NUREG-1725

# Human Interaction With Reused Soil: A Literature Search

## Draft Report for Comment

U.S. Department of Agriculture
National Agricultural Library

U.S. Nuclear Regulatory Commission
Office of Nuclear Regulatory Research
Washington, DC 20555-0001

## AVAILABILITY OF REFERENCE MATERIALS IN NRC PUBLICATIONS

**NRC Reference Material**

As of November 1999, you may electronically access NUREG-series publications and other NRC records at NRC's Public Electronic Reading Room at www.nrc.gov/NRC/ADAMS/index.html. Publicly released records include, to name a few, NUREG-series publications; *Federal Register* notices; applicant, licensee, and vendor documents and correspondence; NRC correspondence and internal memoranda; bulletins and information notices; inspection and investigative reports; licensee event reports; and Commission papers and their attachments.

NRC publications in the NUREG series, NRC regulations, and *Title 10, Energy*, in the Code of *Federal Regulations* may also be purchased from one of these two sources.

1. The Superintendent of Documents
   U.S. Government Printing Office
   P. O. Box 37082
   Washington, DC 20402–9328
   www.access.gpo.gov/su_docs
   202–512–1800
2. The National Technical Information Service
   Springfield, VA 22161–0002
   www.ntis.gov
   1–800–553–6847 or, locally, 703–605–6000

A single copy of each NRC draft report for comment is available free, to the extent of supply, upon written request as follows:
Address: Office of the Chief Information Officer, Reproduction and Distribution Services Section
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001
E-mail: DISTRIBUTION@nrc.gov
Facsimile: 301–415–2289

Some publications in the NUREG series that are posted at NRC's Web site address www.nrc.gov/NRC/NUREGS/indexnum.html are updated regularly and may differ from the last printed version.

**Non-NRC Reference Material**

Documents available from public and special technical libraries include all open literature items, such as books, journal articles, and transactions, *Federal Register* notices, Federal and State legislation, and congressional reports. Such documents as theses, dissertations, foreign reports and translations, and non-NRC conference proceedings may be purchased from their sponsoring organization.

Copies of industry codes and standards used in a substantive manner in the NRC regulatory process are maintained at—
The NRC Technical Library
Two White Flint North
11545 Rockville Pike
Rockville, MD 20852–2738

These standards are available in the library for reference use by the public. Codes and standards are usually copyrighted and may be purchased from the originating organization or, if they are American National Standards, from—
American National Standards Institute
11 West 42nd Street
New York, NY 10036–8002
www.ansi.org
212–642–4900

The NUREG series comprises (1) technical and administrative reports and books prepared by the staff (NUREG–XXXX) or agency contractors (NUREG/CR–XXXX), (2) proceedings of conferences (NUREG/CP–XXXX), (3) reports resulting from international agreements (NUREG/IA–XXXX), (4) brochures (NUREG/BR–XXXX), and (5) compilations of legal decisions and orders of the Commission and Atomic and Safety Licensing Boards and of Directors' decisions under Section 2.206 of NRC's regulations (NUREG–0750).

NUREG-1725

# Human Interaction With Reused Soil: A Literature Search

# Draft Report for Comment

Manuscript Completed: May 2000
Date Published: June 2000

Prepared by
K. Schneider, S. McCarthy, M. Pisa, USDA/ARS/NAL
T. Nicholson, C. Daily, USNRC/RES
J. Peckenpaugh, E. Brummet, G. Gnugnoli, USNRC/NMSS
A. Huffert, R. Tadesse, USNRC/NMSS

U.S. Department of Agriculture
National Agricultural Library
10301 Baltimore Avenue
Beltsville, MD 20705-2351

T. Nicholson, NRC Project Manager

**Prepared for**
**Division of Risk Analysis and Applications**
**Office of Nuclear Regulatory Research**
**U.S. Nuclear Regulatory Commission**
**Washington, DC 20555-0001**
**NRC Job Code Y6227**

## COMMENTS ON DRAFT REPORT

Any interested party may submit comments on this report for consideration by the NRC staff. Comments may be accompanied by additional relevant information or supporting data. Please specify the report number NUREG-1725 draft, in your comments, and send them by the date published in the *Federal Register* Notice to:

Chief, Rules and Directives Branch
U.S. Nuclear Regulatory Commission
Mail Stop T-6D59
Washington, DC 20555-0001

You may also provide comments at the NRC Web site, http://www.nrc.gov. See the link under "Technical Reports in the NUREG Series" on the "Reference Library" page. Instructions for sending comments electronically are included with the document, NUREG-1725 draft, at the web site.

For any questions about the material in this report, please contact:

Thomas J. Nicholson, Radiation Protection, Environmental Risk and Waste Management Branch
Mail Stop: T-9F31
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001
Phone: 301-415-6268
Email: tjn@nrc.gov

# ABSTRACT

This NUREG reports on the results of a literature search for documented information that is intended to provide the technical basis for soil reuse scenarios for use in dose assessments related to residual radioactivity. The literature search focused on human interactions with reused soils in the United States. Using these data, the NRC staff will be able to define realistic soil reuse scenarios and to estimate parameters for use in simulating exposure pathways involving radiologically contaminated soils from NRC-licensed facilities. This report documents the procedures and results of this extensive literature search by the National Agricultural Library (NAL) researchers. The search strategies were structured to query literature from a wide range of published scientific and trade sources. From the more than two million records that were initially found in the databases searched, targeted search strategies recovered 77,877 titles for review. NRC staff reviewed these titles and requested full citations, including abstracts, for a subset of these for further detailed review. After a final review of this subset, the NRC staff selected a final listing of documents that is provided in this report.

# CONTENTS

COMMENTS ON DRAFT REPORT . . . . . ii

ABSTRACT . . . . . iii

EXECUTIVE SUMMARY . . . . . vii

FOREWORD . . . . . ix

ACKNOWLEDGMENTS . . . . . x

ABBREVIATIONS . . . . . xi

1 INTRODUCTION . . . . . 1

2 SOIL REUSE SCENARIO FRAMEWORK . . . . . 3

3 RESEARCH PROCESS . . . . . 7
- 3.1 Introduction . . . . . 7
- 3.2 NAL Internal Review Process . . . . . 7
- 3.3 Interim Reports and Products . . . . . 8

4 LITERATURE SEARCH STRATEGIES . . . . . 11
- 4.1 Strategy Development . . . . . 11
- 4.2 Database Selection Processes . . . . . 11
- 4.3 Literature Survey . . . . . 13
  - 4.3.1 Search Category G (General) . . . . . 13
  - 4.3.2 Search Category P (Particular) . . . . . 13
  - 4.3.3 Search Category V (Volume) . . . . . 14
- 4.4 Extent of Available Literature . . . . . 14

5 QUALITY ASSURANCE/QUALITY CONTROL PLAN . . . . . 22
- 5.1 Construction and Approval of the Plan . . . . . 22
- 5.2 The Quality Assurance/ Quality Control Plan . . . . . 22
  - 5.2.1 Procedures for Collaborative Review . . . . . 22
  - 5.2.2 QA/QC Audit . . . . . 23
- 5.3 External Review . . . . . 23
  - 5.3.1 Selection of the External Reviewers . . . . . 23
  - 5.3.2 Reviewer Comments . . . . . 24
  - 5.3.3 Summary of Actions Taken in Response to the External Reviewers' Comments . . . . . 24

6 ADDITIONAL INFORMATION SOURCES . . . . . 26
- 6.1 Internet Searches . . . . . 26
- 6.2 Defense Technical Information Center Resources . . . . . 28
- 6.3 Other Sources . . . . . 28

7 RECOMMENDATIONS . . . . . 31

# CONTENTS (continued)

## APPENDICES

APPENDIX A. SEARCH STRATEGIES AND RESULTS . . . . . A-1

APPENDIX B. DIALOG® DATABASE FILE LIST . . . . . B-1

APPENDIX C. EXTERNAL REVIEW . . . . . C-1

APPENDIX D. SELECTED INTERNET RESOURCES . . . . . D-1

APPENDIX E. NAL PROJECT INVESTIGATORS . . . . . E-1

## LIST OF FIGURES

Figure C.1 Sample Letter of Instruction Sent to External Reviewers . . . . . C-2

Figure C.2 Dr. Dewayne May Project Review . . . . . C-4

Figure C.3 Ms. Carol Reese Project Review . . . . . C-5

Figure C.4 Ms. Carla Casler Project Review . . . . . C-6

Figure C.5 Additional Comments from Ms. Carla Casler . . . . . C-7

## LIST OF TABLES

Table 1 Soil Reuse Scenario Framework . . . . . 4

Table 2 Summary of Concept Set Findings . . . . . 15

Table 3 Literature Survey Results . . . . . 16

Table A.1 Concept Set Findings . . . . . A-8

# EXECUTIVE SUMMARY

This report provides an important part of the technical basis for developing soil reuse scenarios for use in dose assessments. To develop these scenarios, it is necessary to obtain data on the forms of human contacts with soils in the United States. From these data (see scenario framework in Section 2), exposure pathway modeling by the Nuclear Regulatory Commission (NRC) staff will simulate realistic exposure scenarios involving radiologically contaminated soils from NRC-licensed facilities. Developed under an interagency agreement between the NRC and the National Agricultural Library (NAL) of the Agricultural Research Service, U.S. Department of Agriculture, this report provides the procedures and results of an extensive literature review on human contact with soil. This report is being issued in draft form to solicit public comments and additional information.

The information sources searched for this report include the Dialog® (an online system of more than 500 databases), the Internet, and other sources. Targeted search strategies were developed by the NAL with support from NRC staff and external reviewers (non-NAL library and information science and soil science professionals) to retrieve relevant items from the Dialog® databases. These search strategies were structured to query literature from science publishers, academic presses, professional societies, trade journals and bulletins, theses, and dissertations, as well as information published in industry standards, newspapers, company reports, statistical sources, etc. The Dialog® search was developed by creating three main categories or concept sets: "General" (actions or activities of humans with soils), "Particular" (specific identified types of human-soil interactions), and "Volume" (volume, quantity, or economic terms that quantify or delineate the extent of human contact with soil).

From the more than two million records that were initially found in the Dialog® databases, the targeted search strategies recovered 77,877 titles for review. The majority of these items (Table 2) were provided to the NRC in electronic format. The NRC staff performed electronic searches of these titles for pertinent documents. NAL staff further screened the original 77,877 titles and provided copies of this screening for NRC staff review. From the above procedures, the NRC staff selected 56 documents (Table 3) for further evaluation that will allow identification of different exposure scenarios and document contact parameters.

The quality assurance/quality control plan for this study included (1) collaborative review of literature survey results, retrieval strategies, and information sources that were developed from guidelines of the Reference and User Services Association of the American Library Association, (2) external reviewers (see Section 5.3 External Review) who reviewed the search strategy for completeness, (3) NAL-NRC meetings to review progress and comment, and (4) archives of all online search activities that will be maintained by NAL for five years.

Appendices to this report provide more detailed information: Appendix A is a detailed explanation of search strategies, database selections and results; Appendix B is the Dialog® database file list; Appendix C is instructions to the external reviewers, reviewer comments, and accommodation to reviewer comments; Appendix D is selected Internet resources; and Appendix E is information on the NAL project investigators.

# FOREWORD

This technical report, NUREG-1725, was prepared by the National Agriculture Library (NAL) staff and the U.S. Nuclear Regulatory Commission (NRC) staff. The NAL staff performed the research work under an Interagency Agreement (RES-99-005 JCN Y6227) with NRC's Office of Nuclear Regulatory Research. The report provides information on the results of a comprehensive literature search related to soil reuse scenarios. NUREG-1725 is being issued in draft form to solicit public comments on the literature search findings and to actively seek additional documented information sources for developing soil reuse scenarios for use in dose assessments related to residual radioactivity. The NAL research study was undertaken to support the NRC staff in their development of technical bases for defining soil reuse scenarios. A final letter report from the NAL study, which is the basis for this NUREG, was sent to the NRC Public Document Room on December 8, 1999.

An electronic copy of this report can be found at the NRC homepage address: **<http:///www.nrc.gov/NUREGS/SR1725/index.html>**. NUREG-1725 is being issued for a 60-day public comment period. Written comments should be mailed to David L. Meyer, Chief, Rules and Directives Branch, Office of Administration, Mail Stop T-6D59, U.S. Nuclear Regulatory Commission, Washington DC, 20555-0001.

NUREG/CR-1725 is not a substitute for NRC regulations, and compliance is not required. The literature search strategies and findings documented in this NUREG are provided for information only. Publication of this report does not necessarily constitute NRC approval or agreement with the information contained herein. Use of product or trade names is for identification purposes only and does not constitute endorsement by the NRC or NAL.

Cheryl A. Trottier

Cheryl A. Trottier, Chief
Radiation Protection, Environmental Risk and Waste Management Branch
Division of Risk Analysis and Applications
Office of Nuclear Regulatory Research

# ACKNOWLEDGMENTS

The NAL and NRC Staff, responsible for compiling this report, gratefully acknowledge Mr. Thomas E. Smith, Team Leader, NRC Technical Library and his staff for their assistance in obtaining the publications listed in Table 3 of this report. Many of these reports and articles were obtained through interagency loans, and we acknowledge the excellent cooperation between the NRC Technical Library staff and their colleagues in other Federal agencies' libraries.

We also acknowledge Ann Beranek, NRC Technical Editor in the Office of Nuclear Regulatory Research, and Linda Stevenson, Technical Publications Specialist, Publishing Services Branch, Office of the Chief Information Officer, for their helpful reviews of the draft manuscripts and suggestions on preparing this report.

# ABBREVIATIONS

| | |
|---|---|
| AEC | Atomic Energy Commission |
| ALA | American Library Association |
| ARS | Agricultural Research Service |
| ASCE | American Society of Civil Engineers |
| CAB | CAB International, formerly known as Commonwealth Agricultural Bureaux |
| CD | Compact Disc |
| CIS | Congressional Information Service |
| CISTI | Canada Institute for Scientific and Technical Information |
| DOD | Department of Defense |
| DOE | Department of Energy |
| DTIC | Defense Technical Information Center |
| EPA | Environmental Protection Agency |
| ERDA | Energy Research and Development Administration |
| IAA | Inter-Agency Agreement |
| IAALD | International Association of Agricultural Librarians and Documentalists |
| NAL | National Agricultural Library |
| NMSS | Office of Nuclear Materials Safety and Safeguards |
| NRC | Nuclear Regulatory Commission |
| NRCS | Natural Resources Conservation Service |
| NTIS | National Technical Information Service |
| OCLC | Online Computer Library Center, Inc. |
| QA/QC | Quality Assurance/Quality Control |
| RES | Office of Nuclear Regulatory Research |
| SM | Statistical Masterfile |
| STIC | Scientific and Technical Information Center |
| STN | STN International |
| URL | Uniform Resource Locator |
| USAIN | United States Agricultural Information Network |
| USDA | United States Department of Agriculture |
| USGS | United States Geological Survey |

# 1 INTRODUCTION

The NRC staff needs information regarding potential uses of soil[1] that may be excavated and transported offsite from NRC-licensed facilities for use in commerce or by the general public. The information being sought will assist in developing a reasonably complete characterization of relevant usages for these reused soils. These soil reuse scenarios would include, but not be limited to, soil processing, construction, agricultural, and various commercial and residential uses of reused soil and soil-related products. The goal is to further the development of technical bases and the supporting documentation that could be used to characterize the soil reuse scenarios. As part of this technical basis, it is necessary to obtain data on the use of excavated soils in the United States so that exposure pathway modeling, which is to be conducted by the NRC staff, will reflect a range of potential scenarios based upon real-life uses of soil.

To assist in meeting this need, an Interagency Agreement (IAA) was signed on August 20, 1999, between the U.S. Department of Agriculture's Agricultural Research Service (ARS) and the NRC's Office of Nuclear Regulatory Research. Under the IAA, the National Agricultural Library (NAL)/ARS conducted a literature search to provide the NRC staff with technical references for defining soil reuse scenarios and estimating parameters for dose assessments. Phase 1 of this work was completed in November 1999 with the transmittal of the final letter report of the literature search to the NRC staff and a contractor briefing. Phase 2 of this work was the development of this draft NUREG report, and assistance to the NRC staff in producing a final NUREG report.

The objectives of the IAA were to: (1) develop the technical bases for evaluating possible dose impacts from the reuse of soils from NRC-licensed facilities through focused information searches, (2) develop a draft NUREG report for public comment on the literature findings, and (3) produce a final NUREG report documenting the technical bases. The NRC staff needs characteristics of the soils that may be excavated and transported offsite for use in commerce or by the general public. The information sought was a reasonably complete characterization of relevant soil reusage. The end products are a database (i.e., soil reuse scenarios and assessment parameters) and its supporting documentation. The NRC staff are actively seeking additional technical sources of information on soil reuse scenarios and related documented data for use in dose assessments.

This report describes the methodologies used in developing the literature search strategies and in the database source selection. These strategies and sources were reviewed by external reviewers whose comments are included in the report. The primary focus of the work was to identify documented, verifiable references for the NRC staff. Therefore, the principal focus of this study was to search the published literature.

