U.S. Environmental Protection Agency

# CADRE: A Data Validation Program

## Introduction

The characterization and remediation of hazardous waste sites relies primarily on data about the identity and concentration of pollutants found there. Sound decision-making requires that this data be of known and documented quality. Therefore, the data is subjected to technical validation as part of a quality assurance process. Computer-Aided Data Review and Evaluation (CADRE) is a computerized tool used by data reviewers to assist them in the validation of chemical analytical data generated by laboratories.

CADRE examines the quality control (QC) data for each analytical result and identifies any QC non-compliant data. The impact of any QC non-compliant data found is assessed and CADRE attaches flags to each analytical result to indicate its level of quality. The QC data is evaluated against criteria that are appropriate for the corresponding analytical procedure and the intended use of the results.

Those QC checks that can be performed on the available electronic data are done directly, while the results of checks that are done manually by data reviewers are entered into CADRE. Integrated reports are produced that are tailored to either the data reviewer or the end-user of the data.

**Quality Control Checks**

- Holding time
- GC/MS Instrument performance check
- Initial and continuing calibrations
- Internal standards
- System monitoring compounds/surrogates
- Matrix spikes
- Laboratory and field blanks
- GC system performance
- Sample cleanup
- Analytical sequence
- CRDL standards
- Laboratory control sample
- Duplicate sample analysis
- GFAA quality control
- Interference check sample
- ICP serial dilution
- Sample result verification
- Percent moisture
- Field Blanks

## Features

CADRE increases the completeness, consistency, and quality of the review and allows the data reviewers to devote time to the data that requires professional judgement.

A side benefit of the use of CADRE for data validation is that the results are obtained in electronic format and can be transferred to local or national databases together with their quality indicators for later retrieval. For example, CADRE is fully integrated with the central CLP Analytical Results Database (CARD) and users can transfer data between the two systems.

The CADRE system has evolved to meet the needs of the EPA's Superfund and the environmental quality assurance community. As a result, CADRE was enhanced with many features for both general CLP use and for custom data validation needs.

In addition, CADRE integrates data validation functions for both organic and inorganic analytical results into a single system.

CADRE runs on PCs with extended memory and does not need any additional software to operate. Many of the screens in the CADRE system look like the CLP reporting forms, which provide a familiar environment to data reviewers. It has user-friendly features, such as a standard user interface, on-screen help display, explanations for errors, file management capabilities, and customization to user preferences.

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## Organic and Inorganic Analytical Support

The organic analyses supported include volatile, semivolatile, and pesticide compounds while inorganic analyses include metals and cyanide. The CADRE system has predefined CLP method information and QC criteria for the latest CLP Statements of Work, but it can be customized to support variations on the analytical techniques employed by the CLP and to review data according to project-specific QC criteria.

CADRE manages laboratory data, field sample collection, manual review results, and tracking data. Any missing data that is required for a complete review is noted and the affected results flagged appropriately. CADRE also alerts the data reviewer to any indications of QC problems which would require further investigation beyond the checking that is possible by the computer.

As data are being imported electronically into CADRE, they are checked thoroughly for format, completeness, and consistency. Validated data is exported, with all their associated QC information, in a CLP Agency Standard Format electronic file.

## Flexibility

The CADRE data review procedures can be tailored to the needs of the user organization or the specific environmental assessment project.

Analytical methods can be defined for analytes which differ from the CLP target list compounds, their corresponding quantitation limits, and their analytical properties. All QC limits, such as threshold values for percent recoveries or holding times, can be set by the user according to the method capabilities and the project's data quality objectives. The actual flags to be assigned for any QC non-compliant data that is found can be specified in CADRE to adhere to those flags used in the organization or project. In addition, users can design a custom hierarchy for assignment of the final flags to results based on the relative severity of QC non-compliance.

A number of variations to the CLP National Functional Guidelines for Data Review were built into CADRE to support the U.S. EPA Regional data validation procedures. These variations are available to all users and provide the capability to adapt CADRE to specific needs through a menu-driven customization process. QC checks can be run selectively that allow CADRE to ignore those QC areas that do not apply or that are of no interest in a particular case.

The basic import file format supported by CADRE is the U.S. EPA's Agency Standard Format, but variations on the contents of the files can be supported automatically through the definition of a new method. The contents of data files to be imported into CADRE would then conform to the changes in the corresponding method definition (e.g., different analytes, surrogates, or internal standards).

**Custom Method Options**

- Sample Quantity
- Extract Volume
- Aliquot Volume
- Injection Volume
- Final Digest Volume
- Analyte Names, CAS Numbers, Symbols, and Chemical Properties
- Quantitation and Detection Limits
- Internal Standard Compounds
- Surrogate Compounds
- Matrix Spike Analytes
- Performance Evaluation Material Compounds
- Continuing Calibration Verification Mixture Compounds
- Florisil Cartridge Check Spiking Compounds
- Gel Permeation Chromatography Calibration Compounds
- Spiked Interferent Analytes
- Laboratory Control Sample Analytes
- Common Laboratory Contaminants

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## Hardware Requirements to Use CADRE

- IBM PC (or compatible)
- MS-DOS
- Extended memory of 2 MB recommended
- 486 Processor
- A math coprocessor chip is recommended but not required
- LaserJet printer

## Reference

Simon, A. W., J. A. Borsack, S. A. Paulson, B. A. Deason, and R. A. Olivero, Computer-Aided Data Review and Evaluation: CADRE CLP Organic User's Guide, U.S. EPA, June 1991.

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