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IPEP: The Integrated Performance Evaluation Program for the Department of Energy's Office of Environmental Management[1]

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Introduction

The quality of the analytical data being provided to DOE's Office of Environmental Management (EM) for environmental restoration activities and the extent to which these data meet the data quality objectives are critical in the decision-making process. One of several quality metrics that can be used in evaluating a laboratory is its performance in performance evaluation (PE) programs.

In support of DOE's environmental restoration and waste management efforts, EM has been charged with developing and implementing a program to assess the performance of participating laboratories. Argonne National Laboratory (ANL) and DOE's Environmental Measurements Laboratory (EML) and Radiological and Environmental Sciences Laboratory (RESL) have been collaborating on the development and implementation of a comprehensive Integrated Performance Evaluation Program (IPEP) for DOE-wide implementation. IPEP was developed in response to the Inspector General's request for consistent oversight of analytical laboratories providing analytical services to EM.

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The IPEP will use results from existing inorganic, organic, and radiological PE programs when these are available and appropriate for the analytes and matrices being determined for DOE's EM activities. Existing programs include the U.S. Environmental Protection Agency's (EPA's) Contract Laboratory Program (CLP), the Water Supply (WS) and Water Pollution (WP) PE studies for inorganic and organic analytes, and DOE's Quality Assessment Program (QAP) for radiological analytes. In addition, DOE has begun the development of the Mixed Analyte Performance Evaluation Program (MAPEP) to address the needs of the DOE Complex. These PE programs provide a spectrum of matrices and analytes covering the various inorganic, organic, and low-level radiologic categories found in routine environmental and waste samples. These PE programs already provide some assessment of laboratory performance; IPEP will expand these assessments by evaluating historical performance, as well as results from multiple PE programs, thereby providing an enhanced usage of the PE program information.

The use of information from multiple PE programs will allow a more global assessment of an individual laboratory's performance, and will provide a means of more fairly comparing performance by different laboratories in a given analytical area. Areas where corrective action might be needed will be identified. The IPEP will provide reports of PE performance to the laboratories to assist them in self-assessment and improvement. Assessment reports are being designed to facilitate consistent and fair laboratory oversight. The IPEP will interact with other

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programs within EM to provide an integrated system for assessment and improvement of data quality from participating analytical laboratories.

IPEP laboratory assessment reports will be made available to sample management organizations and DOE management.

Organizations

The DOE Office of Environmental Management (EM) has been charged with the activities associated with the environmental restoration and waste management projects within the DOE Complex. Currently, the Packaging and Analytical Services Team (PAST) within EM is responsible for assuring adequate analytical capabilities, quality assurance, and sample management for the EM programs. To address these issues, EM established an Analytical Services Program (ASP) (Ref. 1) that consists of the following areas: Policy and Coordination, Data Management, Resource Management, Methods and Instrumental and Quality Assurance. IPEP is part of Quality Assurance whose major functions include developing, coordinating, and managing quality assurance documents, performance evaluation programs, and field and audit programs; and implementing the use of data quality objectives (Fig.1).

Figure 1: Structure of LMD

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Argonne National Laboratory (ANL), in collaboration with DOE's Radiological and Environmental Sciences Laboratory (RESL), Environmental Measurements Laboratory (EML), and Grand Junction Project Office (GJPO), is working with DOE Headquarters and the EPA to develop IPEP (Fig. 2). The program is designed to provide information on the quality of radiological and nonradiological analytical data being produced by all laboratories on which DOE is relying for analyses of environmental restoration and waste management samples.

Figure 2: IPEP Collaboration

Both RESL and EML share the field lead in developing the radiological and nonradiological PE program requirements and in developing a strategy for implementing the program. RESL and EML also have responsibility for designing and implementing the radiological PE program. GJPO is assisting them in developing new PE materials of interest to DOE. ANL is assisting in the development of the program requirements and strategies for implementation, especially in the nonradiological portions of the program. ANL is also developing and implementing the strategies for compiling and analyzing the PE program results, for maintaining these results in the IPEP database, and for monitoring to assure that needed corrective actions are taken.

Performance Evaluation Programs

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IPEP plans to integrate information from existing PE programs with expanded QA activities to develop information about the quality of environmental sample analyses provided by all laboratories supporting EM programs. The samples include radiological, mixed, and hazardous wastes. The IPEP plans to use existing PE programs when available and appropriate for DOE's needs; new PE programs will be developed only when no existing program meets DOE's needs (Figures 3 and 4).