The information sources searched for this report include the collections of the NAL; Dialog®, an online system of more than 500 databases; the Internet; and other sources. The literature search strategies were structured to query literature from science publishers, academic presses, professional societies, trade journals and bulletins, theses and dissertations, as well as

[1]Soil as used in this report means naturally occurring porous media at or originating from an NRC (or formerly AEC) licensed site (or Agreement State licensed site) that may have become contaminated by licensed materials.

information published in industry standards, newspapers, company reports, statistical sources, etc. The literature search survey recovered 77,877 titles for review. The NAL staff made recommendations from the surveyed literature to the NRC staff, who selected the documents for further analysis. These documents are listed in this report.

Appendices to this report provide more detailed information: Appendix A is a detailed explanation of search strategies, database selections and results; Appendix B is the Dialog® database file list; Appendix C is instructions to the external reviewers, reviewer comments, and accommodation to reviewer comments; Appendix D is selected Internet resources; and Appendix E is information on the NAL project investigators.

# 2 SOIL REUSE SCENARIO FRAMEWORK

The assumptions regarding how the soil is reused and the associated activities of people are referred to as scenarios. The soil reuse scenario framework should consist of a reasonably complete characterization of relevant usages for soils. These soil reuse scenarios would include, but not be limited to, construction, agriculture, recreational, and soil processing activities. These scenarios would be completed by estimating relevant parameters involved in these uses (e.g., contact time, soil type, number of people involved, volumes of soils). For example, reuse of soil as backfill around a residence, and the activities of the people living in the residence such as gardening, could be used to define a 'suburban scenario.'

Once the scenario has been defined, the detailed actions of the people can be evaluated to define the important exposure pathways. For example, for gardening activities within the suburban scenario, exposure pathways could include inhalation, ingestion of vegetables or fruits, inadvertent ingestion of soil, and external exposure. The complete scenario may have more than one set of exposure pathways, depending on the expected activities of the residents. For example, the resident may have a home office or bedroom in the basement, with the associated external exposure pathway from soil used as backfill. All the applicable pathways, including intake quantities and exposure times, are then summed to give the hypothetical dose from the scenario.

To evaluate the potential overall impact of soil reuse, several scenarios would be analyzed to determine the critical group. The critical group is the group of individuals reasonably expected to receive the greatest exposure to residual radioactivity for any applicable set of circumstances. The dose to the average member of the critical group is then used to determine whether limitations are required so that soil reuse will be controlled in a way that is protective of the public health and safety and the environment.

The following preliminary table was developed to organize information regarding how soil may be reused and how people may come into contact with it. Column headings refer to potential soil reuse scenarios, rows list information important to describing parameters important for modeling exposure. Public comments are specifically requested on additional data that would complete or expand the soil reuse scenario framework (see Table 1).

Table 1 Soil Reuse Scenario Framework

| Parameter | Recreational Activities | | | | | Intentional Intake Activities | |
|---|---|---|---|---|---|---|---|
| Usage | Golf Courses | Indoor Venues (farm shows) | Athletic Fields | Tot Lots | Outdoor Venues (dirt bike, horse tracks) | Dirt Eating | Mud Baths and Facials |
| Contact Time/yr | | | | | | | |
| Exposure Modes* (pathways) | | | | | | | |
| Soil Type (e.g., silt, sand) | | | | | | | |
| Number of People Involved | | | | | | | |
| Cultural Groups | | | | | | | |
| Occupational Categories | | | | | | | |
| U.S. Regional Limitations | | | | | | | |
| Typical Volumes per Use | | | | | | | |

* Indicates the principal exposure mode such as inhalation or ingestion.

Table 1 Soil Reuse Scenario Framework (continued)

| Parameter | Soil Processing Activities | | | Other Activities | | |
|---|---|---|---|---|---|---|
| Usage | Soil Processing (screening, bagging) | Soil Washing | Soil Remediation | Artistic Uses (sculpture, sand paintings) | Soil Excavation | Soil Hauling |
| Contact Time/yr | | | | | | |
| Exposure Modes* (pathways) | | | | | | |
| Soil Type (e.g., silt, sand) | | | | | | |
| Number of People Involved | | | | | | |
| Cultural Groups | | | | | | |
| Occupational Categories | | | | | | |
| U.S. Regional Limitations | | | | | | |
| Typical Volumes per Use | | | | | | |

* Indicates the principal exposure mode such as inhalation or ingestion.

Table 1 Soil Reuse Scenario Framework (continued)

| Parameter | Construction Activities | | | | Agricultural Activities | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Usage | Back Fill | Roadbed | Grading | Adobe and Rammed Earth | Indoor Gardening | Outdoor Gardening | Landscaping | Crop Farming | Livestock Farming |
| Contact Time/yr | | | | | | | | | |
| Exposure Modes* (pathways) | | | | | | | | | |
| Soil Type (e.g., silt, sand) | | | | | | | | | |
| Number of People Involved | | | | | | | | | |
| Cultural Groups | | | | | | | | | |
| Occupational Categories | | | | | | | | | |
| U.S. Regional Limitations | | | | | | | | | |
| Typical Volumes per Use | | | | | | | | | |

* Indicates the principal exposure mode such as inhalation or ingestion.

# 3 RESEARCH PROCESS

## 3.1 Introduction

The process for this project began in July 1999 with exploratory meetings held at the National Agricultural Library on July 30 and August 5, 1999. The scope for the research, mutuality of interest, and staff expertise were established by all parties at these meetings. The understanding that was reached was formalized through an Interagency Agreement on August 20, 1999. The agreement spelled out the scope of the project in detail.

Based upon discussions between NRC and NAL staff, sets of search strategies were initially created and organized into three broad conceptual categories: general concepts, particular scenarios, and volumetric studies. The early strategies were delivered to the NRC staff and reviewed with them in a teleconference. Additional terms were later added to the strategies and priority rankings were made for the concept sets (see Table 2) at that time.

Over the next six weeks, the strategies were run in selected databases and record titles were downloaded and shared with NRC staff for their review and selection. Considerable cooperation was given by the NRC staff through telephone, e-mail, and face-to-face meetings. The basic process involved NAL staff identifying information resources, which were then provided to the NRC staff for their selection.

## 3.2 NAL Internal Review Process

Information research is conducted in repetitive stages beginning with the initial problem statement. The next stage in the process involves the information professionals creating search strategies in conjunction with making database or other information resource selections. Next, the strategies are run against the selected databases and the initial results are analyzed for relevancy and completeness. The initial results are then reviewed with the client for feedback. The process repeats beginning with refinements to the search strategy and database selection.

A team of information professionals was assembled to work collaboratively on the NRC project (see Appendix E). The team reviewed the primary search strategies with the NAL principal investigator responsible for comprehensive search retrieval. The comprehensive search results recovered 77,877 titles for review.

The large number of items retrieved from comprehensive searching is partly due to the inclusion, within the search strategy, of nonspecific terms such as "use" that occur frequently within bibliographic records. A second approach was adopted by team members in an effort to facilitate the literature review for the NRC staff without compromising the desired comprehensive literature search results. Three modifications of the primary search methodology were used in the collateral approach to reduce the total number of titles retrieved and to improve overall relevancy:

(1) The strategies were made more selective.

(2) Databases selected for searching were focused on 10 to15 highly productive files.

(3) NAL staff reviewed some of the primary search results and preselected titles.

Results from both methodologies were provided to the NRC.

## 3.3 Interim Reports and Products Delivered

Soil as a commodity is not well characterized in the literature. Therefore, it was unlikely that all the information needed by the NRC would be found summarized in a few documents. This meant that large literature surveys would be needed in order to cull the few important resources. Initial survey results captured large numbers of record titles for screening. Candidate titles were selected for further consideration. Once selected, complete bibliographic citation[2] information was retrieved. Citation information identifies items through book and journal titles, volumes, page numbers, and publication dates. From this information, copies of full-text reports can be obtained by request from libraries, bookstores, government agencies, publishers, or other access providers.

Database providers typically charge customers for complete bibliographic citation access. For the purposes of this project it was impractical to download complete bibliographic citations for the large number of records retrieved through 19 executed searches. It was mutually agreed that NAL would provide title listings in the Draft Letter Report to the NRC staff for their selection.

The Draft Letter Report included:

- Statement of Work
- Instructions to and list of external reviewers
- Comprehensive search strategy concept sets
- Sample record titles in the broad concept categories of **G** for general human soil interactions, **P** for identified or particular scenarios, and **V** for volume or quantitative data.
- Book titles
- Preliminary Internet search results
- Defense Technical Information Center search results.

The very large recall of record titles obtained in the comprehensive searching did not lend itself to easy review. A reasonable sampling of results was obtained from the original information sources through focusing the databases selected for searching, altering the original search strategies, and preselecting by the NAL staff from the comprehensive search files. These title samples were provided to the NRC and the external reviewers in a notebook organized by search concept set.

A second electronic report was provided to the NRC staff on September 30, 1999. The electronic report consisted of 42 files listing the full title recall for all of the comprehensive search concept sets described in Table 2, Section 4.3, and Appendix A. This full title set was not provided to the external reviewers; the sampling provided in the Draft Letter Report was felt to be representative.

Although the primary focus of the Interagency Agreement between NAL and the NRC was to locate citable information from peer-reviewed published literature, it

---

[2]Use of the term citation throughout this report refers solely to information describing publication authorship and source. The term is not used in any legal or regulatory sense.

was also agreed that NAL would search the Internet. Preliminary results were cited in the Draft Letter Report. A more thorough search of the Internet was conducted between September 27 and October 13, 1999. The results of these searches were given to the NRC staff in a notebook, Supplement to the Draft Letter Report.

A Final Letter Report, which is the basis of this report, was provided in November 1999 to the NRC staff.

# 4 LITERATURE SEARCH STRATEGIES

## 4.1 Strategy Development

In July 1999, the NRC staff contacted NAL to explore the possibility of NAL assisting the NRC in the development of comprehensive search strategies to locate and document citable sources covering every aspect of soil use that might be applicable to the release of soils from NRC regulated sites.

The NAL staff was asked to document the scope of this broad topic area by conducting a general survey of the NAL collection through its AGRICOLA database and other databases available from Dialog®, a system of more than 500 databases covering science, technology, business, news, and other categories. This initial survey yielded well over two million records that contained the terms "soil" or "soils", or "dirt" or "earthen" in the title or as subject keywords. The vast majority of the records were not relevant for the NRC project. After detailed discussions with NRC staff, targeted search strategies were developed to retrieve relevant items.

General parameters for these searches were established in order to define the scope of the searches. For example, all literature published on relevant topics going back as far as 1970 was sought. English language literature was specified, although non-U.S. publishers were not excluded. Items covering normal soil testing operations for plant nutrients, pH, CEC, bulk density, etc., were excluded.

To stay within NRC-specified parameters, additional exclusions were defined: (a) because the soils would remain in the United States, export data on potting soil, for example, was not sought and (b) because the focus involved the use of, or treatment of, soil removed from a native site, studies treating soils in normal farming and agricultural settings were not searched. Further, because even these targeted searches retrieved thousands of items, it was agreed that the initial report of search results would be limited to record titles only. The abbreviated titles format allowed the NRC staff to scan records and select specific items for complete citation access and further review.

Initial work on strategy concept development and term selection was based on concepts and terms presented by the NRC in the Statement of Work for this project. These basic concepts and terms were extended based upon NAL staff expertise with soil science topics and operations and with natural resource literature. The search strategies developed by the NAL principal investigator were internally reviewed and then shared with NRC staff. The preliminary terms and delimiters were incorporated in the search strategy and concept set constructions. This established priority rankings before complete searches and title downloads were executed. The final search strategies used are shown in Appendix A.

## 4.2 Database Selection Processes

Database selection began using the DIALINDEX® file from Dialog® to identify databases that contained records with specified search terms and show the numbers of records that would be retrieved by those terms in each database. The databases available from Dialog® may be grouped in the DIALINDEX® system into subject and source categories, including "allscience" (258 files), "allbusiness" (348 files), and "allnews" (160 files). Relevant databases were initially selected for search

by reviewing the numbers of items posted for each concept set. These major subject categories together comprise more than 470 unique database files[3] (many files are included in more than one of the aforementioned categories). Counts of items retrieved from each database for all the defined concept sets were the initial results used in database selection.

Databases with significant item counts were further analyzed for sources of records, scope of subject coverage, and time span of records included. The general project parameters were used in the database selection process. The following databases were excluded.

- Business, science and news databases focused outside North America,
- Business databases focused on personnel and management topics,
- Business databases focused on stocks, corporate finance and mergers,
- Newspaper databases from locations other than North America,
- Newspaper databases[4] added to Dialog® after 1990,
- Science databases for non-subject topics (biotechnology, computer science and programming, mathematics).

From the more than 470 unique databases in the major groups surveyed for file inclusion, 200 databases were specifically selected and actually utilized in this study. The database file names with their associated Dialog® file numbers, dates of record inclusion and updates are shown in Appendix B.

For specific concept sets (Section 4.3 and Appendix A), major category groups of database files were sometimes excluded, for example, most business files were not searched for soil material flow, or soil remediation/reclamation methods; economics terms were not searched in all science databases.

Other file selection decisions were made after initial search efforts, including the decision that patent databases would not be included. The decision was reached after search results from patent databases for concept set G1 were reviewed. NAL and NRC staff agreed that patents involving soil with impact in terms of soil-human interactions would likely be documented in other business, science or news database files. This was shown to be the case in several specific instances, with patents retrieved from these other sources.

Although database files focused specifically on geographic areas outside the United States or Canada were generally excluded, much literature from non-U.S. examples of soil-human interactions was retrieved. Items selected by the NRC staff included citations treating soil topics involving Chernobyl and other non-U.S. activity sites and non-U.S. publishing locations.

Index databases for newspapers covering multiple titles and wire service index files

---

[3]DIALINDEX® includes most but not all of the files available through the Dialog Corporation.

[4] Recently added newspaper files were generally local papers. Major stories carried in local papers are also covered through national wire services that were already included among the databases searched.

were also searched for many topics, as well as popular literature index databases such as Magazine Index® and Reader's Guide®, covering generally nontechnical sources. Specific databases included for the searches for each concept set are shown in Appendix A.

The concept sets developed to search the literature are organized into three groups. Each strategy group contains three or more specific concept sets. These are listed in the next section. Detailed strategy statements, with notes that describe the concept set purposes and the terms, codes and Dialog® commands that appear in the search statements, and database selections are presented in Appendix A. Proximity operators that are shown were sometimes adjusted to increase stringency during final retrieval operations from the initially approved strategy sets to improve the overall relevancy of the results.

Dialog® databases are structured information resources. Each database has specific fields such as descriptors (DE), identifiers (ID), abstracts (AB), and others included in the basic index for each file. Searches retrieve records in which a term is found in any basic index field unless particular fields are listed in the search command to limit retrieval. When it is desired that a term appears only in one or more specific fields, the syntax "term / f1, f2, f3", etc., may be used, with selected term tags (DE, ID, etc.) entered after the "term/ ", in place of "f1, f2, f3".

Dialog® allows other sophisticated search and retrieval commands. Those called proximity commands are based on relative locations between terms or parenthetically nested groups of terms. Standard Boolean logic commands may be utilized to further specify retrieved item characteristics.

Boolean set[5] combination commands include "and", "or" and "not". These operators link terms or groups of terms in a search statement by requiring their respective occurrence to either "must be", "may be", or "must not be" included in records retrieved.

## 4.3 Literature Survey

The literature survey was organized into three broad categories for searching: general (labeled G), particular (labeled P), and volumetric or quantitative (labeled V). Detailed descriptions of the actual search strategies, notes on the Dialog® command syntax, and databases selected for each set are presented in Appendix A. Refer to Appendix B for a complete listing of the files searched for their file names and coverage dates.

### 4.3.1 Search Category G (General)

The search category G was designed to discover any activities reporting how humans use soil. The terms used in these sets were broad and nonspecific. The group contained six sets that examined concepts, including commercial material flow, storage, processing, general use, and Government publications. Altogether the six concepts sets retrieved a total of 21,310 items for NRC staff review.

### 4.3.2 Search Category P (Particular)

At the outset of the research project, certain scenarios describing human uses of excavated soils were known. Search category P was designed to retrieve records relating to these known scenarios. Scenarios in the category relate to

---

[5] A Boolean set refers to terms or groups of terms that are connected using Boolean operators, i.e., "and", "not", "or".

construction uses; pottery; recreational uses; dust; potting, garden, and topsoil; and so forth. Search category P comprised 11 concept sets and retrieved 27,296 records for NRC staff review.

### 4.3.3 Search Category V (Volume)

Parameter information needed for dose modeling studies includes contact time, number of people involved, volumes of soil, and so forth. Search category V was designed to discover relevant parameter information. The sets searched for information relating to: soil as a commodity, transportation of soils, and statistical information. The V category comprised three concepts sets and retrieved a total of 29,271 records for NRC staff review.

