4.3.1

The Pennsylvania Agreement State Program will follow as closely as possible the NUREG 1556 procedure for Technical Evaluation of Proposed Uses of Radioactive Material.

The program has adapted MC 1246 A-I and B-I for state use.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF RADIATION PROTECTION

APPLICATION FOR RADIOACTIVE MATERIAL LICENSE
Agreement State Program

Instructions: See the appropriate **NUREG-1556 Consolidated Guidance** for detailed instructions for completing application. Send **two** copies of the completed application with attachments to: Bureau of Radiation Protection, P.O. Box 8469, Harrisburg, Pa 17105-8469.

If this is an application for a NEW license, it must include remittance for the appropriate annual fee. NEW license applications cannot be accepted without payment of the annual fee. Applicants for a NEW license or RENEWAL must also submit the Department's General Information Form (GIF).

NOTE: The possession and use of byproduct, source and special nuclear materials is NOT covered by this application. Licenses for the use of byproduct, source, and special nuclear material in Pennsylvania are under the jurisdiction of the U.S. Nuclear Regulatory Commission.

1. This an application for *(check appropriate block)*: ☐ A. New License ☐ B. Amendment to License Number _____ ☐ C. Renewal of License Number _____	2. Name and Mailing Address of Applicant (include Zip Code):
3. Address(es) where Licensed Material will be used, possessed or stored:	4. Contact Person for this Application: Telephone Number:

Submit Items 5 through 11 on 8-1/5" X 11" paper. The type and scope of information to be provided is described in the appropriate NUREG 1556 series.

5. Radioactive Material A. Element and mass number; B. chemical and/or physical form; and C. maximum amount that will be possessed at any one time.	6. Purpose(s) for which licensed material will be used	
7. Individual(s) responsible for Radiation Safety Program, their training experience and e-mail address(es).	8. Training for individuals working in or frequenting restricted areas	
9. Facilities and Equipment	10. Radiation Safety Program	
11. Waste Management	12. License Fees (25 Pa. Code, Ch. 218, App. A) (New Licenses Only) Fee Category:	Amount Enclosed $

13. Certification (must be completed by applicant). The applicant understands that all statements and representations made in this application are binding upon the applicant.

The applicant and any official executing this certification on behalf of the applicant, named in Item 2, certify that this application is prepared in conformity with Article V, Radiological Health, of the Department of Environmental Protection and that all information contained herein is true and correct.

Warning: The Statements Contained or Referenced Herein Are Made Subject to the Provisions of 18 Pa. Consolidated Statutes, Section 4904 (Relating to Penalties for Unsworn False Statements to Governmental Authorities).

Type or Printed Name	Signature
Title	Date

FOR DEP USE ONLY

Fee Category	Amount Received	Check Number	Comments
Approved By			

ATTENTION

Title 25 of the Pennsylvania Code is available electronically at:

www.pacode.com

25 ENVIRONMENTAL PROTECTION

Article V: Radiological Health

Pennsylvania has incorporated by reference the Federal radiation protection regulations found in 10 CFR Parts 19-150.

The federal regulations can be accessed at

http://www.nrc.gov/reading-rm/doc-collections/cfr/

Guidance to complete an Application is contained in the

NUREG 1556 Series

This guidance can be accessed at

http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1556/index.html

for the entire series.

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF
ENVIRONMENTAL PROTECTION

Bureau of Radiation Protection

Review of an Initial Application for License or an Amendment Request

Prepared By:_____**Date**_____

Reviewed By:_____**Date**_____

Approved By:_____**Date**_____

Effective Date: _____

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Section

Review of an Initial Application for License or an Amendment Request

1.0 PURPOSE

1.1 Applicability

The purpose of this procedure is to define the process for reviewing all types of specific license requests, with the exception of applications for license renewal or license termination
Standard review plans, checklists and policies that shall be used during the review process will be identified.
The process for issuing a specific license or an amendment to a license and standard license conditions will be provided.
The process for denying (State's initiative} or abandoning (applicant's or State's initiative) a request for licensing action shall be defined.