Figure 3: Existing EPA PE Programs to be used by IPEP

Interagency Agreements have been developed between EPA and DOE to allow DOE to use major existing PE programs developed by EPA. The EPA's laboratory in Cincinnati, Ohio provides two water matrix PE programs for regulatory needs in the Clean Water Act (WP Studies) and the Safe Drinking Water Act (WS Studies). Both of these programs provide inorganic, organic, and miscellaneous analytes in water matrices. As shown in Fig. 3, the EPA's laboratory in Las Vegas, Nevada, has two established programs. First, the Contract Laboratory Program (CLP) is designed to meet the regulatory requirements of Superfund. This program provides inorganic analytes in both soil and water. It also provides, as separate studies, organic analytes in water. Second, the Performance Evaluation Studies Program (PESP) provides low-level radiological analytes in both water and air filter media.

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Figure 4: Existing DOE PE Programs to be used by IPEP

DOE currently supports two PE programs of interest to IPEP and is developing a third for mixed wastes. First, the DOE radiological QAP is being expanded for use in EM work. The QAP provides low-level radiological analytes in natural and artificial matrices. Second, RESL manages a program for the Nuclear Regulatory Commission (NRC) to provide radiological PE materials to the nuclear power industry. This program may be of interest to DOE as it moves into Decontamination and Decommissioning (D&D) projects. Third, RESL and GJPO are developing MAPEP to provide, in a single matrix, radiological, inorganic, and organic analytes of interest to EM programs for mixed wastes.

Figure 5: Comparison of organic and inorganic analytes among CLP, WS, WP, and MAPEP

Figure 5 shows a comparison of organic and inorganic analytes among the three EPA PE programs (CLP, WS, and WP) and the DOE MAPEP. The MAPEP has only conducted two pilot studies, so it is currently limited in comparison to the EPA programs; it has provided 21 trace metals from the EPA Target Analyte List, in a matrix also containing radioactive analytes. Among the EPA programs, the CLP generally provides the greatest number of organic and inorganic analytes, but there are some overlaps as well as analyte differences, which could

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indicate that participation in one program rather than another may be appropriate for use in a given situation. The WS and WP PE programs provide a relatively broad spectrum of miscellaneous analytes. Using historical PE information archived in its databases, IPEP has recently prepared a report comparing analyte concentration ranges among the three EPA programs over the history of each program; MAPEP data are currently being incorporated into the report. This report can be used by program managers to help decide which PE program(s) would be appropriate for their support laboratories to participate in.

Figure 6: Comparison of radiological analytes among the PESP, QAP, and MAPEP

Figure 6 shows a comparison of radiological matrix-analyte types among the EPA PESP, the EML QAP, and the RESL MAPEP. The EML QAP provides a broad spectrum of radiological analytical types of alpha, beta, and gamma-emitting nuclides, in two natural matrices (soil and vegetation) and in water and air filter media. The EPA PESP only provides the artificial media of water and air filter. Generally, the EML QAP covers the broader range, the EPA PESP analyte types are characterized for gross alpha-beta in both water and air filter matrices, areas not currently covered by the EML QAP. The EPA PESP is also the only provider of radium-226, and -228 in water, an analyte of interest to regulators of municipal drinking water. The MAPEP information is limited to the two pilot studies; however, as noted above, the

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MAPEP is currently the only provider of both inorganic and radiological analytes in the same matrix. The MAPEP is planning to develop PE materials that will provide inorganic, organic, and radiological analytes.

Figure 7: IPEP relationship to PE programs and DOE

Integrated Performance Evaluation Program

The IPEP will act as an umbrella, or clearinghouse, for PE program results (Fig.7). The use of information from multiple PE programs will allow a more global assessment of an individual laboratory's performance, and will provide a means of more fairly comparing a set of laboratories in a given performance area. If a laboratory has performed poorly in one PE program, its participation in a similar PE program may indicate that the laboratory does have proficiency in the given analyte-matrix area. The use of information from multiple PE programs could also have an economic benefit, in that if a given laboratory can demonstrate proficiency in a PE program that provides the relevant matrix-analyte types of interest to DOE, that laboratory might be made exempt from participating in another PE program providing similar matrix-analyte types (assuming there are no regulations requiring that the laboratory participate in both PE programs).

The IPEP will provide routine periodic reports to the laboratories, the sample

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management organization, and DOE project and program offices on laboratory performance in the various PE programs. For Quality Assurance Section (Fig. 1), IPEP will also provide reports in support of the Audit Program (Fig. 8), both for routine scheduled audits and to alert the Audit Section to the need for oversight in the case of poor performance by an individual laboratory. These reports will include recent historical data as well as current performance, so that a single performance can be put in perspective.