## 4.4 Extent of Available Literature

From more than two million database records initially found in surveys of Dialog® databases, approximately 78,000 items were presented to the NRC from results of the searches outlined in the previous section. The majority of these items were titles that were provided to the NRC in electronic format.

An inventory of the complete count of items retrieved by concept set is shown in Table 2. Additional information on search results and methodology is provided in Appendix A.

**Table 2 Summary of Concept Set Findings**

| Concept Set [a] | Total Bytes | Total Records |
|---|---|---|
| **G1** *Soil use* | 2,992,239 | 12,424 |
| **G2** *Soil material flow* | 116,521 | 502 |
| **G3** *Soil process (not soil forming)* | 146,378 | 719 |
| **G4** *Human contact with soil* | 825,283 | 2,404 |
| **G5** *Storing soil* | 1,082,646 | 4,966 |
| **G6** *Soil Publications from applicable Federal agencies* | 64,237 | 295 |
| **P1** *Golf courses and sods* | 30,172 | 150 |
| **P2** *Reclamation methods* | 1,014,986 | 5,143 |
| **P3** *Soil dust* | 118,490 | 516 |
| **P4** *Earthmoving and soil use in construction fill and rammed earth* | 697,177 | 3,388 |
| **P5-6** *Soil in wall, dams, berms and dikes* | 3,124,201 | 14,199 |
| **P7** *Adobe* | 34,755 | 177 |
| **P8** *Pottery production and potting clay* | 27,035 | 152 |
| **P10** *Soil erosion rates* [b] | 42,236 | 39 |
| **P11** *Potting soil and bagged or bulk soil* | 669,537 | 3,254 |
| **P12** *Topsoil* | 134,414 | 278 |
| **V1** *Soil economics, business activities* | 2,295,349 | 9,363 |
| **V2** *Statistical and numeric data for soils* | 654,653 | 2,745 |
| **V3** *Soil transportation* | 837,839 | 17,163 |
| **Total** *19 Concept set results* | 14,908,148 | 77,877 |

[a] No relevant material was found in concept set P9.
[b] Related materials from the NRCS/USDA web pages and links were also provided.

After their review of the titles and complete citations from the database search results provided by NAL in both electronic file and print formats, 269 specific items were selected by the NRC for further review and detailed study by their staff. NAL compiled

a complete bibliographic listing of these items for the NRC. Table 3 includes the final selections by the NRC staff plus additional citations identified following the literature search.

During discussions with NRC staff it was agreed that recommendations for additional information research would be offered by NAL in the final report. These recommendations are included in Section 7 of this report.

**Table 3 Literature Search Results**

**1. 100 Area Hanford soil washing treatability tests.**
Westinghouse Hanford Co., Richland, WA. *Department of Energy environmental remediation conference, Augusta, GA (United States), 24-28 Oct 1993.* Washington, DC, Department of Energy, 10 p. Sep 1993.

**2. 100 Area soil washing: Bench scale tests on 116-F-4 pluto crib soil.**
Westinghouse Hanford Co., Richland, WA. Department of Energy, Washington, DC. 95 p. 10 Jun 1994.

**3. $^{137}$Cs mobility in soils and its long-term effect on the external radiation exposure.**
Bunzl -K, Jacob -P, Schimmack -W, Alexakhin -RM, Arkhipov -NP, Ivanov -Y, Kruglov -SV. *Radiation and Environmental Biophysics, 36(1): 31-7.* Feb 1997.

**4. Absorption of radiocesium by sheep after ingestion of contaminated soils.**
Cooke -AI, Weekes -TEC, Green -N, Wilkins -BT, Rimmer -DL, Beresford -NA, Fenwick -JD. *Science of the Total Environment, 192(1): 21-29.* Oct 8, 1996.

**5. Alternatives for management of wastes generated by the formerly utilized sites remedial action program and supplement.**
Gilbert -TL, Peterson -JM, Vocke -RW, Alexander -JK. Argonne National Lab., IL (USA) Department of Energy, Oak Ridge, TN. Oak Ridge Operations Office. 39 p. Mar 1983.

**6. Ash: A valuable resource. Volume 4. Ash handling/transportation-roads-engineering fill-marketing. Assessing inhalation exposure from airborne soil contaminants.**
Council for Scientific and Industrial Research, Pretoria (South Africa). *Presented at: Council for Scientific and Industrial Research Conference Centre, Pretoria, South Africa, February 2-6, 1987.*

**7. Assessing inhalation exposure from airborne soil contaminants.**
Shinn -JH. USDOE, Washington, DC. Report No.: UCRL-ID-130570. 9 p. 1 Apr 1998.

**8. Bark and soil producers product index.**
Lee -SY, Tamura -T, Larsen - IL. National Bark and Soil Producers Association (NBSPA). Manassas, VA.

**Table 3 Literature Search Results (continued)**

**9. Biological and chemical tests of contaminated soils to determine bioavailability and environmentally acceptable endpoints (EAE).**
Montgomery -CR, Menzie -CA, Pauwells -SJ. *SETAC 17. Annual meeting -- Abstract book. Partnerships for the environment: Science, education, and policy. p 198-199.* Pensacola, Society of Environmental Toxicology and Chemistry. 378 p. 995.

**10. Building with adobe brick.**
Masterson -R. *Studio Potter. 4 (2): 54-58.* 1975.

**11. Calculation of soil cleanup criteria for carcinogenic volatile organic compounds as controlled by the soil-to-indoor air exposure pathway.**
Sanders -PF, Stern -AH. *Environmental-Toxicology-and-Chemistry, 13(8): 1367-1373.* 1994.

**12. Characteristics of radionuclide-contaminated soils from the Sedan crater area at the Nevada test site.**
Lee -SY, Tamura -T, Larsen -IL, Essington -EH. *Soil Science, v. 144(2): 113-121.* Aug 1987.

**13. Chemical contaminants in house dust: Occurrences and sources.**
Battelle, Columbus, OH; Environmetrics, Inc., Seattle, WA; Engineering Plus, Seattle, WA.. Funded by: Environmental Protection Agency, Research Triangle Park, NC. Atmospheric Research and Exposure Assessment Lab. 8 p. 1993.

**14. Clean slate transportation and human health risk assessment.**
Department of Energy, Las Vegas, NV. Nevada Operations Office. 60 p. 1997.

**15. Critical pathways of radionuclides to man from agro-ecosystems. Annual progress report Oct 80-Sep 81.**
Smith -MH, Alberts -JJ, Adriano -DC, McLeod -KW, Pinder -JE. III. Savannah River Ecology Lab. 50 p. Apr 1982.

**16. Dermal exposure assessment: Principles and applications. Interim rept.**
Versar, Inc., Springfield, VA; Funded by: Environmental Protection Agency, Washington, DC. Office of Health and Environmental Assessment. 392 p. Jan 1992.

**17. Determination of transfer coefficients for $^{137}$Cs and $^{60}$Co in a slime-soil-grassland ecosystem.**
Handl -J, Kuehn -W. *Health Physics, v. 38(4): 703-705.* Apr 1980.

**18. Directory of principal construction sand and gravel producers in the United States in 1997.**
U.S. Geological Survey, U.S. Department of the Interior. *Mineral Industry Surveys. pp 1-12.* Mar 1999.

**Table 3 Literature Search Results (continued)**

**19. EPA engineering bulletins: current treatment and site remediation technologies.**
U. S. Environmental Protection Agency Bulletin. Government Institutes, Inc. 172 p. 1993.

**20. [Establishment and maintenance of grassed sports fields - experience from a field experiment on soil construction alternatives].** Original title: Sportgrasytors etablering och skotsel - erfarenheter fran ett markbyggnadsforsok.
Karlsson - IM. *Rapporter-fran-Jordbearbetningsavdelningen. No. 89,* Uppsala, Department of Soil Sciences, Swedish University of Agricultural Sciences. Uppsala, Sweden. 94 p. 1996.

**21. Federal focus: Army base recycles contaminated soil for pavement.**
Mouche -C. *Pollution Engineering v. 31(1):* 39-40. Jan 1999.

**22. Field measurement of dermal soil loadings in occupational and recreational activities.**
Holmes - KK Jr, Shirai -JH, Richter -KY, Kissel - JC. *Environmental Research, v. 80(2 Pt 1): 148-57.* Feb 1999.

**23. First Energy and Barnes Nursery create soils technology, LLC.**
Business Wire. Akron, Ohio. p7021143. Jul 2, 1998.

**24. Fugitive dust emissions from construction haul roads.**
Struss -SR, Mikuck i-WJ. Army Construction Engineering Research Laboratory. Champaign, IL. 53 p. 1977.

**25. Geochemistry and mineralogy of soils eaten by humans.**
Aufreite -RS, Hancock -RGV, Mahaney -WC, Stambolic -RA, Sanmugadas -K. *International Journal of Food Sciences and Nutrition, v. 48(5): 293-305.* 1977.

**26. Hazardous soil to be used in paving mix.**
Civil Engineering News, Marietta, GA. *Civil Engineering News v. 5(4): 29.* 1993.

**27. The interactions of low-level, liquid radioactive wastes with soils: 1. Behavior of radionuclides in soil-waste systems.**
Fowler -EB, Essington -EH, Polzer -WL. *Soil Science, v. 132 (1): 2-12.* Jul 1981.

**28. The interactions of low-level, liquid radioactive wastes with soils: 2. Differences in radionuclide distribution among four surface soils.**
Essington -EH, Fowler -EB, Polzer -WL. *Soil Science, v. 132 (1):* 13-18. Jul 1981.

**29. The interactions of low-level, liquid radioactive wastes with soils: 3. Interactions of waste radionuclides with soil from horizons of two soil series.**
Polzer -WL, Fowler -EB, Essington-EH. *Soil Science, v. 132 (1):* 19-24. Jul 1981.

**Table 3 Literature Search Results (continued)**

**30. Introduction to symposium 19: construction and use of artificial soils.**
Koolen -AJ, Rossignol -JP, Kutilek -M (ed.), Horn -R (ed.), Clothier -BE (ed.). State of the art in soil physics and in soil technology of anthrophic soils. Proceedings of the World Congress of Soil Science, Montpellier, France, 20-26 August 1998. *Soil and Tillage Research, v. 47(1-2): 151-155.* 1998.

**31. Issues of risk assessment and its utility in development of soil standards: the 503 methodology an example.**
Ryan -JA. Cincinnati, US Environmental Protection Agency, National Risk Management Research Laboratory. International Conference on the Biogeochemistry of Trace Elements, Paris, France, 15-19 May 1995.

**32. Large-scale adobe-brick manufacturing in New Mexico.**
Smith -EW. *Circular - New Mexico Bureau of Mines and Mineral Resources. (182): 49-56.* 1982.

**33. Lead in paint, soil and dust: health risks, exposure studies, control measures, measurement methods, and quality assurance.**
Beard -ME, Iske -SDA, (eds). *1993 Boulder Conference on Lead in Paint, Soil and Dust, Boulder, Colorado, July 25-29 1993.* ASTM STP 1226. Philadelphia, American Society for Testing and Materials (ASTM). 422 p. 1995.

**34. Marketing organic soil products.**
LaGasse -R. *BioCycle, v. 33(3): 30-33.* Mar 1992.

**35. Methodology to estimate the amount and particle size of soil ingested by children: implications for exposure assessment at waste sites.**
Calabrese -EJ, Stanek -EJ, Barnes -R. *Regulatory Toxicolology and Pharmacology, 24(3): 264-268.* Dec 1996.

**36. A Native American exposure scenario.**
Harris -SG, Harper -BL. *Risk Analysis, 17(6): 789-95.* Dec 1997.

**37. National Research Council study targets US soil programs.**
National Research Council. *Agrow (198): 13.* Dec 17, 1993.

**38. Off-Site Radiation Exposure Review Project: Phase 2 Soils Program. Revision**
Water Resources Center, University of Nevada at Las Vegas, Las Vegas, NV December 1989, Department of Energy Publication DOENV1038423Rev

**39. On the effect of probability distributions of input variables in public health risk assessment.**
Hamed -MM, Bedient -PB. *Risk Analysis, v. 17(1): 97-105.* Feb 1997.

**Table 3 Literature Search Results (continued)**

**40. Probabilistic prediction of exposures to arsenic contaminated residential soil.**
Lee -RC, Kissel -JC. *Environmental Geochemistry and Health, v. 17( 4): 159-168.* 1995.

**41. Radiation exposure from radionuclides in ground water: An uncertainty analysis for selected exposure scenarios.**
Prohl -G, Muller -H. *Radiation and Environmental Biophysics, 35(3): 205-18.* Aug 1996.

**42. Remediation of uranium-contaminated soils using uranium extractants and microbial uranium reduction.**
Lovley -DR, Landa -ER, Phillips -EJP, Woodward -JC. *203rd American Chemical Society (ACS) national meeting, San Francisco, CA, 5-10 Apr 1992, p. 8688-8690.* Washington, DC, American Chemical Society. 2442 p. 1992.

**43. [Resuspension in contaminated soils by the Chernobyl Accident]** Original Title: Resuspension en suelos contaminados por el accidente de Chernobyl.
Martinez Serrano -J, Espinosa Canal -A, Aragon del Valle -A. *Radioprotection, v. 5: 104-115.* 1997.

**44. Sand and organic amendment influences on soil physical properties related to turf establishment.**
McCoy -EL. *Agronomy-Journal, v. 90(3): 411-419.* 1998.

**45. Soil ingestion by humans: A review of history, data, and etiology with application to risk assessment of radioactively contaminated soil.**
Simon -SL. *Health Physics, 74(6): 647-72.* Jun 1998.

**46. Soil ingestion issues and recommendations.**
Calabrese -EJ, Stanek -EJ. *Journal of Environmental Science and Health.-Part A, Environmental Science and Engineering, v. 29(3): 517-530.* 1994.

**47. Soil recycle and transportation model.**
Hanzawa -Y, Matsuda -T, Nomura -K. *Research for Tomorrow's Transport Requirements : Proceedings of the World Conference on Transport Research, Vancouver, British Columbia, Canada, v. 1: 717-732.* Vancouver, Centre for Transportation Studies. 1986.

**48. Soil washing physical separations test procedure - 300-FF-1 operable unit.**
Westinghouse Hanford Co., Richland, WA. Washington, DC, Department of Energy. 117 p. 8 Oct 1993.

**49. Statistical uncertainties in predicting plutonium dose to lung and bone from contaminated soils.**
Garten -CT, Jr. *Health Physics, v. 39(1): 99-103.* Jul 1980.

**Table 3 Literature Search Results (continued)**

**50. Technical basis for establishing environmentally acceptable endpoints in contaminated soils.**
Nakles -DV, Linz -DG. *Proceedings of the SPE/EPA exploration and production environmental conference: government and industry working together to find cost effective approaches to protecting the environment, Houston, TX, 27-29 Mar 1995, p 9-18.* Richardson, TX, Society of Petroleum Engineers. 797 p. 1995.

**51. Testing soil mixed with waste or recycled materials**
Wasemiller -MA (ed.), Hoddinott -KB (ed.). *Proceedings of the 1997 Symposium on Testing Soil Mixed with Waste or Recycled Materials Conference, New Orleans, LA, Jan 16-17, 1997.* Conshohocken, PA, ASTM. Special Technical Publication 1275. 327 p. Sep 1997.

**52. Uncertainty and variability in human exposures to soil contaminants through home-grown food: a Monte Carlo assessment.**
McKone -TE. *Risk Analysis, v. 14(4): 449-463.* Aug 1994.

**53. Use of recycled soil for the regeneration of contaminated land.**
Fleming -G, Thomson -L. *Contaminated soil '93: Fourth international KfK/TNO conference on Contaminated soil, Berlin, Germany, May 3-7, 1993, Arend -F, Annokkee - GJ, Bosman -R, van den Brink - WJ (eds.) p. 871-880.* Boston, Kluwer Academic. 1993.

**54. Utilization of fly ash for stabilization/solidification of heavy metal contaminated soils.**
Dermatas - D, Meng -X. *Advanced Power Assessment for Czech lignite, Task 3.6, Part 2. Sondreal -EA, Mann -MD, Weber -GW, Young -BC (eds). p. 563-581.* Grand Forks, North Dakota Univ. 774 p. Dec 1995.

**55. We're in the soils business, remember!**
Toffey -WE. *BioCycle, v. 39(12): 57-61.* Dec 1998.

**56. Whole Earth let 'em eat dirt. (human and animal earth-eating behavior)**
Abel -A. *Saturday Night, v.113(5): 27-28.* Jun 1998.

# 5 QUALITY ASSURANCE/QUALITY CONTROL PLAN

## 5.1 Construction and Approval of the Plan

Information retrieval is a more qualitative than quantitative process by virtue of the continuously expanding base of available resources. By way of example, it has been estimated that as many as 14,000 technical reports are written each day in the United States.

All systems, including information retrieval systems, are constrained in three ways: time, quality, and cost. Each constraint is operative at all times although relative importance varies. Quality measures are based upon two components, precision and recall. Precision refers to the percentage of valid or highly significant citations as a function of the total number of citations retrieved (recalled). Recall performance is evaluated as a percentage of how many significant publications were retrieved as a function of the total number of significant publications.