1.2 References

1.2.1 10 CFR 19-150
1.2.2 NUREG-1556,"Consolidated Guidance About Materials Licenses".
1.2.3 25 Pa Code 215-232

1.3 Computer Based Letters, Forms and Reports

1.3.1 License application
1.3.2 Links to Guidance and Regulations
1.3.3 Form 3
1.3.4 Deficiency Paragraphs
1.3.5 Transmittal Letter
1.3.6 Microsoft EXCEL Radioactive Material License Database

1.3.7

1.4 Hardcopy Files

1.4.1 Specific License
1.4.2 License Application and/or Amendment Request Submittal
1.4.3 Deficiency Letter
1.4.4 License Transmittal Letter

1.5 Definitions

1.5.0 Application request means a request for an application for a license from a prospective applicant.

1.5.1 Licensing action means a request or application received from an applicant or a licensee as follows:
a) an application for a license to receive, possess and use licensed radioactive material;
b) an application for renewal of a license;
c) an application for an amendment to a license, e.g., change in administration, authorized use and/or user(s), RSO, quantity of material, add isotopes, facilities, and etc.; and,
d) a request for termination of a license(s).

1.5.2 Processing means reviewing the application for license or amendment, requesting additional information, if appropriate, and either issuing or denying with or without prejudice, the requested license or amendment.

1.5.3 Denying without prejudice means that the application for license was deficient and denied, but that the applicant may reapply after correcting the deficiencies.

1.5.4 Denying with prejudice means that the applicant for license is not qualified and shall not reapply for a license, e.g., a minor applying for a license to possess and use radioactive material or a non medical qualified individual applying for a license to use radioactive material in the diagnosis and/or treatment of humans.

1.5.5 Regulatory Guide means guidance published by the NRC, in which each guide defines an acceptable program or part of a program, for the possession and specific use of radioactive materials. An applicant is not obligated to follow one of these guidance documents when developing their program and applying for a license or amendment; however, if not followed, the applicant must demonstrate that the proposed program is at least equivalent to the one described in the guidance document.

1.5.6 Consolidated Guidance About Materials License means guidance published by the NRC in NUREG-1556 in which each volume defines an acceptable program for a specific type of use of radioactive material.

2.0 RESPONSIBILITIES

2.1 Licensing Radiation Health Physicist

The Licensing Radiation Health Physicist is responsible for receiving and acknowledging the receipt of an application for a new license. Requests for amendments to a license shall be received.

The Licensing Radiation Health Physicist is responsible for maintaining the computer based and hardcopy files and for tracking the applications for license or amendment during processing.

The Licensing Radiation Health Physicist is responsible for responding to requests for license applications by transmitting an application, order form and Internet address of the regulations, and a copy of or reference to specific guidance.

2.2 Licensing Radiation Health Physicist

The qualified Licensing Radiation Health Physicist is responsible for reviewing the assigned application, determining if it is complete, requesting additional information as appropriate, and if appropriate, preparing the license or amendment for review and signature by the Chief, Radioactive Materials Licensing.

The Licensing Radiation Health Physicist is responsible for recommending whether an application is deficient and should be denied either with or without prejudice.

2.3 Chief, Radioactive Materials Licensing

The Chief, Radioactive Materials Licensing is responsible for assigning a licensing action for processing to a Licensing Radiation Health Physicist.

The Chief, Radioactive Materials Licensing is responsible for reviewing, approving and signing licenses and license amendments.

The Chief, Radioactive Materials Licensing following consultation with and concurrence by the department's Office of Legal Counsel is responsible for denying, with or without prejudice, an application for license or for license amendment.

2.4 Radiation Control Division Chief

The Radioactive Control Division Chief is responsible for signing licenses and license amendments in the absence of the Chief, Radioactive Materials Licensing.