The IPEP interacts with other parts of the Quality Assurance Section (Fig. 1) by helping to develop quality assurance requirements and supporting documentation for those requirements. IPEP is also developing a scoring procedure for PE programs to address the Data Quality Objectives (DQO) concept. This procedure is designed to allow use of multiple methods and to allow fair comparisons of laboratories with dissimilar participation patterns in PE programs. This procedure also identifies areas where effort could improve even an excellent laboratory's score.

Figure 8: IPEP relationship to parts of ASP

Besides the Quality Assurance Section, the IPEP will also interact with ASP's, Analytical Support and Resource Management Sections (Fig. 1) to provide an integrated system for assessment and improvement of data quality. As Sample Management Offices (SMOs) identify

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laboratories which perform EM analyses (Fig. 8), Resource Management will inform IPEP to ensure that valid reports on the current laboratory population are issued.

IPEP has been developed to support DOE's Total Quality Management (TQM) initiative. The requirements for participating in the IPEP are being developed. These requirements will be incorporated into model contracts being developed by the Resource Management Group, for use in EM-related analytical laboratory support.

Presently, laboratories are required to participate twice a year in PE programs that reflect the matrix-analyte types of the samples which they are analyzing for EM. Criteria for corrective actions are being developed and will be incorporated into the appropriate documents when these criteria have been reviewed and approved by EM.

Conclusion

The current status of the IPEP is commensurate with its relative newness. The technical aspects of data transfer and archiving are generally solved, and work has begun on production of routine reports using electronic methods to ensure rapid turn-around time between IPEP receipt of PE data and subsequent issuance of reports. The program will not be fully implemented until the necessary political aspects of imposing the requirements on laboratories providing analyses to EM are completed. These may include requirements by DOE order or stipulations by contract. These political aspects are currently being addressed and are expected to be resolved in the near future. Currently, two IPEP pilot projects are underway. One is at the Idaho National

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Engineering Laboratory, and the other is at the DOE Albuquerque Operations Office. Upon successful completion, the IPEP is expected to be implemented across the DOE Complex.

This work has been performed under the auspices of the U.S. DOE, under Contract W-31-109-ENG-38.

Reference:

1. Office of Environmental Restoration and Waste Management, Analytical Services Program Five-Year Plan, January 29, 1992.