Quality measures for any project are therefore dependent upon the stated information needs of the client balanced with the other constraints of time and cost. For the purposes of this report the search quality performance must balance precision and recall against time and cost. It was anticipated that a reasonably extensive search would be required to achieve the information needs of the NRC staff. The research plan was constructed in such a way as to minimize to the extent possible the negative impacts of a high recall comprehensive survey.

The development of a quality assurance or quality control plan was required by the terms of the Interagency Agreement (IAA). A plan was drafted for the IAA and submitted to the NRC staff for their review and approval. Revisions suggested by the NRC staff were made to the plan.

## 5.2 The Quality Assurance/ Quality Control Plan

The final Quality Assurance/Quality Control (QA/QC) Project Plan, as approved by the NRC staff, is summarized below.

### 5.2.1 Procedures for Collaborative Review

Procedures for collaborative review of literature survey results, information sources, and retrieval strategies were established using guidelines set by the Reference and User Services Association of the American Library Association.[6] The published guidelines are adhered to when feasible, based upon access to the patron and resources as outlined under the NAL policy on user fees.

Based on initial survey results, NRC staff, external reviewers, and other NAL staff will review search strategies, concepts, definitions and descriptions, search terms, and database selections. Preliminary search results will be reviewed (in titles-only format) by NRC staff and external reviewers. An important quality control measure is obtained through the simultaneous review by non-NAL library and information science and soil science professionals (i.e., external reviewers).

---

[6] Reference and User Services Association. "Guidelines for Behavioral Performance of Reference and Information Professionals." January 1996. American Library Association. <http://www.ala.org/rusa/stnd_behavior.html>. Section 4.

Recommended changes will be incorporated as appropriate. Additional search results will be presented to NRC staff for their consideration in order to determine relevant titles for downloading.

### 5.2.2 QA/QC Audit

The Draft Letter Report will be provided to the external reviewers for the QA/QC audit. The Draft Letter Report will include search strategies, data sources, and a complete set of the titles-only downloads. The reviewers will be asked to review the strategy for completeness. Specifically the search terms will be reviewed for any missing concepts, the strategy will be reviewed for logic, and finally, the reviewers will be asked to assess the retrieved results for inclusiveness of seminal works. The auditors will be requested to return their comments to coincide with the NRC staff review.

At this point NAL staff will meet with NRC staff to review the comments from both the external and NRC reviewers. Refinements will be made to searches, as needed, to ensure maximum precision and completeness. Selection of specific titles for complete citation retrieval for the Final Task 1 Report will be made jointly by NRC and NAL staff.

Archives of all online search activities will be maintained by NAL for five years. Session logs will include costs, search terms and databases used, and copies of all records downloaded, in any format. Logs will be maintained for all Internet searches, showing search techniques and sources used, as well as any specific relevant resources that are discovered or retrieved directly via Internet search engine use. Copies of these data will be provided, upon request, to NRC staff.

## 5.3 External Review

A key element in the QA/QC Plan was to engage external (i.e., non-NAL) experts to review project results. This independent review by outside experts has two benefits. The review (1) may alert NAL and NRC researchers to concepts missed in strategy development and (2) may identify important information sources that may have been overlooked. These benefits are best achieved through careful selection of experts for the external review.

### 5.3.1 Selection of the External Reviewers

NAL and NRC staff jointly determined that external reviewers should come from three key disciplines: (1) soil science, (2) civil engineering, and (3) information science. Soil science experts provide the best opportunity to identify new technical terms that could be added to the search strategies to enhance recall of relevant citations. The field of civil engineering with its focus on construction provides many important scenarios for the reuse of soils. Finally, professional information specialists are best suited to understanding the complex syntax and logical search strategy construct, and are the most knowledgeable about available information sources.

Having established the expertise needed in the reviewers, NAL staff sought capable experts. It should be noted that in all cases the reviews were voluntarily conducted without payment.

The following experts were selected by NAL and approved by the NRC staff to serve as external reviewers.

Dr. Dewayne Mays
Head, USDA, NRCS, Soil Survey Laboratory
NRCS, Federal Building
100 Centennial Mall N., Room 152
Lincoln, NE 68508

Dr. Mays has a Ph.D. in Soil Science from the University of Nebraska and is currently heading the National Soil Survey Laboratory for the USDA, Natural Resource Conservation Service.

Carol H. Reese
American Society of Civil Engineers
Production Unit
1801 Alexander Bell Dr.
Reston, VA 20191-4400

Ms. Reese has a Master of Library Sciences degree. She has developed and is maintaining databases for the American Society of Civil Engineering and is responsible for indexing the Society's publications. In addition, Ms. Reese has 16 years of reference research experience at a University. She serves as a board member of the Special Libraries Association's Engineering Division.

Carla Long Casler
Arid Lands Information Center
University of Arizona
1955 E. 6th Street
Tucson, AZ 85719-5224

Ms. Casler has a Master of Library Sciences degree. She has compiled information resources on "Soils of Arid Regions of the United States and Israel," "World Desertification Bibliography," and other soil-related projects. Ms. Casler has had professional involvement in both the United States Agricultural Information Network (USAIN) and IAALD, an international agricultural library association. She has 10 years of online bibliographic search experience in the Arid Lands Information Center. For eight years, Ms. Casler served as the CAB International North American Representative (a key database resource used in the current study).

### 5.3.2 Reviewer Comments

NAL requested that each reviewer consider four specific elements in conducting the review for the project:

- Specific terms used in the strategies for additional terms
- Search string logic or construction
- Database selection
- Recall of highly relevant publications.

With respect to the last point, the reviewers were asked to identify any highly relevant literature not found in the materials under review.

The reviewers were sent the Draft Letter Report, which provided a copy of the comprehensive search strategy concept sets and sample title listings. These titles were felt to be an adequate sampling for review.

### 5.3.3 Summary of Actions Taken in Response to the External Reviewers' Comments

The external reviewers provided comments on search terms, strategy syntax, and information sources. Reviewer comments and detailed responses to the comments are provided in Appendix C.

One reviewer suggested the additional search terms "removal" and "cost" for concept sets V3a and V1b respectively. These enhancements were made to the

strategy statements. A syntax error was noted and corrected in the strategy statement for concept set P3.

The reviewers recommended assessing the following information sources: dissertations and theses; USGS publications; STN; and CISTI.

Dissertations and theses are indexed in Dialog® file 35 *Dissertation Abstracts Online*. This file was searched in 15 out of 42 searches. USGS publications are indexed in Dialog® file 89 GeoRef, which was used in 25 of the final 42 searches. Database and information access providers STN and CISTI were reviewed. Initial screening suggested that the depth of coverage was not sufficient to warrant further analysis at this time. They remain potential new sources should additional research become necessary.

Recommended information sources from one reviewer included web sites related to Chernobyl and Three Mile Island. Information about these sites was relayed to the NRC staff for their consideration.

Appendix C contains complete details of the external review, comments, and actions taken.

# 6 ADDITIONAL INFORMATION SOURCES

Acknowledging the importance of this project and the complexity of the information retrieval, it was decided that additional information sources would be scanned. The primary purpose for the scanning was to provide an overview for the NRC staff as to the availability, extent, and the nature of these resources. These explorations were not exhaustive because the information environment is extremely diverse and dynamic. The NRC staff was in agreement with this approach because of their high-priority requirement for citable sources from the literature as the primary product.

Additional information research explorations included Internet Web searches using selected search engines and specific databases available via the web, NAL networked resources, and database resources available from the University of Maryland at College Park, library system. The NAL staff explored and reviewed items obtained through searching the Defense Technical Information Center Web site, and statistical databases on compact disc (CD) from Congressional Information Systems (CIS), called "Statistical MasterFile." The NAL staff reviewed titles available from the Online Computer Library Center, Inc. (OCLC) "WorldCat" international library cataloging database and conducted some searches in the Thomas Register of American Manufacturers℠ database on CD.

## 6.1 Internet Searches

A recent report in *Nature,* July 1999, notes the existence of more than 800 million indexable pages on the web.[7] Because the growth of volume is so great, the changes are so frequent and rapid, and the processing of complex searches for an involved topic such as this one so difficult, it was not considered reasonable to pursue the complete retrieval of all material on the Internet for this project. Additionally, with the results of Internet searches, it is not readily apparent to what extent a particular item has been peer-reviewed, or to otherwise verify and substantiate the scientific accuracy of information included.

Further, recent studies characterizing the web conducted by OCLC document more than five million web sites.[8] While the vast majority of web sites are publicly accessible, comprehensive standards are rarely used in constructing, formatting, or indexing sites, or for the search engines available to locate specific information on these sites, and the more than 800 million pages that they include.

Internet coverage of specific topics is arguably as inconsistent as its rate of growth has been remarkable. Because of this lack of consistency, retrieval of subject-specific web documents in a complex, multifaceted topic area cannot be readily planned and structured to ensure comprehensive coverage of Internet resources. Estimates are that perhaps as many as 2,000 search engines are

---

[7]For more information about Internet search engines consult the following URL: <http://www.searchenginewatch.com/sereport/99/08-size.html>.

[8]OCLC Office of Research, "Web Characterization Project: Statistics." 1999. <http://www.oclc.org/oclc/research/projects/webstats/statistics.htm> (23 January 2000).

available.[9] Each may have its own indexing systems, techniques, and methods of acquiring new sites and adding appropriate terms.

It is also noted that many search engines do not support the kind of advanced and complex search statements used in this study to retrieve items from scientific, technical and business-related citation databases.[10] Without truncation, proximity commands, and specific field-searching capability, the results of most web searching for these complex concept groups, if they could be constructed and actually run, would lead to significant overflow in retrieval. If particular sets of terms and concepts can be identified and developed, some additional success might be expected for further research using general Internet search systems and techniques.

In spite of these limitations, Internet explorations using various search engines produced several interesting and valuable documents. Specific search engines utilized to compile the listings that were submitted for NRC review include the following:

AllTheWeb URL:
<http://www.alltheweb.com>

AltaVista URL:
<http://www.altavista.com>

Google URL:
<http://www.google.com>

Metacrawler URL:
<http://www.cs.washington.edu/>

Recommendations from NAL staff and external reviewers for this project also located additional resources. Searcher skill and experience, some significant good fortune, and particular experience with known sites and familiarity with particular search engines were all part of this additional effort. These items were forwarded to the NRC staff in the Draft Letter Report, Draft Letter Report Supplement, and in later documents. Specific sites providing searchable database access, such as that provided by the American Society of Civil Engineers (ASCE) and searchable databases from the Defense Technical Information Center (DTIC), were located by external reviewers, as well as NAL staff. Although some of these may provide additional sources of published literature and other information, there is little to suggest that these will be unique items to those retrieved in the exhaustive Dialog® searches. Internet Web pages and related items that were selected by the NRC staff are listed in Appendix D.

While the project needs of the NRC were national in scope, pertinent local information was found on the Internet. Local and regional businesses, involved with soil as a commodity, were often listed in subject-oriented directories (i.e., for construction or landscaping) or through the local Better Business Bureau.

The U. S. Geological Survey compiles statistical reports by State for sand and gravel operations. Individuals interested in learning about this industry in their home States should look to their own Department of Natural Resources for more information. Ohio, for example, has provided

---

[9]Stanley, Tracey, "Meta-Searching on the Web." *Ariadne* Issue 14. 1998. <http://www.ariadne.ac.uk/issue14/search-engines/> (23 January 2000).

[10]University of Northumbria at Newcastle. "Web Search Service Features." 1999. <http://www.unn.ac.uk/features.htm> (23 January 2000).

outstanding information available on the web at URL: <http://www.dnr.state.oh.us/odnr/geo_survey/geo_fact/geo_f19/geo_f19.htm>. New Jersey provided another example of an important State initiative in publishing regulations for the remediation of contaminated soils.

The U.S. Department of Defense has reported on its significant experience in the cleanup and remediation of former military bases. These reports may provide pertinent analogies for the NRC soil clearance program. The Defense Technical Information Center (DTIC) can provide access to much of this literature through its searchable STINET database on the Internet at URL: <http://www.dtic.mil>.

Similarly, the U.S. Department of Energy (DOE) has had pertinent experience with the cleanup and remediation of their nuclear weapons production and storage facilities. Many reports describing DOE remediation efforts were found in the National Technical Information Service (NTIS) database and reported to the NRC through this study.

Chemical contamination of soil and site cleanup are under the regulation of the U. S. Environmental Protection Agency. Several representative "Superfund" cleanup reports were provided to the NRC staff for evaluation.

## 6.2 Defense Technical Information Center Resources

The Internet pages maintained by the DTIC, under the Scientific and Technical Information Center (STIC) are an excellent source of defense-related and other scientific documents that have been entered into DTIC's Technical Reports Collection from late December 1974 to present as well as some full text reports for those citations. This resource is searchable, using the URL: <http://www.dtic.mil:80/stinet/ >.

Searches from this location were conducted by NAL staff. From the STINET database, a complete listing of items covering "soil(s)" included more than 11,000 items. Specific DTIC searches included the DOE OPENNET Database. A listing of about 500 titles of items covering soils from OPENNET was delivered to NRC staff. NRC staff selected some items for futher study.

One interesting item that was identified from the DTIC database search was an article published in a subject-specific issue of *Soil Science*, July 1981. v. 132 (1). This issue contained 18 articles reporting studies of the behavior of radionuclides in soil environments. The articles were reviewed and selected citations were added to the study results listed in Table 3.

## 6.3 Other Sources

Additional sources that were searched for this report included the OCLC WorldCat library cataloging database, the Statistical Masterfile (SM) CD, the Thomas Register of Industrial Products, and the InfoTrac database. The first three of these resources have specific types of data records included, and the last is a general bibliographic resource. Each of these resources in conjunction with NAL's information research activities is discussed below.

The WorldCat database from OCLC includes cataloging records for books and journal titles held in libraries across the United States, as well as many international libraries. More than 40 million items are included in this database. Searching on the WorldCat database for books was undertaken in a manner to provide a sampling of items that might be reviewed

for possible inclusion, and to evaluate the resource for further review and searching.

Searches using WorldCat for broad concept terms like "earthmoving" were tried, and several selected items were forwarded to the NRC staff for their review and selection. Items that the NAL staff recommended for review covered equipment used in this industry, in the expectation that some of this material would help to describe the physical context of exposure scenarios related to earthmoving. Other searches with terms such as "soil", "soil(s)" and "recycling", "soil(s) and material flow", "soil near5 sale(s)"[11], and "gardening and statistics" were tested as well, but either numerous records (over 91,000 for "soil" as a title word, and more than 120,000 as a subject term), or very few records (63 for "soil recycling", 8 records for "soil(s) and material flow(s)", and 9 records for "soil(s) near5 sale(s)", and 54 records for "gardening and statistics") were found. From these small-yield search groups very few or no records with relevance for this project were found.

Complex strategies that were defined for the Dialog® system database searches would need to be further refined and tailored for use in the WorldCat database system to be effective. Book titles and their subject headings are often rather general. Further research using this database might prove valuable to identify topic-specific publications for the work of the NRC.

The Statistical Masterfile (SM) CD database includes publications with significant statistical data from U. S. government, private, and international sources. This database was accessed at the University of Maryland at College Park library. The searches produced few relevant statistical references for this project but some items that might be useful were noted and forwarded to the NRC. Specific search terms explored were "earthmoving" and "topsoil". Little definitive detail was found, but items such as Pit and Quarry: State of the Industry (ISSN 0032-0293), ENR (a trade weekly for the construction industry, ISSN 0891-9526), and several documents that cover aspects of building and construction industries were found. Most of these were related to overall industry trends and did not note the inclusion of details specific to soils. Quarries, cement, concrete, and stone data were mentioned, but not earthmoving or transport or other uses of soils materials.

Searches in the SM database for statistics on gardening and horticulture produced listings that addressed overall production of floriculture and horticulture products. Data covering equipment such as tractors and implements was also seen, but nothing was shown related to soils or soil use directly. Other searches using the SM CD databases were focused on waste processing (including nuclear wastes). Searches were completed for topsoil, and also included mining, minerals, and quarries, but only sand and gravel and related topics were found.

Search efforts using the Thomas Register of American Manufacturers℠ CD database provided another means to identify significant companies involved in the production of soil-related products. If additional source or producer data is required for any specific products, this would be a most convenient source of that information.

Searches using the InfoTrac system retrieved relevant citations. NAL staff noted that these items were already included

[11]"Near5" is a proximity operator. Terms located on either side must both be present for a record to be recalled. The terms can appear in any order and can be separated by up to five words.

within the result of both the Dialog® comprehensive listings and the focused additional search results list that were presented to the NRC in the Draft Letter Report.

Because selection of specific resources from the Dialog® system databases was the primary objective of this project, and because most of the published "citable" literature is likely to be included in those databases, little additional time or effort was expended in exploring these other information research resources. Should additional research be deemed necessary for specific topics, these resources may yield useful information.

