved by EMB. The members of the Team represented a cross section of data providers, data managers, data users and IT support managers from various program areas. This Team was able to form a broad consensus on both the needs and the guiding principles for the Departmental Framework which would ensure the long term *credibility*, *relevance* and *accessibility* of EC's environmental data holdings. It was felt that these overriding requirements would be met if all managers accept and follow a set of common principles in their data management affairs.

Some data may exist in EC by virtue of a contract or agreement with a client or partner whereby the Crown does not attain ownership, and hence the data may be exempted from the Principles, Guidelines and Standards of this Framework.

4.1 Data

Data forms the foundation of the *data - information - knowledge - wisdom* pyramid. This data forms the basis from which information is derived and the knowledge and wisdom for decision making are gained. It is essential to collect and record this data in the best way possible, to know that the data exists and to have access to it now and in the years to come. The data may be our most valuable resource.

Principle 1 - *Data created or acquired are valued EC resources* held in trust,

Principle 2 - *Data sets shall be registered* by name, type and location in a central Directory according to the guidelines and standards attached to this Framework..

Principle 3 - *Data shall be readily accessible.* Access to research data sets may remain under the control of the principle investigator for a reasonable period of time normally not to exceed 2 years beyond completion of initial lab or field study period. Access to certain data may be subject to specific charges and/or conditions where so specified by a relevant policy, contract or agreement.

4.2 Program Managers

Stewardship of the data is the responsibility of the program manger. This responsibility extends to managers at all levels of the organization for all of the various aspects of data integrity, credibility and accessibility. It directly parallels what is in place for other departmental program resources such as human, financial, material and property. Such responsibility needs to be formally recognized in all departmental accountability and planning instruments.

Principle 4 - *Program managers shall be responsible and accountable for the complete life cycle of the data.* Although the continuum of stages in the "life cycle" can be defined and assigned in a multitude of ways, it begins with the decision to observe and/or acquire and ends with the acts of use and/or long term retention and includes all aspects of quality assurance and documentation.

Principle 5 - *Program managers shall consult and involve users and clients* about all stages of the life cycle. In turn, users and clients have a responsibility to support program managers in the fulfillment of their responsibilities for good data management practices.

Principle 6 - *program managers shall seek and follow only recognized standards, procedures and protocols* in their data management practices.

4.3 Decision Making Principles

In making decisions involving data activities there are certain key management principles which are of particular relevance to the efficient and effective use of the available human, financial and material resources.

Principle 7 - Before starting any data activity, *tests for reasonableness shall be applied* involving assessment of the need, relevance, cost, value and benefit. Program managers and scientists should consider alternative sources or equivalent means which may be less demanding of resources prior to investing in any particular data activity.

Principle 8 - *Plans for program changes or initiatives* (including policy, legislative and regulatory documents) *shall include explicit consideration of all data resource needs prior to approval or adoption.* This applies equally to both "positive and negative" changes.

Principle 9 - *Data holdings shall be reviewed regularly for a decision on future retention.* This decision is based on criteria of reasonableness as in Principle 7. Circumstances and relevance of the data and applications can change over time as can the related issues and mandate. The period between reviews should not normally exceed 3 years.

SECTION 5: Accountabilities

5.1 Roles and Responsibilities

In accordance with the related guiding Principles, general accountability for data management is at both the individual and program level. It extends throughout the organization to all levels and all activities.

However, EMB may also appoint "corporate data managers" as Custodians, Stewards, Collectors, etc. with formal responsibilities, authorities and accountabilities for specific areas or types of data and data management within EC at the national and inter-organizational level. (see Attachment II for more information on this approach)

5.2 Performance Measures

Performance objectives for data management should be established by reference to the following criteria:

- application of the national Data Management Framework;
- application of Public Service, Treasury Board and Environment Canada policies;
- quality service measures including regular client/user consultations and/or adherence to established quality standards;
- achievement of expected results within the Departmental planning process; and
- the performance of designated roles and responsibilities for data management activities of Environment Canada.