Structure of EM's Analytical Services Program

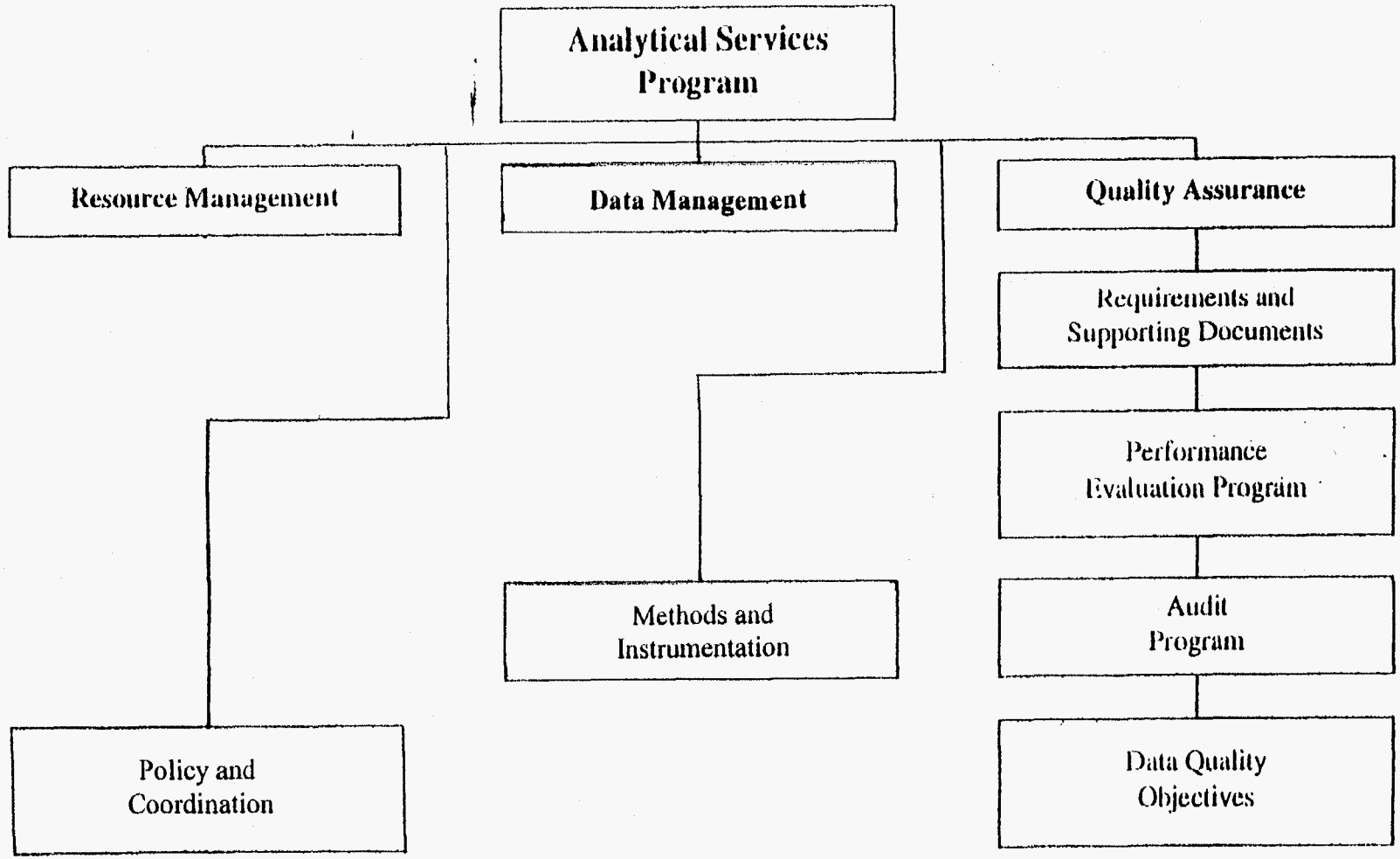

Figure 1

IPEP Collaborators

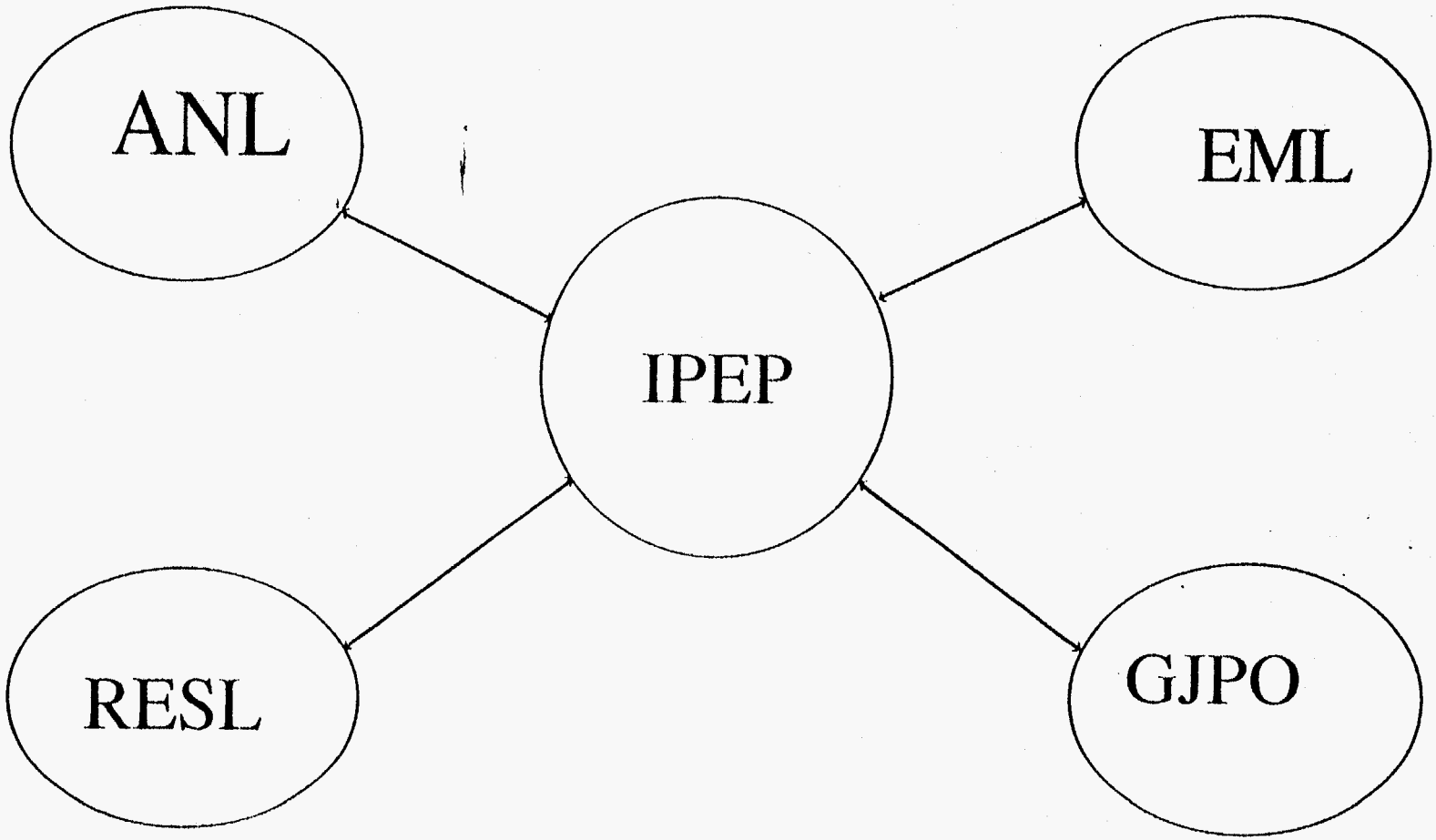

Figure 2

Performance Evaluation Programs
U. S. Environmental Protection Agency