# 7 RECOMMENDATIONS

The thoroughness of the research services provided by NAL to the NRC was validated by the external review process. Essentially no new search terms were identified. The few information sources suggested by the reviewers had largely been covered by one or more of the searches executed in the course of this study.

Using information in this report, the NRC staff is reviewing the literature listed in Table 3. This review may reveal topical areas requiring further information research. Given the complexity of the search strategies used and the exhaustive nature of the results reported, the following recommendations identify research options that should prove productive yet avoid unnecessary duplication of results.

These recommendations fall into four categories as described below:

(1) Product code searching in the Dialog® system. This strategy will identify specific companies that might be contacted for anecdotal information if documented sources are not found. Examples of this approach have been reviewed by NRC staff.

(2) Expand search concepts to include named radionuclides and their behavior in soil. In this approach special attention should be given to reviewing soil remediation at contaminated sites. This approach would include independent searches for each radionuclide, its isotope names, and its decay products.

(3) Survey the literature using (a) specific soil characteristics and physico-chemical properties (i.e., sand, gravel, loam, clay) and (b) additional scenario terms (i.e., racetracks, playgrounds, tot lots, ball fields, hiking trails).

(4) Search additional information resources. Additional venues for information retrieval will be difficult to search for the most part, but may with diligence provide information. One such important source is the Internet. The external reviewers have also suggested specific information sources that may be worthy of further exploration.

# APPENDIX A. SEARCH STRATEGIES AND RESULTS

## A.1 Introduction

Extensive searches were conducted to identify human interaction with soil. Emphasis was placed on locating published, verifiable sources of information. Published literature is primarily indexed in bibliographic citation or full-text databases. Access to these databases can be obtained through commercial vendors in two key formats: online services or compact disc (CD).

Online access to the bibliographic citation and full-text databases was the primary method used for this study. The primary online access provider selected for the study was the Dialog® Corporation.

In some instances, databases were searched using the SilverPlatter® CD platform. Records accessed using this interface are equivalent to those available from the Dialog® system.

This appendix provides exact details of the methodology employed in this study.

## A.2 Search Strategies

The searches were organized into three categories: (1) general terms labeled G, (2) particular scenarios labeled P, and (3) quantitative or volumetric terms labeled V.

In the following section, each category is described. Following the category description, each concept set is identified by a label and followed with a narrative description of the purpose of the strategy concept set in italics. The actual strategy follows on a separate line beginning with "S", which is the search command for Dialog®. Below each search statement is a listing showing the selected databases.

### A.2.1 General Terms (G) (6 final sets)

These searches were designed to discover and retrieve records of actions or activities of humans with soils not specifically identified by the NRC or NAL staff. Search results could identify particular additional "scenario" names or terms or help to quantify particular soil contact parameters.

#### A.2.1.1 Concept Set G1

This concept set retrieved many records describing soil use. Results were provided in five separate files because of the high numbers of records retrieved.

S (SOIL? ? OR DIRT)/TI,DE,ID,SH,CC (2N) (USE OR USERS OR USING OR USES OR USED OR USAGE? ? OR REUSE OR REUSING OR REUSED)

Dialog® business-related databases selected and searched, by file number:
7,9,33,63,67,119,139,146,148,194,211,258, 262,318,323,474,475,483,484,492,494,495, 496,497,571,583,603,624,632,633,634,638, 639,640,642,649,701,702,704,705,706,707, 708,713,714,716,718,719,721,724,738,739, 741,743

Dialog® science-related databases selected and searched, by file number:
10,6,50,60,8,15,16,18,20,35,47,49,58, 64,68,77,87,89,92,99,103,109,110,111,118, 143,144,238,257,266,292,319,335,479,484, 535,553,559,608,635,636,655,764

#### A.2.1.2 Concept Set G2

This concept set retrieved records about material flow and soil. Material flow refers to the transfer or movement of a material or substance within a physical or commercial environment.

S SOIL? ?/TI,DE,ID,SH,CC AND MATERIAL? ?()FLOW?

Dialog® science databases selected and searched, by file number: 5,203,6,50,60,34,440,63,484,2,8,35,40,44, 71,89,94,103,108,117,118,144,156,162, 266,292,315,340,347,348,351,353,652,653, 654

### A.2.1.3 Concept Set G3

This concept set retrieved records covering all forms of soil processing or processes, except soil formation.

S ((SOIL? ? OR DIRT)/TI,DE,ID,SH,CC (2N) PROCESS???) NOT (SOIL? ? (2W) FORM?)

Dialog® business-related databases selected and searched, by file number: 118,63,119,266,2,16,19,108,148,636,240, 484,7,109,67,624,323,621,813,111,583,18, 553,194,262,633,649,516,635,15,238,47, 51,64,92,211,479,139,474,705,727,733,141

Dialog® science-related databases selected and searched, by file number: 50,10,6,89,8,65,292,103,68,110,76,58, 143,77,40,41,87,60,29,357,99

### A.2.1.4 Concept Set G4

This concept set searched for records related to direct human contact with soils.

S (SOIL? ? OR DIRT)/TI,DE,ID,SH,CC (S) (CONTACT? OR EXPOSURE OR HUMAN? ? OR PEOPLE? ? OR PERSON? ? OR WORKER? ? OR LABORER? ? OR WORKMEN OR WORKMAN)

Dialog® business-related databases selected and searched, by file number: 7,9,15,16,20,33,47,49,93,115,139,146,148, 180,248,258,474,475,484,492,494,496,497, 498,535,584,603,608,630,631,632,633,634, 636,638,641,642,655,701,702,704,705,707, 708,713,714,721,723,732,733,734,736,738, 740,743,781

Selected SilverPlatter® CD science-related databases: AGRICOLA, 1970-1999/06;[12] CAB (1972-1999/04); NTIS, 1983-1999 (1-18)

### A.2.1.5 Concept Set G5

This concept set searched for records related to temporary soil storage (e.g., surcharge piles) or long-term warehousing of stored soil.

S (SOIL? ? OR DIRT)/TI,DE,ID,SH,CC (2N) (STORAGE OR STORED OR STORING OR DISPOS??? OR SURCHARGE()PILE? ?)

Dialog® business-related databases selected and searched, by file number: 194,118,315,63,60,266,119,109,98,323, 148,636,108,474,484,16,99,553,262,87,92, 603,111,559,660,655,317,195,49,238,335, 479,527,635,492,634,707,737,319

Dialog® science-related databases selected and searched, by file number: 6,10,50,8,89,103,68,292,58,143,29,41, 2,35,96

### A.2.1.6 Concept Set G6

This concept set retrieved records from specific U. S. Government agencies whose missions and responsibilities regulate radionuclides and describe soil.

S (SOIL? ? OR DIRT)/TI,DE,ID,SH,CC (F)

---

[12]The SilverPlatter® CD based databases are followed by date ranges of subject coverage; the two-digit number following the slash represents the release month for the CD.

(AEC or DOE (S) (FOCUS () GROUP or STABIL?) OR ERDA or NRC)

Dialog® science-related databases selected and searched, by file number:
10,6,203,5,50,65,2,73,76,89,123,108,109, 117,144,148,155,156,241,266,285,292,440, 624,636,655,660

### A.2.2 Particular Scenario Terms (P) (11 final sets)

Searches constructed to retrieve items on specifically identified types of human-soil interactions.

#### A.2.2.1 Concept Set P1

This concept set retrieved records on soil uses for golf courses and for sod farming and sod roof construction.

S SOIL? ?/TI,DE,ID,SH,CC (S) (GOLF()COURSE? ? OR (SOD OR TURF)()(FARM? ? OR ROOF? ?))

Dialog® databases selected and searched, by file number:
10,50,76,5,203,8,35,41,60,65,71,77,16,18, 19,47,103,143,144,266,286,292,479,516, 555,630,631,632,633,634,641,707,708,713, 714,716,723,725,733,742,777,781,34,440

#### A.2.2.2 Concept Set P2a and P2b

These two concept sets were combined with the "and" operator to locate and retrieve records describing techniques used in the cleanup of contaminated soils.

S SOIL? ?/TI,DE,ID,SH,CC (3N)(REMEDIAT? OR RECLAM? OR RECLAIM??? OR WASH??? OR CLEAN??? OR PROCESS??? OR RECYCL??? OR STABILIZ?)

**-and-**

S (METHOD? OR TECHNIQUE? ? OR MECHANISM? ? OR PROCEDUR?? OR OPTION?? OR PLAN???? OR ACTIV????? OR ACTION??)/TI,DE,ID,SH,CC

Dialog® science-related databases selected and searched, by file number:
10,6,50,76,203,8,15,16,18,19,35,40,41,58, 60,63,65,68,77,87,89,92,98,99,103,110, 111,117,118,144,148,238,266,285,292,315, 317,484,527,535,553,559,621,624,636,660, 764,766,813,7,194,262,649

#### A.2.2.3 Concept Set P3a and P3b

These two concept sets were combined with the "and" operator to retrieve literature describing dust from soil.

S DUST? ?/TI,DE,ID,SH,CC (3N)(LOAD? OR LEVEL? ? OR VOLUME? ? OR QUANTIT? OR AMOUNT??? OR HAZARD? OR LOSS OR LOSSES OR DAMAG? OR TRANSFER? OR CONTAMINAT?) NOT (DUST (2N) (HOUSE? ? OR MITE? ?))

**-and-**

S (SOIL? ? OR DIRT OR EARTH? ?) /TI,DE,ID,SH,CC

Dialog® databases selected and searched, by file number:
10,50,6,5,103,40,89,110,41,73,144,8,2,76, 337,117,155,68,474,65,109,63,655,108, 119,315,334,7,240,16,323,60,77,161,9,19, 31,99,317,535,636,111,118,262,475,747

#### A.2.2.4 Concept Set P4

This concept set retrieved literature covering the use of soil in construction.

S (EARTHMOV??? OR EARTH()MOVING OR RAMMED()EARTH OR (BACKFILL??? OR FILL()DIRT OR (BACK OR CLEAN OR

CONSTRUCTION OR RESIDENTIAL () FILL))(F)(SOIL? ? OR DIRT OR EARTH??)/TI,DE,ID,SH,CC

Dialog® business-related databases selected and searched, by file number:
7,9,49,146,269,474,475,478,483,484,492, 494,495,527,535,553,555,559,570,603,608, 621,624,632,634,563,633,636,638,639,640, 641,642,649,655,660,704,707,708,712,713, 714,718,723,738,743,781,813

Dialog® science-related databases selected and searched, by file number:
10,6,50,203,8,15,16,18,20,35,41,47,58,63, 64,180,194,195,196,257,285,635,636,14, 19,68,77,87,89,98,99,156,161,292,103,109, 117,118,144,110

### A.2.2.5 Concept Set P5-6

This search concept set retrieved literature covering soil use in walls, berms, dams, etc.

S (SOIL? ? OR EARTH?? OR DIRT)/TI,DE,ID,SH,CC (2N) (REINFORC? OR EMBANKMENT? ? OR DAM? ? OR LEVEE? ? OR DIKE? ? OR BERM?? OR WALL?? OR ADMIXTURE? ?)

Dialog® databases selected and searched, by file number:
63,8,65,89,118,144,10,6,50,203,103,15,33, 34,35,50,67,119,194,262,248,535,559,624, 670,765,2,19,31,35,47,40,44,58,68,41,77, 87,92,96,98,89,110,117,430,238,99,240, 266,292,293,440

### A.2.2.6 Concept Set P7

This concept set included terms to retrieve records describing adobe building materials and construction.

S (ADOBE/TI,DE,ID,SH,CC NOT (SOFTWARE OR PROGRAM??? OR COMPUT??? OR DESKTOP? ? OR ILLUSTRATOR OR PHOTOSHOP OR PRINTSHOP OR ACROBAT))(F) (SOIL? ? OR DIRT OR MATERIAL? ? OR SOURCE? ? OR MAKING)

Dialog® databases selected and searched, by file number:
10,6,203,5,89,531,118,103,47,65,68,2, 148,634,35,111,475,16,87,99,292,492, 603,9,132,262,498,630,713,716,719,732

### A.2.2.7 Concept Set P8

This search statement retrieved records covering pottery production or potter's clay.

S ((POTTING OR POTTERY OR POTTERS)()CLAY? ?)/TI,DE,ID,SH,CC OR ((POTTING OR POTTERY OR POTTERS)() CLAY? ?)(F)(SOURCE? ? OR SITE? ? OR PRODUC??? OR SUPPL???? OR MANUFACTUR?)

Dialog® databases selected and searched, by file number:
5,6,89,47,2,15,117,20,63,571,58,8,103,109, 118,146,148,535,583,483,704,708,716,717, 719,724,608,632,519,633,634,638,641,642, 706,718,781,736,702,703,706,725,734,492, 494,737,248,335,624,723,733,740,741,743

### A.2.2.8 Concept Set P9

This search concept set was constructed to retrieve items covering detrital materials.

S (DETRIT?? AND SOIL OR DIRT OR EARTH??)/TI,DE,ID,SH,CC

Note: No relevant material found.

#### A.2.2.9 Concept Set P10

This concept set searched for records discussing soil erosion rates.

S SOIL()EROSION/TI,DE,ID,SH,CC (F) RATE

Selected SilverPlatter® CD database: AGRICOLA (1970 - 1999/06)

Note: web documents from USDA/NRCS were also retrieved.

#### A.2.2.10 Concept Set P11

This concept set retrieved records on bulk or packaged soils (potting soil or other packaged soil mixes).

S SOIL? ?/TI,DE,ID,SH,CC (2N) (BULK?? OR PACKAG??? OR BAGGED OR BAGGING OR MIX??? OR POTTING)

Dialog® business-related databases selected and searched, by file number: 18,67,116,119,141,194,358,474,475,478, 484,492,494,495,527,531,559,603,632,633, 634,639,640,701,702,703,704,705,706,707, 708,712,713,714,715,718,720,724,731,735, 736,781,813,861,733,9,15,647,285,319, 479,535,553,621,624,635,766,7

Dialog® science-related databases selected and searched, by file number: 10,50,5,6,60,8,63,68,89,103,117,143, 144,285,292,516,515

#### A.2.2.11 Concept Set P12

This concept set retrieved records with topsoil as a subject term, excluding records retrieved from other searches using soil and dirt terms.

S TOPSOIL? ? NOT (SOIL? ? OR DIRT))/TI,DE,ID,SH,CCV)

Dialog® databases selected and searched, by file number: 50,6,76,34,40,41,47,2,9,44,58,68,77,89,92, 99,103,110,117,118,143,144,148,180,238, 285,479,484,516,535,571,608,624,635,636, 637,665

### A.2.3 Volume Terms (V) (3 final sets)

Searches using volume, quantity, or economic terms to retrieve records that quantify, specify, or delineate the extent of human contact with soils.

#### A.2.3.1 Concept Set (V1a or V1b) not V1c

These three concept sets were combined as shown to retrieve records covering the economic literature for soils, while excluding the economic discussions regarding soil erosion and conservation, soil fertility, pesticides, soil surveys, etc.

S (SOIL? ? OR DIRT)/TI,DE,ID,SH,CC (S)(ECONOM? OR DOLLAR? ? OR PRICE? ? OR PRICING OR PAYMENT? ? OR EXPENS? OR CASH OR VALU????? OR BUSINESS?? OR RETAIL?)

**-or-**

S (SOIL? ? OR DIRT)/TI,DE,ID,SH,CC (S) (WHOLESALE? OR PROFIT? OR COST??? OR INDUSTR??? OR COMMERC??? OR BUSINESS?? OR INVEST? OR MARKET??? OR SALE? ? OR PURCHAS??? OR DOLLAR? ?)

**-not-**

S (EROSION OR EROD? OR FERTIL? OR LOSS OR LOSSES OR POLLUT? OR RECLAM? OR RECLAIM? OR SAMPL? OR INVESTIGAT? OR CONSERV? OR SOIL()SURVEY? ?)

Dialog® business-related databases selected and searched, by file number: 7,63,139,47,474,111,484,20,16,635,713, 483,603,553,110,99,636,2,29,660,49,705, 642,18,87,475,634,98,621,258,631,718, 624,119,632,633,19,92,103,559,148,63, 531,285,194,16,266,474,119,87,109,9,20, 635,479,636,483,47,484,7,603,99,713,660, 535,765

Dialog® science-related databases selected and searched, by file number: 10,50,6,89,103,60,292,68,65,8,143,266,35, 58,40,77,109,118

#### A.2.3.2 Concept Set V2

This concept set used terms to retrieve records with specified numeric data for soils, excluding erosion, pesticides, and fertility topics.

S (SOIL? ? OR DIRT)/TI,DE,ID,SH,CC (2N) (QUANTIT? OR STATISTIC? OR AMOUNT? ? OR WEIGH? OR VOLUME? ?) NOT (EROSION OR EROSIV??? OR EROD??? OR LOS??? OR WEIGHTED OR FERTILI? OR YIELD??? OR PESTICIDE? ? OR HERBICIDE? ?)