5.3 Reporting

Performance evaluation would normally be effected/reported through the following:

- the Departmental business planning cycle, including management contracts;
- the Departmental performance review system; and
- internal and external reviews.

5.4 Review

This Framework and the related guidelines and standards shall be reviewed and updated regularly by members of the Team appointed by the EMB Champion(s) and members.

The updating will address changes in requirements and in technology, based on regular consultation department-wide with program managers, clients/users and partners.

The Department's review policy will apply to data management, and these activities will be addressed in the Departmental Long Term Review Plan as managed by the Review Branch.

PART III - The GUIDELINES

Part III of the Framework establishes the guidelines and standards for environmental data management deemed necessary and sufficient to achieve the results prescribed in the Vision and the principles of this policy Framework. In some cases these are in themselves the *prescriptive standards* that must be followed in each and every case; in others they are *descriptive guidance* on the type and nature of the standards and practices that must be in place at the day to day working level of any particular organizational unit involved in a data management activity.

In fact this part of the Framework will have to be somewhat dynamic as the needs and technologies evolve. It will be a responsibility of the department's Champion(s) to ensure that the Guidelines are maintained current and responsive to these changes by an appropriate mechanism involving the managers, custodians and stakeholders of the data.

The Framework is designed in such a way that any existing operational standard, protocol and procedure (such as exist internationally and domestically for the collection, exchange and storage of real time and large, long term weather or wildlife data sets) may be "attached" to the Framework for its specific application in a particular data management area.

SECTION 6: Standards for Data and METADATA

This section of the Guidelines establishes the definitions and standards necessary to ensure the existence and reliability of a workable and efficient departmental cataloging of environmental data that is comprehensive, accessible and responsive. These standards must be prescriptive and must be maintained, according to the Principles, for all data sets created or acquired by Environment Canada if it is to work.

6.1 Database Structures

All databases can be structured and defined by three distinct elements or levels:

- First each database must carry a unique "LABEL" by which the general nature of the information (type, location, time, purpose, etc.) and custodial contact (name, phone number and e-mail address) can be determined. This Label will normally consist of two fields: DATA SET NAME and CONTACT, each assigned as specified in a standardized thesaurus to be fully compatible with international, national and departmental standards for a high level, WEB-based Directory system. Data Directories are normally held centrally and locally(see Appendix C for background and details).

- Second, each database should have a minimum Dictionary of METADATA, i.e. information on the nature (attributes), purpose, quality, detailed time and space coordinates of the data. Included in this record(s) should be a basic description of the schema or format of the database to follow, so that the means necessary for accessing the data can be determined. Dictionaries may be retained on the database server or held centrally on a dedicated network server

- Third database element is the actual data set(s) of individual records and elements of environmental data according to the particular scheme and application used to collect and hold the data. Normally today and into the future these should be open, non-proprietary applications and media. However some databases may not be electronic but rather physical records written on paper or even material samples of the environmental element (i.e. bird carcasses in a freezer, precipitation vials in storage, etc.). These too must be duly catalogued, registered and documented. Databases are normally distributed and under local management control.

The design, development and implementation of a database model is a very significant and often large undertaking in the process of data management. Specific models and means(schema and applications) must often be tailored to the particular size, speed and nature of the data and database system required. In some cases efficiencies can be achieved by sharing these costs among projects or groups within a common data management framework. Significant IT support and specialized design expertise will often be required. However, more and better "off the shelf" and shareable "open systems" are becoming available and should be used where and when deemed suitable and effective.

6.2 Registration in Directory

Environmental data as defined by this Framework shall be registered into the departmental Directory System as soon as that data activity commences and shall be reviewed and updated regularly, but at least annually, according to the Policies and Principles of this Framework. The registration will be executed by accessing, completing and submitting an ***electronic catalog form*** to be available on the EC Intra-net Server and/or on the Green Lane of the Internet.