3.0 PROCEDURE

3.1 Receipt of an Application or Request

Upon the receipt of an application for license or a request for a license amendment the following shall be performed:

3.1.1 Priority

An action priority shall be assigned to the application or request in accordance the

following order: New, Amendment, Termination, Renewal and concurred with by the Chief, Radioactive Materials Licensing.

3.1.2 Assignment of Reviewer

The Chief, Radioactive Materials Licensing shall assign a Licensing Radiation Health Physicist to process the application or request. The review of an application or request shall be conducted by a Licensing Radiation Health Physicist qualified to conduct such a review.

3.2 Processing an Application for License

The application and, all appended and referenced material shall be reviewed. Pennsylvania specific regulations , and Consolidated Guidance, Regulatory Guides, Standard Review Plans, Reviewers Evaluation Forms and Technical Assistance Requests shall be used as appropriate, by the reviewer to evaluate the applicant and the application.

If additional information is needed, a meeting with the applicant and/or a visit to the proposed facility(s) shall be requested by the reviewer. If the applicant is licensed to possess and use radioactive materials, appropriate information may be included by reference.

If only NRC guidance is used in the evaluation of the application then Pennsylvania specific rule and policies must be consulted. For example, uses of radioactive materials in medicine are subject to specific Pennsylvania Rule.

The reviewer shall assure that the review of the application includes the following commonly missed items:

a) Application signed by upper management - RSO, only if appropriate,
b) Facility diagrams or sketches, including but not limited to, hoods, shielding, ventilation, work areas, storage areas, location of nearest occupied area, and physical security of radioactive material,
c) Number, type and range of survey instruments including procedures for calibration, checks for operability and maintenance,
d) Training and experience records, preceptor statement for all authorized users,
e) Training and experience records, preceptor statement, delegation of authority and the duties, responsibilities, and if appropriate, the availability of the RSO,
f) Training and experience records for the Radiation Safety Committee Chair if appropriate,

g) Records to be retained and responsibility for records retention assigned. Frequently missed records include training for new employees, annual refresher training, survey instrument calibrations and source checks, and dose calibrator constancy, accuracy, linearity, and geometric variation checks for medical licenses.

h) Procedures for receipt of radioactive material, specifically off-hours and week-ends.

Following the completion of the review of the application and any supplemental material requested by the reviewer, a recommendation to issue a license or deny the application shall be made to the Chief, Radioactive Materials Licensing.

If the recommendation is to issue the license and the Chief, Radioactive Materials Licensing concurs, the reviewer shall prepare the license for the Chief, Radioactive Materials Licensing's signature. All submitted and referenced information shall be tied-down. A tie-down license condition is used for procedures, radiation detection equipment, use locations, possession limits etc., that are not already specifically identified on the license.

If the recommendation is to deny the application and the Department's Office of Legal Counsel and the Chief, Radioactive Materials Licensing concur, the reviewer in concert with legal shall prepare a notification to the applicant. The notification shall state the reason for denial and if a new application would be accepted from the applicant.

3.3 Processing a Request for License Amendment

A request for an amendment to a specific license need not and probably will not be on a department form. The request may be a letter plus attachments or a formal application. The request shall be signed by the individual in the position, or higher, that signed the application for license or the request shall be returned for proper signature. Alternatively, the licensing action request may be signed by an individual delegated by the person who signed the application or higher.

The initial review of the request for amendment shall determine if the request is so broad that it should be processed as a rewrite of the current license or as a new license. If it's determined that either a rewrite or a new license is appropriate and the Chief, Radioactive Materials Licensing concurs, the request shall be returned to the licensee and an appropriate application shall be requested.

A request from a medical licensee to add a qualified user to their license shall be accompanied by records of the individuals training and qualifications. Records of training shall be signed by the preceptor and shall not be just a letter stating that

these procedures had been performed at another licensed facility.
Where appropriate, material previously received for the license may be incorporated by reference.