Dialog® business-related databases selected and searched, by file number: 763,240,118,119,109,108,2,92,266,716, 194,99,484,7,474,609,708,357,148,248, 315,317,636,483,738,9,16,111,553,559, 475,494,633

Dialog® science-related databases selected and searched, by file number: 10,50,6,103,68,58,292,143,41,110,40,60, 98,29

#### A.2.3.3 Concept Set V3a not V3b

These concept sets were combined using the "not" Boolean operator to retrieve items covering soil movement, shipment, or transport, but excluded movement of fertilizer elements, pesticides or other chemicals applied to soils.

S (SOIL? ? OR DIRT)/TI,DE,ID,SH,CC (F) (TRUCK? OR SHIP? OR TRANSPORT? OR HAUL? OR BARG? OR TRAIN? OR RAIL? OR CONVEY??? OR REMOV? OR RELOCAT? OR REPLAC? OR PLACE? ? OR PLACEMENT)

**-not-**

S (FERTIL? OR CHEMICAL? ? OR INSECTICIDE? ? OR SEED? ? OR NUTRIENT? ? OR PESTICIDE? ? OR HERBICIDE? ?)

Dialog®i databases selected and searched, by file number: 10,6,50,2,58,67,68,89,103,109,143,292,9, 15,16,18,19,20,33,47,49,63,64,92,98,99, 111,118,119,180,211,238,240,241,245,248, 266,269,479,516,527,535,553,559,570,571, 608,621,624,635,636,637,660,813,7,474, 475,258,262

## A.3 Explanation Of Dialog® Search Command Syntax

The following sections describe the Dialog® search command syntax used in this study as reported above in Sections A.2.1 - A.2.3.

### A.3.1 The Search Command

The Dialog® information system can perform many types of operations. The operation to search files for records is initiated with the search command. The syntax for the search command is an "S" that is placed at the beginning of each statement.

### A.3.2 Truncation Command

Word truncation is a method used to capture spelling variations, such as -ed, or -ly of the root word. The Dialog® system

truncation command is "?" that can be used in the following ways.

- A single "?" will retrieve all records with the root word. This use of the command allows an indeterminate number of characters to follow the root word.

- A double "?" ("? ?") can be used to limit spelling variations to no more than one character after the root word.

- Additional "?" commands, such as "???" or "????", can limit the ending length of the root word for any number of characters up to and including the number of "?" commands shown.

### A.3.3 Boolean Operators

Boolean operators "AND", "OR" , "NOT" specify if terms occurring on either side of the operator must be, maybe, or cannot be within a record, respectively.

Concept set labels modified by small letters are used to define subsets that are then combined using boolean operators.

### A.3.4 Suffix-Coded Field Tags

Dialog® databases are generally structured into specific fields. The fields are identified with tags. It is possible to use the database field tags to limit searching to specific fields. This type of limitation can generally improve the relevancy of the search findings.

The Dialog® syntax for using suffix-coded "Field tags" is a "/" followed by the field name abbreviation [ /TI, DE, ID, SH, CC ]. Terms appearing immediately before the "/" must be present within a specified field. The fields used here include TI = titles, DE = descriptors (subject terms), ID = identifiers, SH =subject headings and CC =category codes.

### A.3.5 Proximity Operators

Proximity operators [(F), (S), (3N), or ()] indicate the allowed location of terms within a record. (F) requires that terms on either side of the operator be in the same field; (S) requires that terms be in the same subfield, i.e. in the same phrase or "sentence"; (nN) requires that terms on either side of the operator be separated by not more than "n" terms, where "n" is a number, in any order; the "( )" operator requires the terms shown on either side of the operator must be both adjacent and in the order entered.

### A.3.6 Parenthetical Grouping

Parentheses group terms together for processing. Such grouping is used for Boolean operations (AND, OR, NOT), or to apply field search limits (/TI, DE, ID, SH, CC), or to apply proximity operators (F), (S), (3N), etc., to all terms within a parenthetical group.

Command operations are performed first within parenthetical groupings before any other operations are processed. This command syntax is analogous to the precedence of operation seen in mathematical equations.

### A.3.7 Field Limitations

Proximity operators that search for terms within a given field or subfield will by default limit other linked but unlimited terms to the same field or subfield.

For example, searching a given set of terms that have been limited to fields, as in /TI,DE,ID,SH,CC, when linked to another term or parenthetical group, using (F) or (S) requires all terms in the second group must

also occur in one of the specified fields (/TI,DE,ID,SH,CC), by virtue of the (F) or (S) requirements.

## A.4 Study Results

From more than two million database records initially found in surveys of Dialog® databases, approximately 78,000 items were presented to the NRC from results of the searches outlined in the previous section. The majority of these items were titles that were provided to the NRC in electronic format.

An inventory of the complete count of items retrieved by the completed searches is shown in Table A.1. Because of the large amount of data retrieved, processing limits of the Dialog® system did not allow all the results from many of the individual concept sets to be included into single files. Therefore, many concept set results were split into two or more files as seen in Table A.1. Specific details on these processing limits and the techniques that were used to separate the data into multiple files are described below.

**Table A.1 Concept Set Findings**

| Concept Set | Included Files | File Size in Bytes | Count |
|---|---|---|---|
| **G1**<br>*Soil use* | G1BIZ.TTL<br>G1SCI1.TTL<br>G1SCI2.TTL<br>G1SCI3.TTL<br>G1SCI4.TTL | 146,325<br>652,687<br>668,994<br>819,476<br>704,757<br>(2,992,239) | 696 titles<br>2,797 titles<br>2,928 titles<br>3,624 titles<br>2,379 titles<br>(12,424 titles) |
| **G2**<br>*Soil material flow* | G2SCI.TTL | 116,521<br>(116,521) | 502 titles<br>(502 titles) |
| **G3**<br>*Soil process (not soil forming)* | G3BIZ.TTL<br>G3SCI.TTL | 114,157<br>32,221<br>(146,378) | 574 titles<br>145 titles<br>(719 titles) |
| **G4**<br>*Human contact with soil* | G4AGR.TTL<br>G4AGR.TXT<br>G4BIZ.TTL<br>G4CAB.TTL<br>G4CAB.TXT<br>G4NTIS.TTL<br>G4NTIS.TXT | 97,511<br>43,427<br>189,395<br>91,292<br>85,997<br>133,183<br>184,476<br>(825,283) | 571 titles (CD)<br>49 selected records<br>442 titles (CD)<br>559 titles (CD)<br>19 selected records<br>724 titles (CD)<br>40 selected records<br>(2,296 titles)<br>(108 records) |

**Table A.1 Concept Set Findings (continued)**

| Concept Set | Included Files | File Size in Bytes | Count |
|---|---|---|---|
| **G5**<br>*Storing soil* | G5BIZ.TTL<br>G5SCI.TTL | 119,052<br>963,594<br>(1,082,646) | 587 titles<br>4,379 titles<br>(4,966 titles) |
| **G6**<br>*Publication on soil from applicable Federal Agencies* | G6.TTL | 64,237<br>(64,237) | 295 titles<br>(295 titles) |
| **P1**<br>*Golf courses and sods* | P1.TTL | 30,172<br>(30,172) | 150 titles<br>(150 titles) |
| **P2**<br>*Reclamation methods* | P2ALL1.TTL<br>P2ALL2.TTL | 534,222<br>480,764<br>(1,014,986) | 2,747 titles<br>2,396 titles<br>(5,143 titles) |
| **P3** *Soil dust* | P3.TTL | 118,490<br>(118,490) | 516 titles<br>(516 titles) |
| **P4**<br>*Earthmoving and soil use in construction fill and rammed earth* | P4BIZ.TTL<br>P4SCI.TTL | 244,778<br>480,764<br>(697,177) | 1,158 titles<br>2,230 titles<br>(3,388 titles) |
| **P5-6** [a]<br>*Soil in walls, dams, berms and dikes* | P56Big6.TTL<br>P56Big62.TTL<br>P56NTIS.TTL<br>P56Other.TTL | 916,776<br>1,200,346<br>444,637<br>562,442<br>(3,124,201) | 4,038 titles<br>5,485 titles<br>1,787 titles<br>2,889 titles<br>(14,199 titles) |
| **P7**<br>*Adobe* | P7.TTL | 34,755<br>(34,755) | 177 titles<br>(177 titles) |
| **P8**<br>*Pottery production and potting clay* | P8.TTL | 27,035<br>(27,035) | 152 titles<br>(152 titles) |
| **P10**<br>*Soil erosion rates* | P10AGRIC.TXT<br>P10Web.TXT | 19,620<br>22,616<br>(42,236) | 39 AGRICOLA records<br>NRCS web page & links (39 records, + web links) |

**Table A.1 Concept Set Findings (continued)**

| Concept Set | Included Files | File Size in Bytes | Count |
|---|---|---|---|
| **P11**<br>*Potting soil and bagged or bulk soil* | P11BIZ.TTL<br>P11SCI.TTL | 82,003<br>587,434<br>(669, 537) | 433 titles<br>2,821titles<br>(3,254 titles) |
| **P12**<br>*Topsoil* | P12ALL.TTL | 134,414<br>(134,414) | 278 titles<br>(278 titles) |
| **V1**<br>*Soil economics, business activities* | V1ABIZ.TTL<br>V1ASCI.TTL<br>V1BBIZ.TTL<br>V1BSCI.TTL | 286,444<br>961.951<br>826,537<br>220,487<br>(2,295,349) | 953 titles<br>4,034 titles<br>3,384 titles<br>992 titles<br>(9,363 titles) |
| **V2**<br>*Statistical and numeric data for soils* | V2BIZ.TTL<br>V2SCI.TTL<br>V2SCI89.TTL | 132,438<br>513,626<br>8,589<br>(654,653) | 641 titles<br>2,069 titles<br>35 (sample titles)<br>(2,745 titles) |
| **V3**<br>*Soil transportation* | V3BIZ.TTL<br>V3SCIPRT.TXT<br>V3SCIB1.TXT<br>V3SCIB2.TXT<br>V3SCIB3.TXT<br>V3SCIB4.TXT | 788,143<br>49,696<br>(837,839) | 3,554 titles<br>205 (sample titles) [b]<br>3,040 titles<br>3,372 titles<br>3,074 titles<br>4,123 titles<br>(17,163 titles) |
| **Totals** *19 concept set results* | 42 search files | 14,908,148 bytes | 77,730 titles, plus 147 complete citations |

[a] P5-6 is concept set P5 combined with set P6. The electronic file name for this combined set is P56.
[b] This file only included a sampling of titles. Complete listings were provided to the staff of the NRC at a later date in files V3SCIB(1-4).TXT. The 205 titles are encompassed within the complete files and are not counted in the total.

For the purposes of this project, two Dialog® system limitations impacted the processing of the searches: (1) total number of files that could be simultaneously searched, and (2) the total number of items that could be processed for removal of duplicate records.

The Dialog® system limits multiple database searching to a maximum of 60 simultaneous files. Some search concepts required exploration of more than 60 files; in those cases the same search strategy was run several times against different groups of databases until all the selected databases

had been searched. Often databases would be grouped into science-focused "SCI" or business-focused "BIZ" categories. Overlap of literature coverage exists between databases where the same journals are indexed. Dialog® can process the removal of duplicate records from multiple database searches up to a maximum of 5,000 items. These maximum limits were often exceeded. When the limits were exceeded, the records were separated into groups of less than 5,000. In most cases, appropriate groupings were made using publication dates as group delimiters.

When particular searches included the use of SilverPlatter® CD versions of specific databases, results files from each database were kept separate. This was done because duplicates among multiple databases could not be removed by processing commands within the SilverPlatter® system. For these various reasons, many results groups listed above include more than one file.

Research results in addition to the comprehensive database output described in this Appendix came from review and selection of specific resources from: the Internet, WorldCat® (OCLC's comprehensive national multi-library database), Statistical Masterfile on CD, DTIC databases, and the Thomas Register of American Manufacuters℠ database. These results and processes are described in Section 6. A specific list of selected Internet resource URLs is shown in Appendix D.

# APPENDIX B. DIALOG® DATABASE FILE LIST

Dialog® is one of the most comprehensive information resources available today with more than 500 databases. The Dialog® system contains more than 330 million articles, abstracts, and citations with information covering a wide spectrum of topics.

This valuable resource was extensively searched for literature describing how humans come into contact with soil, how soil is used, methods for cleaning or reclaiming contaminated soils, and models used to calculate potential exposures.

The databases searched were carefully selected based upon the following criteria:

- Journals indexed
- Focus or scope of the database
- Date ranges of database material

The validity of the database selections was further verified through sampling the search output for relevancy.

Appendix A presents a detailed description of the concept sets searched. Database selection was tailored for each unique set. The specific Dialog® databases searched for each concept set are listed in Section A.2 of Appendix A by their identifying Dialog® file number designation. Appendix B provides the database name corresponding to the file number.

Detailed descriptions of each database are available on the Internet at URL: <http://library.dialog.com/bluesheets>. The descriptions include information related to subject coverage, date ranges, update frequency, sources of information, and so forth.

Information about Dialog® is also available online at URL: <http://products.dialog.com/products/dialog/index.html>

## Dialog® Database Files Searched

**File Name/Date of last update (as of Oct 25, 1999)**

2: INSPEC_1969-1999/Oct W1
5: Biosis Previews(R)_1969-1999/Sep W4 (also reviewed via CD format)
6: NTIS_64-1999/Nov W3via (also reviewed via CD format)
7: Social SciSearch(R)_1972-1999/Oct W3
8: Ei Compendex(R)_1970-1999/Oct W3
9: Business & Industry(R) _Jul 1994-1999/Oct 25
10: AGRICOLA_70-1999/Oct (also reviewed via CD format)
14: Mechanical Engineering Abs_1973-1999/Nov
15: ABI/INFORM Aug 1971-1999
16: Gale Group PROMPT(R)_1990-1999/Oct 25
18: Gale Group F & S Index 1988-1999
19: Chemical Industry Notes (CIN) 1974-1999

**File Name/Date of last update (as of Oct 25, 1999)**

20: World Reporter May 1997-1999
29: Meteor.& Geoastro.Abs._1970-1999/Sep
31: World Surface Coatings Abs_1976-1999/Jul
33: Aluminum Ind Abs_1968-1999/Nov
34: SciSearch(R) Cited Ref Sci_1990-1999/Oct W3
35: Dissertation Abstracts Online_1861-1999/Oct
40: Enviroline(R)_1975-1999/Jul
41: Pollution Abs_1970-1999/Nov
44: Aquatic Sci&Fish Abs_1978-1999/Oct
47: Gale Group Magazine DB(TM)_1959-1999/Oct 25
49: PAIS INT._1976-1999/Aug
50: CAB Abstracts_1972-1999/Sep (also reviewed via CD format)
51: Food Sci.&Tech.Abs_1969-1999/Oct
58: GeoArchive 1974-1999
60: CRIS/USDA 1996-1999
63: Transport Res(TRIS)_1970-1999/Sep
64: Global Mobility Database (R)_1965-1999/Aug
65: Inside Conferences_1993-1999/June W2
67: World Textiles_1970-1999/Sep
68: Env.Bib._1974-1999/Sep
71: ELSEVIER BIOBASE_1994-1999/Sep W2
73: EMBASE_1974-1999/Sep W4
76: Life Sciences Collection_1982-1999/Aug
77: Conference Papers Index 1973-1999
87: TULSA (Petroleum Abs)_1965-1999/Oct W4
89: GeoRef_1785-1999/Sep B2
92: IHS Intl.Stds.& Specs._1999/Oct
93: TableBase(R) Sep_1997-1999/Oct W3
94: JICST-EPlus_1985-1999/Jul W1
96: FLUIDEX_1973-1999/Sep
98: General Sci Abs/Full-Text_1984-1999/Sep
99: Wilson Appl. Sci & Tech Abs_1983-1999/Sep
103: Energy Science & Technology 1974-1999
108: Aerospace Database 1962-1999
109: Nuclear Science Abstracts 1948-1976
110: WasteInfo_1974-May/99
111: TGG Natl.Newspaper Index(SM)_1979-1999/Oct 25
115: Research Centers & Services_1994-1998/Dec
116: Brands and Their Companies
117: Water Resour.Abs._1967-1999/Sep
118: ICONDA-Intl Construction_1976-1999/Oct
119: Textile Technol.Dig._1978-1999/Oct
123: CLAIMS(R)/Current Legal Status_1980-1999/Oct 12
132: S&P's Daily News_1985-1999/Oct 22
139: Econ. Lit. Index_1969-1999/Oct
141: Readers Guide_1983-1999/Jul