6.3 Access

Electronic access to the Environmental Data Holdings of EC will be through the universal Directory of the data created by virtue of the catalog registration policy under this Framework. Also included in the Directory may be "hot-links" to EC contact(s), and the related databases (including its metadata) and/or information systems dependent on the nature of the particular holding. At the very least an E-mail or phone contact must be given for every holding in the Directory. In many cases direct access and the mechanisms/protocols for data access and transfer will be immediately available through these links. In some cases access beyond this high level Directory will require authorizations due to the proprietary or commercial nature of the access being sought.

The high level Directory access will normally be by electronic means on the EC ECONET/Intra-Net or, with the appropriate security, through Internet access via the Green Lane. Further descriptions of such access protocol are given in Appendix C and Section 7.

6.4 Security

All data holdings of EC are a valued resource held in trust and shall be maintained secure from unauthorized access, theft, loss or damage. It is the responsibility of all employees to follow government policies on security in their data management activities. Program managers and scientists must make and document their determination of the level of access security appropriate for each data set for which they have responsibility. In this sense data is no different than other material properties such as valuable, sometimes irreplaceable equipment for which a manager is given responsibility to protect. The Principles of this Framework should form the bases of this determination with respect to access security, supplemented by any specific policies or agreements as may apply to any particular data set. Any such other conditions of access should be clearly identified in the metadata.

6.5 METADATA

The primary purpose of metadata is to help users discover data sets that are likely to meet their needs. *Simply stated metadata is data on the data.* It also serves to permanently document the attributes, characteristics and circumstances associated with the data set, its acquisition and its quality. *Many environmental data sets have been left by the originators without proper metadata and are virtually unusable today because of uncertainties surrounding the nature and quality of the original data.*

Detailed guidelines for all the various formats that metadata could take is neither possible nor necessary. What is important is that adequate metadata exist for all data sets and that

it is readily accessible to clients, partners and users for key word searches, for data quantity and quality assessments and for data exchange protocol definitions.

6.6 Quality Control

Quality control (QC) of data is of critical importance to the integrity of all analysis, information and knowledge that are derived from it. QC begins with the decisions surrounding the observational methods chosen at the outset and continues through the many decisions made throughout the entire life cycle of data management. The essence of quality control lies not just in the methods used but in the documentation of the standards used (or lack thereof), the accuracy and precision of instruments and/or sampling techniques used, and the effects that any processing or analytical methods may have on the final data values recorded. It may also extend to the integrity of the storage, access and delivery systems which interact with the data holdings.

To the greatest extent feasible, quality control should be a consideration in all stages of data management. ISO 9000 level standards should be the objective, which simply stated, means "***we write what we do, then do what we write***". Clearly, documentation of the QC information in the METADATA is as important to effective quality management as is the actual means used to control the data quality. Further background information on relevant ISO 9000 guidelines are given in Section 8.3 and in Appendix D.

6.7 Archiving

Data archives, as distinct from other facilities for stored data and holdings, refer to the holding of data sets for which there is a specific statute, policy, agreement or adopted standard to retain that information in perpetuity, usually within a particular and dedicated organizational unit. As such all of the principles and policies of this framework would still apply but would be supplemented by other government policies and agreements specific to the archives or to the particular data sets involved. Within EC at this time there are no known formally identified archives, though various groups have undertaken to maintain long term holdings for such data sets as Canadian Climate Station Data, Hydrometric Station Data, WMO World Ozone Data Bank, etc.

6.8 Maintenance

Implementation of this Framework requires an ongoing commitment to the upkeep of the data sets and the respective guidelines and standards. Previous efforts toward data inventories have not succeeded in part due to lack of commitment by both data provider

and management to the work of maintaining and updating the directory and metadata records in the system. The activities must begin at the moment the acquisition is first considered and extend to the last date the data is held. This is the essence of true life cycle management.