A request to add an authorized user to a license shall be accompanied by records of the individuals training and qualifications and preceptor statement unless the authorized user has been listed on another radioactive material license. Recentness of training will also be reviewed.

A request to add or replace a Radiation Safety Officer (RSO) or Chair of the Radiation Safety Committee (RSC) shall include training and experience records and duties, responsibilities, and if appropriate availability.

A request to add isotopes, quantities, physical form, use, facilities, instrumentation, or the authorized place of use shall be reviewed in the same way as a request for a specific license for that activity.

An amendment to a license is normally amended in entirety and includes new tie-down license conditions as appropriate. The Chief, Radioactive Materials Licensing shall sign the amendment.

4.0 RECORDS

4.1 Hardcopy

4.1.1 Applications for license plus attachments are kept in the license file.
4.1.2 Requests for amendments are maintained in the appropriate specific license file.

4.2 Computer Based

4.2.1 Microsoft Excel Radioactive Material License Database
4.2.2 Bureau's Share Folder
4.2.3 eFACTS Database

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF
ENVIRONMENTAL PROTECTION

Bureau of Radiation Protection

Prioritization of Licensing Actions

Prepared By:_____**Date**_____

Reviewed By:_____**Date**_____

Approved By:_____**Date**_____

Effective Date_____

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1.0 PURPOSE

1.1 Applicability

The purpose of this procedure is to define the process for prioritizing each licensing action received by the Radioactive Materials Program.

Implementation of this procedure will assure that each licensing action will be processed in a timely and efficient manner.

1.2 References

1.2.1

1.3 Computer Based Letters, Forms and Reports

1.4 Hardcopy Files

1.5 Definitions

1.5.0 Application request means a request for an application for a license from a prospective applicant.

1.5.1 Licensing action means a request or application received from an applicant or a licensee as follows:
a) an application for a license to receive, possess and use licensed radioactive material;
b) an application for renewal of a license;
c) an application for an amendment to a license, e.g., change in administration, authorized use and/or users, RSO, quantity of material, add isotopes, facilities, and etc.; and,
d) a request for termination of a license(s).

1.5.2 Prioritizing means establishing the order and time increment in which the requests or applications are to be processed and completed.

1.5.3 Processing means reviewing the application for license or amendment, requesting additional information, if appropriate, and either issuing or denying the requested license or amendment.

1.5.4 Expedited Renewal means the renewal of a license where the application indicates that there is no change or a very minor change, e.g., change in dosimetry, or leak test vendor, from the previously licensed activity.

1.5.5 Timely Renewal means receipt of an application for renewal of a license, that has been postmarked or received 30 days or more before the license's expiration date. The license remains in effect until processing of the application for renewal has been completed.

2.0 RESPONSIBILITIES

2.1 Licensing RHP

The licensing RHP is responsible for:

- receiving, a renewal or termination request or a new application,
- maintaining the hardcopy and the computer based letters, forms and report files, and
- updating the files, as necessary.

2.2 Licensing RHP

The licensing RHP's are responsible for processing the assigned licensing actions in accordance with the priorities.

2.3 Chief, Radioactive Material Licensing

The Chief, Radioactive Material Licensing is responsible for:

- assigning a priority to a licensing action and
- assigning the licensing action to a licensing RHP for processing.

3.0 PROCEDURE

3.1 Receipt of Application or Request

All applicants for a license, license renewal, or termination request are informed of the receipt of their application.

Appropriate documents such as license applications and appropriate regulatory guides are sent to the requestor. The rule is available at this Internet address:
http://www.dep.state .pa.us

3.2 Licensing Actions - Priorities

Following receipt, each licensing action is assigned a priority that specifies the time allotted for completing the processing of the action. A time increment is assigned each priority.