**File Name/Date of last update (as of Oct 25, 1999)**

143: Biol. & Agric. Index_1983-1999/Sep (also reviewed via CD format)
144: Pascal_1973-1999/Sep
146: Washington Post Online_1983-1999/Oct 25
148: Gale Group Trade & Industry DB_1976-1999/Oct 25
155: MEDLINE(R)_1966-1999/Dec W3 (also reviewed via CD format)
156: Toxline(R)_1965-1999/Sep
161: Occ.Saf.& Hth._1973-1998/Q3
162: CAB HEALTH_1983-1999/Sep (also reviewed via CD format)
180: Federal Register_1985-1999/Oct 25
194: CBD_1982/Dec-1999/Jul
195: CBD_Aug 1999-1999/Oct 26
196: FINDEX_1982-1999/Q2
203: AGRIS_1974-1999/Jul (also reviewed via CD format)
211: Gale Group Newsearch(TM)_1997-1999/Oct 25
238: Abs. in New Tech & Eng._1981-1999/Oct
240: PAPERCHEM_1967-1999/Jul
241: Elec. Power DB_1972-1999Jan
245: WATERNET(TM)_1971-1999Q1
248: PIRA_1975-1999Nov W4
257: API EnCompass(TM):News_1975-1999/Oct 22
258: AP News Jul_1984-1999/Oct 24
262: CBCA Fulltext_1982-1999/Jul
266: FEDRIP_1999/Jul
269: Materials Bus.(TM)_1985-1999/Nov
285: BioBusiness(R)_1985-1998/Aug W1
286: Biocommerce Abs.& Dir._1981-1999/Oct B1
292: GEOBASE(TM)_1980-1999/Sep
293: Eng Materials Abs(R)_1986-1999/Nov
315: ChemEng & Biotec Abs_1970-1999/Oct
317: Chemical Safety NewsBase_1981-1999/Oct
318: Chem-Intell Chem Manu Plnts_1999/Jul
319: Chem Bus NewsBase_1984-1999/Oct 25
323: RAPRA Rubber & Plastics_1972-1999/Oct B2
334: Material Safety Label Data_1999/Q2
335: Ceramic Abstracts 1976-1999
337: CHEMTOX (R) Online_1998/Q3
340: CLAIMS(R)/US Patent_1950-99/Oct 12
347: JAPIO - Patent Abstracts of Japan Oct 1976-1999
348: European Patents_1978-1999/Oct W42
351: DERWENT WPI_1963-1999/UD=, UM=, & UP=199943
353: APIPAT_1964-1999/Oct W3
357: Derwent Biotechnology Abs_1982-1999/Sep B1
358: Current BioTech Abs_1983-1999/Sep
430: British Books in Print_1999/Aug
440: Current Contents Search(R)_1990-1999/Oct W5
474: New York Times Abs_1969-1999/Oct 22

**File Name/Date of last update (as of Oct 25, 1999)**

475: Wall Street Journal Abs_1973-1999/Oct 22
478: Houston Chronicle_1990-1999/Oct 24
479: Gale Group Company Intelligence(R)_1999/Oct 25
483: NEWSPAPER ABSTRACTS DAILY_1986-1999/Oct 21
484: Periodical Abstracts Plustext_1986-1999/Oct W2
492: Arizona Repub/Phoenix Gaz_1986-1999/Oct 23
494: St LouisPost-Dispatch_1988-1999/Oct 24
495: The Columbus Dispatch_1988-1999/Aug 29
496: The Sacramento Bee_1988-1999/Oct 24
497: (Ft.Lauderdale)Sun-Sentinel_1988-1999/Oct 23
498: Detroit Free Press_1987-1999/Oct 23
515: D&B-Dun's Elec. Bus. Dir.(TM)_1999/06
516: D & B - Duns Market Identifiers_1999/Aug
519: D&B-Duns Finan.Records Plus(TM)_1999/Apr
527: S&P's Register-Corp._1998/Oct
531: Amer. Bus. Directory_1999/Aug
535: Thomas Register Online(R)_1999/Q1
553: Wilson Business Abstracts Full Text Jan 1983-1999
555: Moody's(R)Corp.Profiles_1999/Feb W4
559: CORPTECH Dir of Tech Companies_1999/Sep
563: Key Note Market Res._1986-1999/Oct 24
570: Gale Group MARS(R)_1984-1999/Oct 22
571: Piers Exports(US Ports)_1999/Aug
583: Gale Group Globalbase(TM)_1986-1999/Oct 26
584: KOMPASS USA_1999/Jul
603: Newspaper Abstracts_1984-1988
608: KR/T Bus.News._1992-1999/Oct 13
609: Bridge World Markets News_1989-1999/Oct 24
621: Gale Group New Prod.Annou.(R)_1985-1999/Oct 25
624: McGraw-Hill Publications_1985-1999/Oct 21
630: Los Angeles Times_1993-1999/Oct 23
631: Boston Globe_1980-1999/Oct 22
632: Chicago Tribune Jan 1988-1999
633: Phil.Inquirer_1983-1999/Oct 24
634: San Jose Mercury_ Jun 1985-1999/Oct 16
635: Business Dateline(R)_1985-1999/Oct 22
636: Gale Group Newsletter DB(TM)_1987-1999/Oct 25
637: Journal of Commerce_1986-1999/Oct 22
638: Newsday/New York Newsday_1987-1999/Oct 24
639: The Houston Post_1988-1995/Apr 18
640: San Francisco Chronicle_1988-1999/Oct 23
641: Denver Rky Mtn News_Jun 1989-1999/Oct 22
642: The Charlotte Observer_1988-1999/Oct 24
647: CMP Computer Fulltext 1988-1999
649: Gale Group Newswire ASAP(TM)_1999/Oct 25
652: US Patents Fulltext_1971-1979

**File Name/Date of last update (as of Oct 25, 1999)**

653: US Pat.Fulltext_1980-1989
654: US Pat.Full._1990-1999/Oct 19
655: BNA Daily News from Washington_Jun 1990-1999
660: Federal News Service_1991-1999/Mar 01
665: U.S. Newswire_1995-1999/Apr 29
670: LitAlert_1973-1999/Oct W2
701: St Paul Pioneer Pr Apr_1988-1999/Oct 17
702: Miami Herald_1983-1999/Oct 22
703: USA Today_1989-1999/Oct 22
704: (Portland)The Oregonian_1989-1999/Oct 22
705: The Orlando Sentinel_1988-1999/Oct 24
706: (New Orleans)Times Picayune_1989-1999/Oct 24
707: The Seattle Times_1989-1999/Oct 23
708: Akron Beacon Journal_1989-1999/Oct 24
712: Palm Beach Post_1989-1999/Oct 18
713: Atlanta J/Const._1989-1999/Oct 25
714: (Baltimore) The Sun_1990-1999/Oct 10
715: Christian Sci.Mon._1989-1999/Oct 25
716: Daily News Of L.A._1989-1999/Oct 21
717: The Washington Times_Jun 1989-1999/Oct 22
718: Pittsburgh Post-Gazette_Jun 1990-1999/Oct 22
719: (Albany) The Times Union_Mar 1986-1999/Oct 21
720: (Columbia) The State_Dec 1987-1999/Oct 24
721: Lexington Hrld.-Ldr._1990-1999/Oct 22
723: The Wichita Eagle_1990-1999/Oct 23
724: (Minneapolis)Star Tribune_1989-1996/Feb 04
725: (Cleveland)Plain Dealer_Aug 1991-1999/Oct 23
727: Canadian Newspapers_1990-1999/Oct 24
731: Philad.Dly.News_1983- 1999/Oct 23
732: San Francisco Exam._1990- 1999/Oct 22
733: The Buffalo News_1990- 1999/Oct 22
734: Dayton Daily News_Oct 1990- 1999/Oct 23
735: St. Petersburg Times_1989- 1999/Oct 23
736: Seattle Post-Int._1990-1999/Oct 19
737: Anchorage Daily News_1989-1999/Oct 22
738: (Allentown) The Morning Call_1990-1999/Oct 24
739: The Fresno Bee_1990-1999/Oct 23
740: (Memphis)Comm.Appeal_1990-1999/Oct 23
741: (Norfolk)Led./Pil._1990-1999/Oct 22
742: (Madison)Cap.Tim/Wi.St.J_1990-1999/Oct 23
743: (New Jersey)The Record_1989-1999/Oct 22
747: Newport News Daily Press_1994-1999/Oct 24
763: Freedonia Market Res._1990-1999/Jul
764: BCC Market Research_1989-1999/Sep
765: Frost & Sullivan_1992-1999/Apr
766: (R)Kalorama Info Market Res._1993-1999/Sep

**File Name/Date of last update (as of Oct 25, 1999)**

777: EdgarPlus(TM)-Annual Reports_1999/Oct 22
781: ProQuest Newsstand_1998-1999/Oct 24
813: PR Newswire_1987-1999/Apr 30
861: UPI News_1996-1999/May 27

# APPENDIX C. EXTERNAL REVIEW

## C.1 Introduction

External review of project results by non-NAL experts was a key element of the Quality Assurance/Quality Control Plan. Qualified independent reviewers were recruited by NAL in the fields of soil science, civil engineering, and information science. It should be noted the reviews were voluntarily conducted without compensation.

The following sections document reviewer instructions, their comments, and accommodation of reviewer comments.

## C.2 Reviewer Instruction

NAL requested that each reviewer consider four specific elements in conducting their review of project results:

(1) Identify additional terms,

(2) Review search string syntax for logical construction,

(3) Review database selection,

(4) Identify any known highly relevant sources not presented in the reviewer package.

Figure C-1 presents a sample of the instruction letter sent to the reviewers.

## C.3 Reviewer Comments

The reviewer comments are provided in Figures C.2 - C.5. The comments were delivered to NAL either in E-mail messages or by mail. Figures C.2 and C.5 are reproductions of E-mail comments. Figures C.3 and C.4 are scanned copies of paper documents.

USDA

United States Department of Agriculture

Research, Education, and Economics
Agricultural Research Service
National Agricultural Library

Carla Long Casler
Arid Lands Information Center
University of Arizona
1955 E. 6th Street
Tucson, AZ 85719-5224

September 24, 1999

Dear Ms. Casler:

Thank you for agreeing to serve as a reviewer on a project of national importance for the Nuclear Regulatory Commission. The Commission has initiated a program of rule-making for the decommissioning of soil from regulated sites. The NRC has need for authoritative reference sources on how soil is used, recycled, and reused, and how people come into contact with this soil.

Extensive literature searching has been conducted at the USDA, ARS, National Agricultural Library for this information. The results of these searches accompany this letter for your review. The Nuclear Regulatory Commission asks that you review the enclosed materials for:

- Specific terms used in the searches for additional terms;
- Search string logic or construction;
- Database selection;
- Recall of highly relevant publications.

The problem has been broken out into three broad categories: (G) for general terms relating to human contact with soil; (P) terms relating to particular scenarios describing human contact with soil; and, (V) search sets to quantify the volume of soil reused and quantitative measures of human contact with soil. These searches are documented in an E-mail message of September 2, 1999 from Karl Schneider to Jon Peckenpaugh. The search results presented in this package have been organized and referenced back to the September 2, 1999 E-mail documentation.

Additional notes and database descriptions are provided in the last appendix.

Please return your written comments by October 11, 1999 to:

Maria Pisa
Associate Director for Public Services
USDA, ARS, National Agricultural Library
10301 Baltimore Ave., Room 203
Beltsville, MD 20705-2351

National Agricultural Library • Public Services Division
10301 Baltimore Avenue • Beltsville, MD 20705-2351

An Equal Opportunity Employer

**Figure C.1 Sample Letter of Instruction Sent to External Reviewers**

Enclosed for your convenience is a pre-paid, pre-addressed FedEx shipment form. If you have any questions please feel free to contact myself or Maria Pisa.

Sincerely,

Susan McCarthy, Ph.D.

**Susan McCarthy**
Technical Information Specialist
USDA, ARS, National Agricultural Library
10301 Baltimore Ave., 4th Floor
Beltsville, MD 20705-2351

TEL: (301) 504 - 5510
FAX: (301) 504 - 6892
E-mail: smccarth@nal.usda.gov

**Maria Pisa**
Associate Director for Public Services
USDA, ARS, National Agricultural Library
10301 Baltimore Ave., Room 203
Beltsville, MD 20705-2351

TEL: (301) 504 - 5834
FAX: (301) 504 - 6892
E-mail: mpisa@nal.usda.gov

**Figure C.1 Sample Letter of Instruction Sent to External Reviewers (continued).**

Dear Dr. McCarthy,

I have reviewed the information prepared by the National Agricultural Library for the Nuclear Regulatory Commission (Job Code: Y6227). The search text seem adequate. The research was complete, except for a few suggestions. I did not find references to published thesis or dissertations that may be related to the subject matter. Also, USGS internet access list many of their publications (http:usgs-georef.cos.com). This may be a source for infiltration and ground water recharge related inforamtion suited for your project on contaminated soils.

I hope these observations prove helpful in your project.

M. Dewayne Mays, PhD
Head, Soil Survey Laboratory
NSSC, Natural Resources Conservation Service

**Figure C.2 Dr. Dewayne Mays Project Review (e-mail message from Dr. Dewayne Mays sent October 13, 1999).**

**ASCE**

*American Society of Civil Engineers*

World Headquarters
1801 Alexander Bell Drive
Reston, VA 20191-4400
Phone: (703) 295-6000
Fax: (703) 295-6333
Web: http//www.asce.org

October 5, 1999

Susan McCarthy
USDA, ARS, National Agricultural Library
10301 Baltimore Ave., 4th Floor
Beltsville, MD 20705-2351

Dear Susan,

Your searches seem to be quite extensive and complete. Regarding the technical areas, I would recommend that you look at the material covered by CISTI (http://www.nrc.ca/cisti/). The Canadian group covers many European publications and the Europeans are ahead of US researchers in many areas of engineering. I would also recommend that you compare your list of databases against those covered by STN International. The STN service does have some specialized databases not covered in DIALOG.

As an additional service, I did conduct some searches in our database (Civil Engineering Database; http://www.pubs.asce.org). While our journals are covered by EI, many of our conference proceedings are not and, in addition, since our database is specialized, a search can sometimes pick up items that are missed in EI. I hope you will find them to be of some help.

As for search terms, you have been very thorough. I only have two suggestions:

1. In addition to searching the term 'remove,' you might wish to try 'removal'
2. In V1a, I would add the term 'cost?'

As an aside, in the P3 search sentence, the 2nd parenthesis is missing – is this a typo or a search strategy error?

Please let me know if you have any questions.

Sincerely,

Carol Reese
Senior Manager
Information Products

1999 October 17-20, 1999
Charlotte, North Carolina
**Civil Engineering Convention & Exposition**
*Leading the Race in Management, Practice & Technology*

... and Builders of the Quality of Life

**Figure C.3 Ms. Carol Reese Project Review**

Office of Arid Lands Studies

ARIZONA

TUCSON ARIZONA

1955 E. Sixth Street
Tucson, Arizona, 85719-5224
Telephone: (520) 621-1955
FAX: (520) 621-3816
The OALS Home Page (WWW)
http://ag.arizona.edu/OALS/oals.htm

October 5, 1999

Maria Pisa
Associate Director for Public Services
USDA, ARS, National Agricultural Library
10301 Baltimore Ave., Room 203
Beltsville, MD 20705-2351

Dear Ms. Pisa:

Thank you for inviting me to review the search on decommissioning of soil from regulated sites, which NAL is conducting for the Nuclear Regulatory Commission.

As I first scanned the search strategy provided in the email printout in the Search Set Index, I was concerned that there were not more terms about contamination or radioactivity. But in viewing the results from the different searches, I was impressed with the retrieval of many pertinent records. It was quite interesting to discover that the best records appeared in NTIS and MEDLINE and in Defense Technical Information Center. This last database is one I had not known about – it has quite good coverage on this topic.

As I read through the records I made various checkmarks to indicate the ones I thought were the best.

✓++ = Excellent Plus ✓+ = Excellent ✓+ = Good ? = not sure if appropriate

Many of the best records were technical reports from various research laboratories. In scouting around I found the following site provides links to several of these. Many have searchable databases, which may include reports not accessible other ways.
http://www.dne.bnl.gov/ssn/Weblinks.html

Best wishes,

Carla Long Casler

Carla Long Casler
Project Librarian
Arid Lands Information Center
ccasler@ag.arizona.edu

**Figure C.4 Ms. Carla Casler Project Review**

Maria,

Thank you for your message. I realized this morning that I did not make a couple of points that I think are important, regarding this work.

I am concerned that the guidelines for the search indicate documents should be in English and published/researched in the U.S. I was happy to see that a few things from Russia and Japan did appear in the binder. Given the importance of the topic being researched -- I see this as affecting the health of my children's children -- I feel it is critical to include soil studies that cover decades of data about the longevity of nuclear contamination and about efforts, successful or unsuccessful, to salvage the soil. Areas providing this sort of data are in Japan and Russia. Besides the soils information, it would be useful to compare epidemiological studies over time conducted in Hiroshima and Nagasaki to see if there are currently clusters of immune deficiencies or cancers. Are there residual effects for the local residents who have been gardening and consuming local produce all these years?

Since this problem is not unique to the U.S.. I would hope that NRC would collaborate with scientists in other countries researching this problem. Or recruit U.S. soil scientists currently collaborating with soil scientists in Japan and Russia to work with NRC in this project.

How can I include this in my "official" response to the search?