Maintenance work requires significant resources. Critical to success in improving storage, access and use of environmental data for decision making will be the support capacity and compatibility of our information technology systems and expertise in these activities. *Assigning a high priority to environmental data systems maintenance support in EC will greatly facilitate the achievement of the goals of this Framework.*

SECTION 7: Protocols for Data Access, Sharing and Transfers

This section of the guidelines deals with reducing the barriers and building the bridges to open, effective and efficient environmental data access and dissemination.

7.1 Intra-net/Internet

The 1990s and the advent of the World Wide Web - ***the Internet*** - as almost a household tool for information dissemination and access has revolutionized thinking and activities related to data management. For the first time ever the tools for rapid search and find, for information transfer and for networking with others, be it within community our around the world, are at our fingertips and universally available and supported by the IT industry. This Framework takes timely advantage of these facts in establishing both the need and the means for an integrated and consistent approach to EC practices in Data Management. *Today this new technology means the task is immediately achievable, low in cost and effort, and high in visible results and tangible rewards for all of the EC business lines.*

To take maximum advantage of this technology in the important business of environmental data management, the policies, principles, guidelines and standards of this Framework must be adopted throughout the department as soon as possible. They are convergent with those being developed and adopted world wide by many governments and environmental organizations so that early results in sharing Global Change information will be achieved.

7.2 Copyright/Acknowledgments

Ownership of intellectual property in Canada, as discussed at some length by the Royal Society of Canada in the section "Review of National Data Policies and Institutions", is

determined by the Copyright Act and the provisions of those international agreements to which Canada is a signatory. These agreements on copyright and intellectual property rights include provisions that define what constitutes a copyrightable work, ownership of intellectual property, and the rights appertaining to the copyright owner. *In the absence of a specific contract or agreement, the policy and principles of this Framework establish a departmental commitment to maximum openness, free and ready access, and unrestricted sharing of environmental data holdings subject only to proper acknowledgment to EC and the author.*

However, in some cases EC may create, acquire, hold and/or manage in some manner data for which it would not have legal ownership by virtue of a contract or agreement likely within a commercial or partnership arrangement.(i.e. analysis done under contract by EC labs, data collected under federal/provincial agreements, etc.) Unless permission is explicitly granted by the client or the parties to the agreement, such data shall not be subject to the Principles and Guidelines particularly respecting registration and access, and shall be managed as confidential information.

7.3 Proprietary Research Data

Data created or acquired in the course of scientific research is recognized to be of special interest to the reputation and integrity of the principle investigator and author despite the rights of ownership vested in the Crown. Such proprietary interests are respected in the principles of this Data Management policy. Nevertheless, as with an ever increasing number of peer reviewed scientific journals and research contracts, the absolute principle of publishing or otherwise making available this research data for shared use or further evaluation by others and the public is of paramount importance.

The principle research investigator is responsible and accountable for ensuring the existence of a comprehensive data management plan and for the registration of the existence of each environmental data set at the outset of the research project. Such data must be managed according the principles of this Framework and should be documented and made accessible according to these guidelines and standards as soon as possible during or at the conclusion of the research project. *The laws and rights of copyright and the principles of acknowledgment guarantee the proprietary interests and public/professional accreditation of the principle investigator.*

7.4 Access to Information/Commercial Access

The federal Access to Information Act (1983) extends the present laws of Canada to provide the right of public access to all government records (with only some limited and specific exceptions i.e. identifiably personal or legally bound information) including that stored by electronic means. In essence, *access to EC data can not be unreasonably denied,* though terms or conditions may exist on data created, analyzed, held or managed by EC which over-ride these guidelines by virtue of ownership resting with another party.(i.e. industry data shared to help create national inventories, lab analysis results done by EC under contract or agreement, etc.)

Together these policies enable managers to know how to make decisions related to data management. *The overriding considerations should arise from EC program mandates, public safety and security, contractual obligations, and the national interests for environmental sustainability.*

SECTION 8: Procedures for Implementation

This section provides the guidance, information and directions on data management planning and resources which will ensure the effective implementation of this framework throughout the organization and hence the attainment of the results being sought.