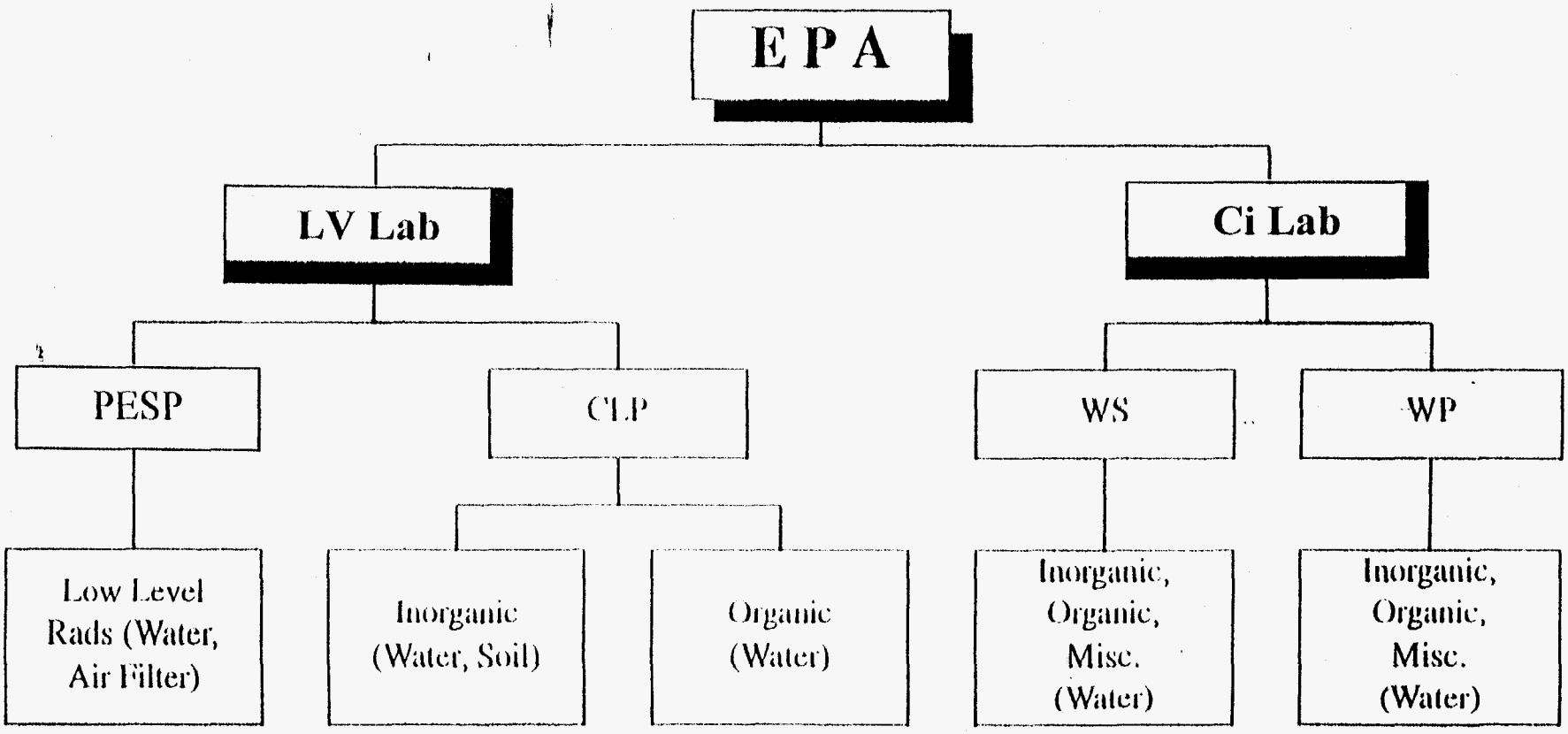

Figure 3

Performance Evaluation Programs
U. S. Department of Energy

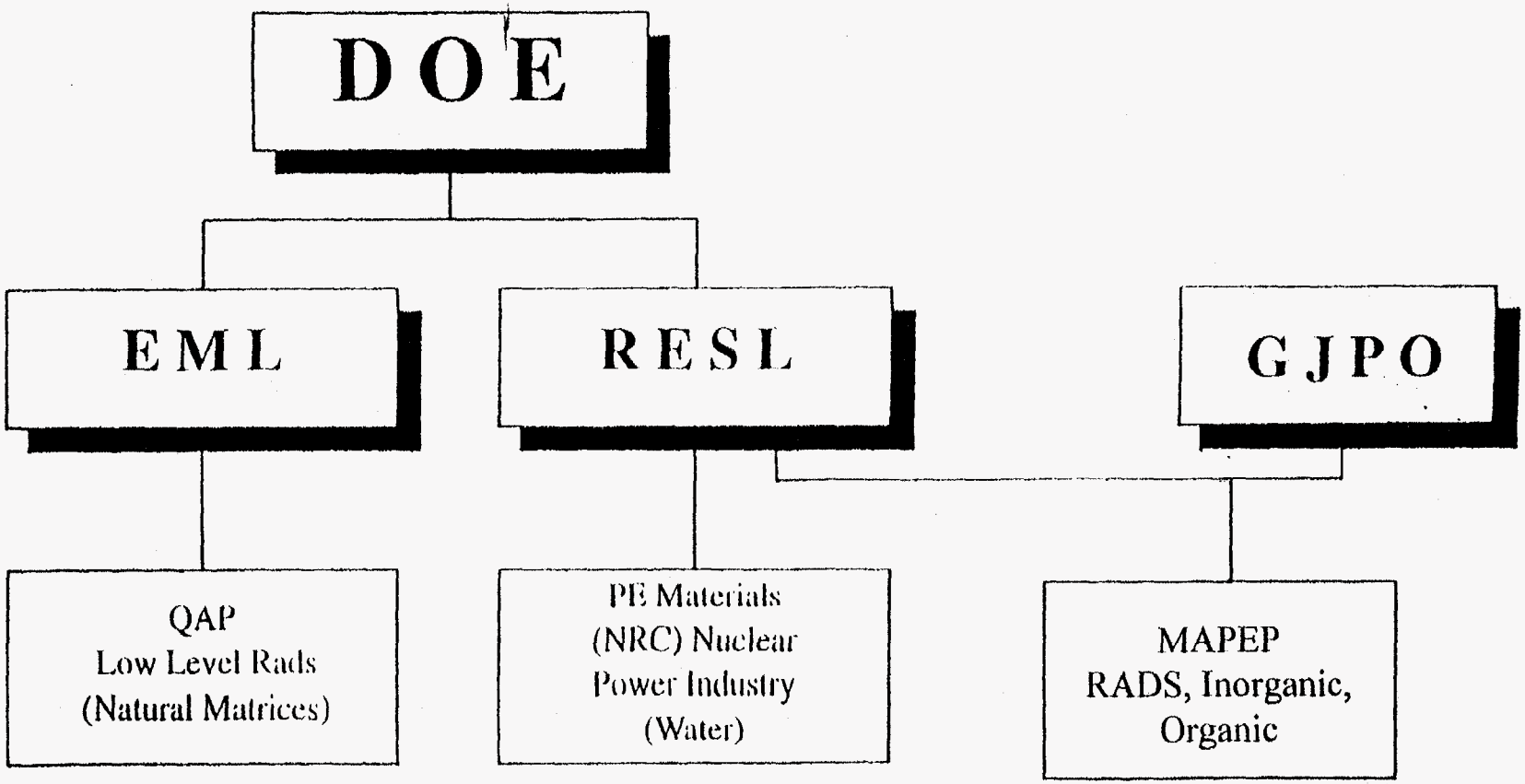

Figure 4

Inorganics and Organics
Performance Evaluation Programs
Comparison of Analytes

Common Analytes	WS	WP	CLP	MAPEP
Trace Metals	8	21	22 (Water, Soil)	21 (Water, Soil)
Nutrients	1	5	-	-
Chlorinated Hydrocarbon Pesticides	4	8	20 (Water)	-
Vol/Semi-Vol Organics - Non-Aromatics	12*	11	37 (Water)	-
Vol/Semi-Vol Organics - Aromatics	-	-	59 (Water)	-
Residual Chlorine	1	1	-	-