I just searched for Three Mile Island on the web and found that the Engineering Library at Penn State has a collection on Three Mile Island Contamination and Recovery. I'm not sure how much this would have on soils specifically, but there are a few bibliographies mentioned on this page of the site: http://www.libraries.psu.edu/crsweb/tmi/resources.htm On another site, I found that there was a conference which discussed the effects of Chernobyl 10 years later; there was a particularly relevant paper: Consequences of the Chernobyl Accident for the Natural and Human Environment Principal author: M. Dreicer, USA Contributing authors: A. Aarkrog, Risø National Laboratory, Denmark R. Alexakhin, Russian Institute of Agricultural Radiology and Agroecology, Russian Federation L. Anspaugh, Lawrence Livermore National Laboratory, USA N.P. Arkhipov, Scientific and Technical Centre of the RIA 'Pripyat', Ukraine K.-J. Johansson, University of Agricultural Science, Sweden the abstract is at url: http://www.iaea.or.at/worldatom/thisweek/preview/chernobyl/paper5.html

This is very important work NAL is doing for NRC. I am glad to help in this.

Carla

Carla Long Casler
Arid Lands Information Center
1955 E. Sixth St.
Tucson, AZ 85719-5224
USA

(520) 621-8571
fax (520) 621-3816
ccasler@ag.arizona.edu
http://Ag.Arizona.Edu/OALS/oals/alic/alic.html

**Figure C.5 Additional Comments from Ms. Carla Casler (an e-mail message sent to NAL Principal Investigator on October 6, 1999).**

## C.4 Summary of Actions Taken in Response to the External Reviewers' Comments

The responses of external reviewers for this information research project included comments, suggestions, and minor corrections to improve the searches and the subsequent information retrieved. All reviewer notes were addressed in revisions or additions to the comprehensive strategy statements (Section A.2 of Appendix A), or through additional Web searches, and the inclusion of pages from noted sites for examination by the NRC staff. These changes were provided to the NRC in the "Supplement to the Draft Letter Report," October 13, 1999.

The text of the comprehensive search strategy statements (Section A.2 of Appendix A) forwarded to the reviewers had not been finalized for all concept sets at the time the Draft Letter Report was mailed. The strategy statements were revised before execution to produce the 42 files of item titles that were delivered to the NRC on September 29, 1999. All the strategy changes suggested by reviewers had been accommodated at the time these final searches were completed.
Specific details related to these changes are noted below.

Carol Reese of the ASCE suggested three specific changes and additions to basic search strategy text. These included the use of "removal" in addition to "remove" in concept set V3a. Note that the final executed version of this command line includes "remov?", shown in bold face text below. This truncated form retrieves all endings for the "remov" root, so that remove, removal, removing, removed, etc., were all included and retrieved in the final searches for this set.

Concept set V3a:
S (SOIL? ? OR DIRT) /TI,DE,ID,SH,CC (F)
(TRUCK? OR SHIP? OR TRANSPORT? OR HAUL?
OR BARG? OR TRAIN? OR RAIL? OR CONVEY??? OR **REMOV?** OR RELOCAT? OR REPLAC? OR PLACE? ? OR PLACEMENT)

Ms. Reese also noted that the term "cost" had been omitted from the draft version of the search concept set labeled V1b. This change was also completed before final execution of the comprehensive search statements, and that change included the use of truncation after "cost", using "cost???" (shown below in bold face type). The final version for this set retrieved all endings with up to three characters for the "cost" root, and included cost, costs, costing, costed.

Concept Set V1b
S (SOIL? ? OR DIRT) /TI,DE,ID,SH,CC (S)
(WHOLESALE? OR PROFIT? OR **COST???** OR INDUSTR??? OR COMMERC??? OR BUSINESS?? OR INVEST? OR MARKET??? OR SALE? ? OR PURCHAS??? OR DOLLAR? ?)

Ms. Reese observed as well that a closing parenthesis was needed in the P3 concept set. This error in the draft version was noted and corrected in execution of the final searches and corrected as shown below using boldface type.

Concept Set P3b:
S (SOIL? ? OR DIRT OR EARTH? ?) /TI,DE,ID,SH,CC

Ms. Reese recommended two additional information providers, STN and CISTI. Both providers were examined and determined not to be significant new sources of project-relevant information. Considerable overlap of database coverage exists between the STN and Dialog® database systems. The notable strengths in the STN database system include

intellectual property and patents, materials and mechanical engineering, and German-language sources. Each of these subject areas had been excluded previously by mutual agreement. Therefore, NAL researchers concluded that searching STN was unlikely to yield new or unique results in any meaningful quantity.

CISTI, the Canada Institute for Scientific and Technical Information, is primarily a publicizing and document ordering service available over the Internet at URL: <http://cat.cisti.nrc.ca>. Survey searches conducted in the CISTI system indicated fewer than 7,500 records containing the terms "soil" or "soils" in the combined catalogues. Without the availability of a sophisticated search engine on the site, in-depth research of this resource was not deemed to be cost effective.

Dr. Dewayne Mays of the USDA Soil Survey Laboratory did not comment on the strategy, but he did suggest specific data sources that should be used for the searches, including theses and dissertations. Dialog® file 35, "Dissertation Abstracts," contains these document types. This database was one of the key files searched for the comprehensive titles listing delivered to the NRC on September 29, 1999, as listed in Appendix A. This database file was included in 15 of the 42 searches that produced the comprehensive titles lists delivered to the NRC. At least one thesis title was initially selected by the NRC.

Dr. Mays also noted a specific Web site covering United States Geological Survey (USGS) documents. The USGS database was among those included in the comprehensive searches conducted on the Dialog® system, listed in Appendix A as file 89. This Dialog® database file 89 was used in 25 of the 42 specific searches completed.

Ms. Carla Casler, of the Arid Lands Research Institute, added no specific comments on the strategy statements, but noted the need for considering international sources in the information survey and review processes. Although search results were limited to English language documents, a great many of the databases searched included international literature by default because a vast majority of these items are published in English, or are posted with English language titles. This enabled their retrieval despite the use of English language limits. A number of these non-English records were selected by NRC staff.

In addition, Ms. Casler specified some Web sites for access to specific reports covering radiation exposure incidents at Three Mile Island and the Chernobyl site. The suggested sites include URL: <http://www.iaea.or.at/worldatom/thisweek/preview/chernobyl/paper5.html> and URL: <http://www.libraries.psu.edu/crsweb/tmi/resources.htm>

Pages from both sites were forwarded to the NRC staff for their review. Note that the NRC staff were familiar with the Three Mile Island Web materials.

Another point made by Ms. Casler was in reference to the long-term and epidemiological impacts of radiation exposure through soil contact scenarios of various sorts, including gardening. She noted that Russian literature covering Chernobyl, and also sources about the long-term effects or impacts of Hiroshima and Nagasaki bombs, on soils might be valuable.

Studies related to these sites were among the many items selected by the NRC staff from the titles listed in the text of the Draft Letter Report and from the files of titles in the comprehensive search results. Note

that the unintentional exposure hazard from high-level radiation that occurred in the cases Ms. Casler mentioned is significantly different from the anticipated exposure derived from soils intentionally released from the NRC-regulated locations. Specific recommendations for further information research in these areas, if needed, are noted in Sections 6 and 7.

# APPENDIX D. SELECTED INTERNET RESOURCES

The Internet is an important new source of information. However, as valuable as this resource undoubtably is, it has significant limitations, most notably the inability to conduct comprehensive complex searches.

The primary focus for this study was to identify verifiable information through conducting traditional literature research. In today's information environment no research project can be considered complete without a preliminary survey of the Internet.

Search engines and specific resources searched are described in Section 6 of this report. Notable information resources were discovered. These resources were reviewed by the NRC staff, who selected the items listed in this Appendix.

## SELECTED INTERNET RESOURCES

Ohio Department of Natural Resources, Geological Survey, "GeoFacts No. 19, Sand and Gravel." <http://www.dnr.state.oh.us/odnr/geo_survey/geo_fact/geo_f19/geo_f19.htm>

Brookhaven National Laboratory, Upton, New York, "Important Web Links." <http://www.dne.bnl.gov/ssn/Weblinks.html>

Ohio Site Technology Coordination Group, "Technology Needs, Ashtabula." <http://www.ohio.doe.gov/oh-stcg/needs.asp>

Mineralogical Society, "Publications." <http://www.minersoc.org/publicat.htm>

Clay Minerals Society, "Homepage." <http://cms.lanl.gov/>

US Mix, "US Mix Products." <http://www.usmix.com/usmix.html>

Bolin Enterprise, Inc. PowerLift Foundation, Repair Division, "Foundation Repair Specialists." <http://www.foundationspecialists.com/html/advanced.htm>

A. B. Chance; Hubbell Power Systems, "Earth Anchors and Foundations." <http://www.hubbell.com/abchance/>

ENA, Inc, "Excavation and Road Construction Specialists." <http://a1.com/ena/index.html>

PRISM - World Resource Foundation, "Landfill Mining Technical Brief." <http://www.wrfound.org.uk/wrftblfm.html>

Purdue News, "Purdue-made Soil." <http://www.purdue.edu/UNS/html4ever/970606.Tishmack.soil.html>

Plant and Soil Sciences Department, Oklahoma State University, "CMLS94: Chemical Movement in Layered Soils." <http://clay.agr.okstate.edu/software/cmls94a.htm>

Government of Canada, Department of Indian and Northern Affairs, "Building a Future, Sand and Gravel." <http://www.inac.gc.ca/building/sands/sand.html>

Off-Road.com, "DirtBikes Online." <http://www.off-road.com/dirtbike/>

National Dirt Digest, "Dirt Late Model News." <http://www.latemodel.com/nddigest/>

AMA Pro Racing, "Dirt Track." <http://www.ama-cycle.org/prorace/99dt/99dt.html>

McGraw-Hill Construction Information Group, "Sweets Web Links." <http://www.sweets.com/topic/weblinks.htm>

State of New Jersey, Department of Environmental Protection, "Site Remediation Program 1998 Revised Guidance Document for the Remediation of Contaminated Soils." <http://www.state.nj.us/dep/srp/regs/soilguide/>

CRC Press LLC Online, "The Reuse & Recycling of Contaminated Soil." <http://www.crcpress.com/index.htm?catalog/L1188>

ATTRA (Appropriate Technology Transfer for Rural Areas), "Organic Potting Mixes - Horticulture Technical Notes." <http://www.attra.org/attra-pub/potmix.html>

# APPENDIX E. NAL PROJECT INVESTIGATORS

The Nuclear Regulatory Commission and the National Agricultural Library established an Interagency Agreement to conduct information research on human-soil interactions. The NAL investigators are identified in this Appendix.

**Maria Pisa, M.L.S.**
Associate Director of Public Services
Principal Investigator for administrative issues and coauthor.

Ms. Pisa has a Master of Library Science degree and more than 20 years experience in library services.

**Karl Schneider, M.L.S.**
Reference Specialist in Soils
Principal Investigator for searching and subject matter and coauthor.

Mr. Schneider has a Master of Library Science, many years of reference and online search experience as well as graduate research and training in soils and related sciences.

**Susan McCarthy, Ph.D.**
Technical Information Specialist
Principal Investigator and coauthor

Dr. McCarthy has a Ph.D. in Plant Physiology, nine years experience in reference services, and more than 15 years of bench research. She conducted Internet and CD-ROM searches for the project, coauthored the Draft, Supplement, and Final reports, and served as project manager.

**Mary Stevanus, M.L.S.**
Reference Specialist
A principal contributor to the Draft Letter Report.

Ms. Stevanus has many years of reference and online search experience. Additionally, she worked for a number of years as an information specialist for the Environmental Protection Agency. Ms. Stevanus served as an internal project reviewer, refined the comprehensive strategies used in the Draft Letter Report, and conducted WorldCat, Internet, and other searches.

**Tim Allen, M.S.**
Technical Information Specialist with the Animal Welfare Information Center
Reference consultant.

Mr. Allen has a Master of Science in Animal Science. He conducted research in private industry before joining the National Agricultural Library. Mr. Allen has extensive search and retrieval experience and conducted the first Defense Technical Information Center Web search. In addition, he served as an internal project reviewer.

**Andy Clark, Ph.D.**
Coordinator, Sustainable Agriculture Network
Reference Consultant.

Dr. Clark has a Ph.D. in Agronomy and serves as the Coordinator for the Sustainable Agriculture Network, a part of the Sustainable Agricultural Research and Education Program, a USDA- funded initiative. He helped screen the initial large G1 data set and his selections were incorporated into the Draft Letter Report.

**Terrance Henrichs**
Program Support Assistant.

Ms. Henrichs has led the project support effort in formatting, sorting and compiling the initial bibliography of the Final Letter Report. In addition, she has provided support in copying and shipping reports to the NRC.

**Sharon Middleton**
Program Assistant.

Ms. Middleton provided project support in report assemblage, packaging, and shipping copies of the reports to the external reviewers and NRC staff. Her most important role has been to reformat selected citations for the Final Letter Report.

NRC FORM 335 (2-89) NRCM 1102, 3201, 3202

U.S. NUCLEAR REGULATORY COMMISSION

# BIBLIOGRAPHIC DATA SHEET

*(See instructions on the reverse)*

1. REPORT NUMBER (Assigned by NRC, Add Vol., Supp., Rev., and Addendum Numbers, if any.)

NUREG-1725

2. TITLE AND SUBTITLE

Human Interaction with Reused Soil: A Literature Search

Draft Report for Comment

3. DATE REPORT PUBLISHED

| MONTH | YEAR |
|---|---|
| June | 2000 |

4. FIN OR GRANT NUMBER

Y6227

5. AUTHOR(S)


K. Schneider, S. McCarthy and M. Pisa, USDA/ARS/NAL
T. Nicholson, C. Daily, USNRC/RES
J. Peckenpaugh, E. Brummett, G. Gnugnoli, A. Huffert and R. Tadesse, USNRC/NMSS


6. TYPE OF REPORT

Technical

7. PERIOD COVERED *(Inclusive Dates)*

August 1999 - May 2000

8. PERFORMING ORGANIZATION - NAME AND ADDRESS *(If NRC, provide Division, Office or Region, U.S. Nuclear Regulatory Commission, and mailing address; if contractor, provide name and mailing address.)*


U.S. Department of Agriculture
National Agricultural Library
10301 Baltimore Avenue
Beltsville, MD 20705-2351


9. SPONSORING ORGANIZATION - NAME AND ADDRESS *(If NRC, type "Same as above"; if contractor, provide NRC Division, Office or Region, U.S. Nuclear Regulatory Commission, and mailing address.)*

Division of Risk Analysis and Applications
Office of Nuclear Regulatory Research
U.S. Nuclear Regulatory Commission
Washington, DC 20555

10. SUPPLEMENTARY NOTES

T.J. Nicholson, NRC Project Manager

11. ABSTRACT *(200 words or less)*


This NUREG reports on the results of a literature search for documented information that is intended to provide the technical basis for soil reuse scenarios for use in dose assessments related to residual radioactivity. The literature search focused on human interactions with reused soils in the United States. Using these data, the NRC staff will be able to define realistic soil reuse scenarios and to estimate parameters for use in simulating exposure pathways involving radiologically contaminated soils from NRC-licensed facilities. This report documents the procedures and results of this extensive literature search by the National Agricultural Library (NAL) researchers. The search strategies were structured to query literature from a wide range of published scientific and trade sources. From the more than two million records that were initially found in the databases searched, targeted search strategies recovered 77,877 titles for review. NRC staff reviewed these titles and requested full citations, including abstracts, for a subset of these for further detailed review. After a final review of this subset, the NRC staff selected a final listing of documents that is provided in this report.


12. KEY WORDS/DESCRIPTORS *(List words or phrases that will assist researchers in locating the report.)*

clearance of soil
dose assessment scenarios
human interaction with reused soil
literature search strategy
radiologically-contaminated soils
recycled soil
residual radioactivity
reused soil
soil reuse scenarios

13. AVAILABILITY STATEMENT

unlimited

14. SECURITY CLASSIFICATION

*(This Page)*

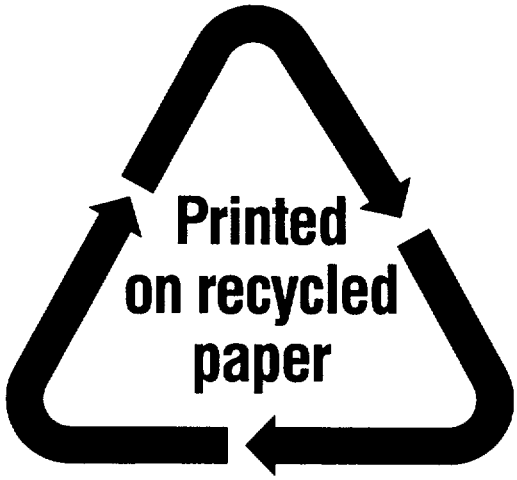
unclassified

*(This Report)*

unclassified

15. NUMBER OF PAGES

16. PRICE




Federal Recycling Program

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001