The priorities for licensing actions follow:

Priority	Time Increment (Days) *Goal*	Licensing Action
R - Rush	As Soon As Possible	As assigned by the Chief New license (MBG-45 days) License Termination License Expiration
H - High	30	New RSO New Authorized User New Use Possible Violations (?)
M - Medium	60	Renewal - In Entirety New Equipment New/Changed Facilities New/Changed Procedures
L - Low	90	Delete AU or RSO Delete Use, Isotopes, Place of Use Expedited Renewal

Applications that do not fit in one of the above categories should be referred to the Chief, Radioactive Materials Licensing for resolution. If it is necessary to request additional information from the applicant/licensee an additional period may be added to the process time.

4.0 RECORDS

4.1 Hardcopy

4.1.1 Requests for applications are maintained in a file.

4.1.2 Applications for license, license renewal or license amendment are maintained in applicable files.

4.2 Computer Based

4.2.1 Appropriate files are updated to record the receipt of applications for license, license renewal and license amendment – L:\Agreement State

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF
ENVIRONMENTAL PROTECTION

Bureau of Radiation Protection

Renewal of Licenses

Prepared By:_____**Date**_____

Reviewed By:_____**Date**_____

Approved By:_____**Date**_____

Effective Date_____

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Section

Renewal of Licenses

1.0 PURPOSE

1.1 Applicability

The purpose of this procedure is to define the steps required for renewal of a specific license. This procedure also defines when an expedited renewal form is allowed rather than renewal in entirety. Timely and untimely applications for renewal are also discussed.

1.2 References

1.3 Computer Based Letters, Forms and Reports

1.3.1 L:/Agreement State\licensing\

1.4 Hardcopy Files

1.5 Definitions

1.5.1 Renewal In Entirety means that based on the review of the application, the inspection history, the current license, or a significant change in the applicable rule, the preparation of a total license revision is warranted. An example is a license that has been amended numerous times since the last renewal, such that the scope of the program has changed.

1.5.2 Expedited Renewal means the renewal of a license where the application, the inspection history and the current license demonstrate that there has not been a significant change in the scope of the licensed program.

1.5.3 Timely Renewal means the receipt of an application for renewal of a license that has been postmarked 30 days or more before the license's expiration date. The license remains in effect until processing of the application for renewal has been completed.

2.0 RESPONSIBILITIES

2.1 Program Assistant

The Licensing RHP is responsible for notifying a licensee that their license(s) will expire in 90 days and sending appropriate guidance document(s) based on input from the technical staff. The Chief, radioactive Material Licensing shall be informed of licensees that have not submitted renewal applications at least 30 days prior to expiration and of any licenses that have expired. The Licensing RHP is responsible for receiving, logging and acknowledging the receipt of an

application for license renewal and ensuring the applicant is informed that the application is considered to be timely.

Maintains the hardcopy file with renewal documentation.

2.2 Licensing RHP

The Licensing RHP is responsible for reviewing the application to see if it is valid and, with the concurrence of the Chief, Radioactive Material Licensing, signing the letter informing the applicant that the application is considered to be timely, and for processing the application, as assigned.

2.3 Chief, Radioactive Material Licensing

The Chief, Radioactive Material Licensing is responsible for determining if an application for renewal is timely or if the license has expired and should be terminated.

The Chief, Radioactive Material Licensing is responsible for determining if a license should be an expedited renewal form or renewal in entirety and for assigning applications for renewal to a nuclear engineer for processing.

The Chief, Radioactive Material Licensing is responsible for reviewing, approving and signing the license renewal.

2.4 Chief, Radiation Control Division

The Chief, Radiation Control Division is responsible for signing license renewals in the absence of the Chief, Radioactive Material Licensing, once a second review has been performed. The Chief is responsible for approving or disapproving continued operation after the license's expiration date if the application was not deemed timely filed.

3.0 PROCEDURE

The review of an application for renewal of a specific license shall be conducted by a Licensing RHP qualified to conduct such a review.

3.1 License Expiration

Ninety (90) days prior to a license's expiration date, the licensee shall be notified of the pending expiration date and that if an application for renewal is post marked at least 30 days prior to the expiration date, the application will be considered to be timely.