8.1 Data Management Plans

From the moment one conceives the need to create or acquire a data set it becomes important to plan for the entire life cycle of the data. Such a plan will make it possible to identify up front the best practices to be used and the full cost implications of proceeding versus the total benefits to be achieved. Even in simple draft form the plan will enable a program manager to share with others the opportunity and to seek the support and approvals from which the real accountabilities and results become clearly defined.. Most Data Management Plans should also become widely accessible or be disseminated on the Internet/Intranet media being used for environmental data access and interchange.

8.2 Accessing Support Resources

There are two critical factors which determine ability to effect change: the will and the means. The Review affirmed a willingness to effect change and renew commitment to environmental data management in EC. The means lies in the priority assigned to the resources, human and financial, allocated by senior program managers to implementing this framework.

Experiences in effecting similar changes in other fields and jurisdictions suggest that strong central support by senior management and by "centers" of dedicated resources and expertise to the program managers responsible for data management is essential for success. The common protocols, procedures, applications(software) and methods(hardware) which are the major elements of the implementation work, though largely in place and part of the basic IT infrastructure of the department, will require increased support and priority by the department's informatics program. Initially at least *special expertise teams may have to be dedicated* to being available throughout the department to advise (and if necessary do) the actual "WHAT" and "HOW TO" of these standards and guidelines. In most cases the knowledge and abilities will exist in situ but only need the direction and commitment of their time and skills to these task by virtue of approval for data management plans as an integral part of the annual Business Plan/Management Contract.

Experiences also suggest comprehensive implementation may take several up to 5 years but the benefits will begin to be realized by clients, partners and managers immediately and throughout the period of the changes.

8.3 Relating to ISO Standards

What is ISO 9000? International Standards for Quality Assurance

ISO 9000 is a set of five universal standards for a Quality Assurance system that is accepted around the world. Currently 90 countries have adopted ISO 9000 as national standards. When you purchase a product or service from a company that is registered to the appropriate ISO 9000 standard, you have important assurances that the quality of what you receive will be as you expect. To a great extent adoption of this Framework is equivalent to many of the ISO requirements.

ISO 9001 and EC

The ISO 9001 standard, which defines quality standards for design, development, production, installation and servicing, is the standard which can be applied to the collection, quality control, archiving and access to environmental data.

ISO 10032 and EC

This ISO/IEC standard defines the Reference Model of Data Management and establishes international standards within the Information Technology community as of 1995 in those areas of the model which lend themselves to standardization. To a great extent the WEB based approach adopted in this Data Management Framework for a data catalog and access system conforms well to the ISO Reference Model. *Hence further work on EC standards and systems should maintain a convergence with these ISO standards to ensure maximum international compatibility and openness.*

8.4 Program Initiative Considerations

Data management considerations should be one of the first elements dealt with in any Program Initiative, yet often it has not been at all. Whether the initiative is of a policy, service or science nature, or combination thereof, there are often significant, sometimes hidden, data management implications. These must be addressed explicitly and be fully planned and costs included for any such initiative to be implemented successfully.

8.5 Action Plans for Implementation

The Data Management Framework Team, in the process of formulating this policy document, also gave some consideration as to how to ensure an early and effective implementation. Several key actions were felt to require immediate attention:

- renew the mandate of the TEAM for the implementation phase and appoint a full time Leader to pursue the wider consultation, planning and dedicated action needed over the next year.
- Seek and receive formal approval by senior management of this national policy framework for EC.
- Initiate and support the departmental Environmental Data Directory project (as outlined in Attachment I and Appendix D).
- Establishment by Senior Management of a detailed and clearly articulated Accountability Framework of national and regional corporate data managers as custodians, stewards, etc. (as outlined in Attachment II).
- support the pursuit of several demonstration projects which build on some early progress and existing needs and solutions.

Successful completion of these actions by the end of 1997, it was felt by the Team, would ensure a successful implementation of the Framework policy and early realization of the benefits.

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