Other Analytes

WS Studies	WP Studies	CLP
Chlorophenoxy Herbicides (2)	PCBs in Water & Oil	PCBs in Water
Sodium/Corrosivity	Cyanide	Cyanide
Turbidity	Total Phenolics	
Total Coliforms	Minerals	
Flouride	pH	
	Non-Filterable Residue	
	Oil & Grease	

* Includes Trihalomethanes

Figure 5

Radiological Performance Evaluation Programs
Comparison of Analytes

EML QAP	alpha	beta	gamma
Air Filter	4	3	10
Soil	3	3	10
Vegetation	4	2	2
Water	4	3	10
EPA LV Lab PESP			
Air Filter	1*	3*	1
Water	3*	3*	9**
DOE MAPEP			
Water	1	1	3

* Gross alpha-beta included
** Ra-226, Ra-228 included

Figure 6

Integrated Performance Evaluation Program

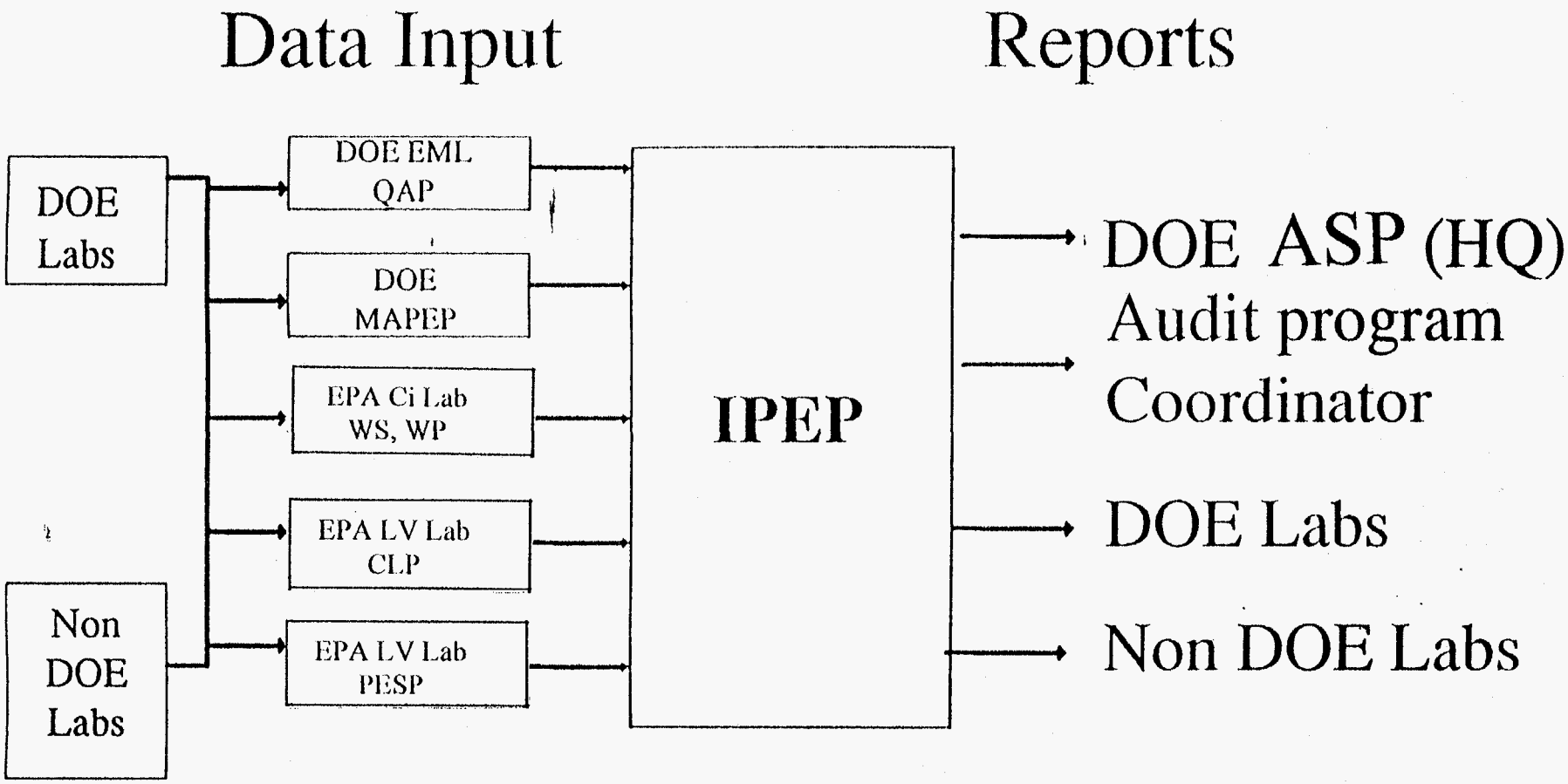

Figure 7

INTEGRATED ASSESSMENT SYSTEM

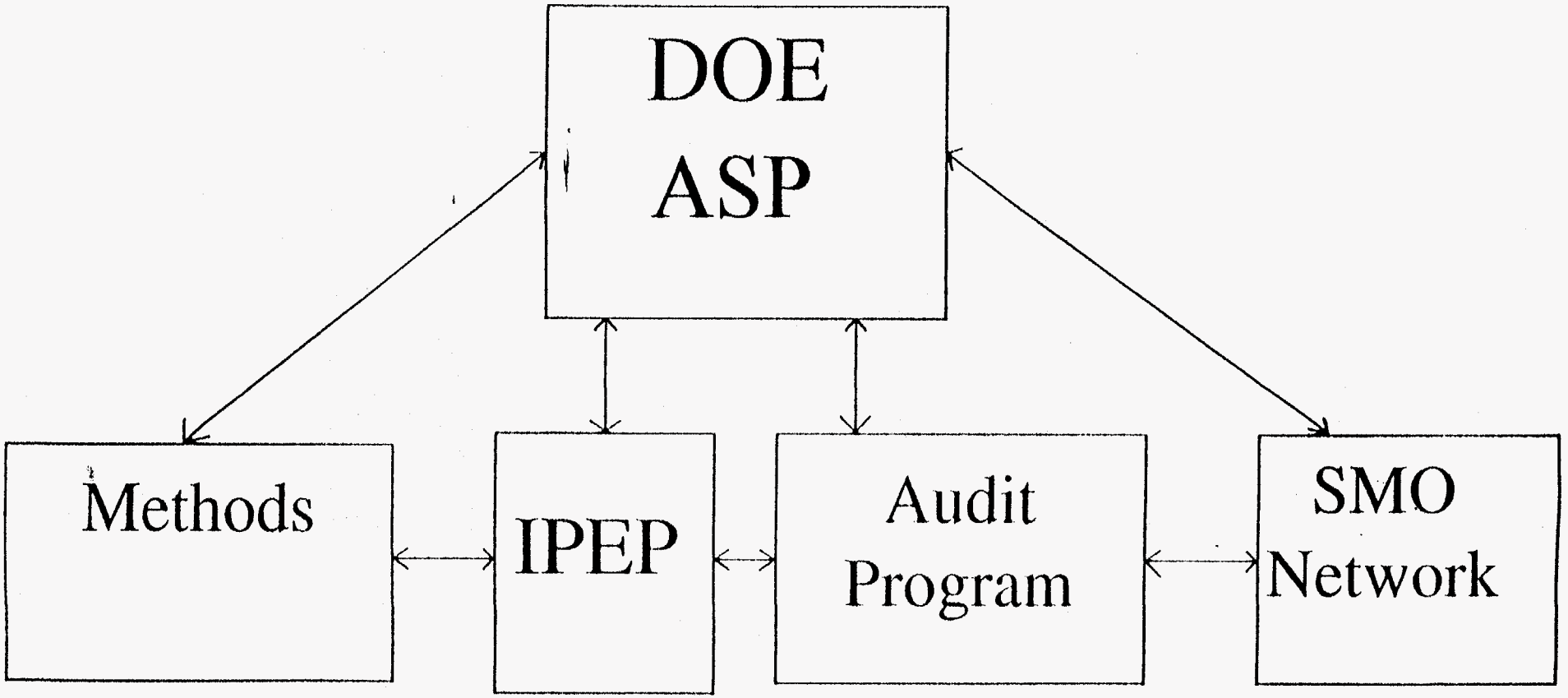

Figure 8