If the renewal application is post marked less than 30 days prior to but not after the expiration date, the Chief, Radioactive Material Licensing shall determine if the application should be considered timely.

If the application is found to be timely, the licensee is informed that activities authorized by the current license may continue until processing of the renewal has been completed.

If a timely application is not received, the licensee is informed that the license is considered to be expired, any activity using licensed radioactive material shall cease and all licensed radioactive material shall be placed in storage or be disposed.

The Chief must approve continued operation under the authority of any license for which the renewal application was submitted after the license's expiration date.

Processing of terminated licenses is covered in License Termination.

3.2 Short Form Renewal

If available, the application for license renewal and the inspection history shall be reviewed.

The application for renewal consists of a completed expedited renewal form.

Expedited renewal of a license may be considered only if the following conditions have been satisfied:

3.2.1 The authorized place of use and facilities are the same.
3.2.2 The program codes for the category-of-use have not changed.
3.2.3 The authorized users have not changed.
3.2.4 The allowable isotopes, quantities, physical form and use have not changed.
3.2.5 The tied down license conditions are the same.
3.2.6 Only instruments that will enhance performance have been added.
3.2.7 No items of noncompliance equal to or greater than Class IV severity have been observed during inspections of the license.

Items of questionable significance that do not satisfy the above requirements, such as adding an authorized user, may be overlooked with concurrence of the Chief, Radioactive Material Licensing.

3.3 Renewal in Entirety

One of the principal reasons for renewing a license in its entirety is to eliminate the confusion that can be caused by multiple amendments to the license and numerous tied down conditions.

The application, all referenced material, prior applications for amendment, and inspection history shall be reviewed. The reviewer shall use, as appropriate, the NURG-1556 Series. If needed, additional information should be requested from the applicant. In particular Pennsylvania specific rule and policy should be reviewed if only NRC guidance was utilized.

The license should contain all information that would be included in an initial license of the same program code(s) including tied down license conditions that are based on a referenced license amendment.

4.0 RECORDS

4.1 Hardcopy

4.1.1 Application for license renewal plus attachments are maintained in the Licensee's file as well as any deficiency letters generated by the technical staff.

4.2 Computer Based

4.2.1 Radioactive Materials Database
4.2.2 Letter for Expired License

5.0 ATTACHMENTS

2.03-1 Sample Renewal Letter for 90 day Notification
2.03-2 Sample Letter for Receipt of Renewal Application-Timely Filed

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF
ENVIRONMENTAL PROTECTION

Bureau of Radiation Protection

License Termination

Prepared By:_____**Date**_____

Reviewed By:_____**Date**_____

Approved By:_____**Date**_____

Effective Date_____

Table of Contents

1.0 PURPOSE

1.1 Applicability

This procedure defines the process for terminating a license to possess, use, store and dispose of licensed radioactive material.

This procedure applies to the disposal of licensed material, decommissioning of the site and facilities, and surveys adequate to demonstrate that residual radioactivity is within regulatory limits at such time that a license is terminated.

1.2 References

1.2.1 25 Pa Code
1.2.2 Title 10 Code of Federal Regulations, Part 20, Subpart E - Radiological Criteria for License Termination
1.2.3 NUREG 1727, NMSS Decommissioning Standard Review Plan, October, 2000 (evaluation of License Termination Plans, offers suggestions for evaluation of residual contamination in subsurface soil)
1.2.4 NUREG/BR-0241 NMSS Handbook for Decommissioning Fuel Cycle and Materials Licensees (replaced by NUREG 1727, however, Type I, II, III, and IV Decommissioning Types only addressed in this guidance)
1.2.6 NUREG-1575 - EPA 402-R-97-016, Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM), August, 2000 (evaluation of residual contamination of building surfaces and in surface soil)
1.2.7 NUREG/CR-5849, Manual for Conducting Radiological Surveys in Support of License Termination, December 1993 (replaced by MARSSIM)
1.2.8 Draft Regulatory Guide DG-4006, "Demonstrating Compliance with the Radiological Criteria for License Termination" (replaced by NUREG 1727, however, contains guidance on how to implement MARSSIM)
1.2.9 NUREG-1549, (Draft) "Decision Methods for Dose Assessment to Comply with Radiological Criteria for License Termination" (replaced by NUREG 1727, discusses use of site specific modeling)
1.2.10 D & D, Dose Modeling Code (Buildings)
1.2.11 RESRAD, Dose Modeling Code (Soil Concentration Levels)
1.2.12 RESRAD-Build, Dose Modeling Code (Buildings)
1.2.13 Regulatory Guide 1.86 Termination of Operating Licenses For Nuclear Reactors (1974) (provides values for acceptable levels of surface contamination, however, not dose based)
1.2.14 NUREG-1757-"Consolidated NMSS Decommissioning Guidance"

1.3 Computer Based Letters, Forms and Reports

1.3.1 Standard Termination Letter
1.3.2 Form 314, "Request for Termination of Specific License and Disposition of Radioactive Material"

1.4 Hardcopy Files

1.4.1 Terminated License File

1.5 Definitions

1.5.1 Background radiation means radiation from cosmic sources, naturally occurring radioactive materials, including radon, except as a decay product of source or special nuclear material and including global fallout as it exists in the environment from the testing of nuclear explosive devices or from past nuclear accidents such as Chernobyl that contribute to background radiation and are not under the control of a licensee or registrant. "Background radiation" does not include sources of radiation from radioactive materials regulated by the department.

1.5.2 Critical group means the group of individuals reasonably expected to receive the greatest exposure to radiation for any applicable set of circumstances.

1.5.3 Decommission means to remove a facility or site safely from service and reduce residual radioactivity to a level that permits release of the property for unrestricted use and termination of the license or release of the property under restricted conditions and termination of the license.

1.5.4 Distinguishable from background means that the detectable concentration of a radionuclide is statistically different from the background concentration of that radionuclide in the vicinity of the site or, in the case of structures, in similar materials using adequate measurement technology, survey, and statistical techniques.

1.5.5 Residual radioactivity means radioactivity in structures, materials, soils, groundwater, and other media at a site resulting from activities under the licensee's control. This includes radioactivity from all licensed and unlicensed sources used by the licensee, but excludes background radiation. It also includes radioactive materials remaining at the site as a result of routine or accidental release of radioactive material at the site and previous burials at the site.

1.5.6 Voluntary termination means that a licensee has requested that a license be terminated.

1.5.7 License revocation means a license is terminated because the licensee has allowed the license to expire; did not respond after being informed that the license had expired; and/or, did not request that the license be terminated or renewed.

2.0 RESPONSIBILITIES

2.1 Licensing RHP

The licensing RHP is responsible for:

- identifying those licenses that have expired and for notifying the Chief, Radioactive Materials Licensing
- sending out acknowledgment letters for receipt of termination requests.
- maintaining hardcopy and computer based files.
- processing requests for license termination or for processing expired licenses, as assigned.

2.2 Chief, Decommissioning and Surveillance Division

The chief, decommissioning is responsible for:

- evaluating and/or conducting final decommissioning surveys, as assigned, or
- over-seeing contractors that are conducting, final decommissioning surveys, as assigned.

2.3 Chief, Radioactive Materials Licensing

The chief, radioactive materials licensing is responsible for:

- assigning a request for license termination or an expired license to a licensing RHP for processing. The chief, radioactive materials licensing will instruct the technical staff member in the required scope of the termination or expired license process, i.e., whether the licensee is required to submit a license termination plan (LTP).
- reviewing, approving and signing the license termination.
- in concert with legal counsel, initiating a petition for revocation of the license or other sanction.

2.4 Chief, Radiation Control Division

The Chief is responsible for reviewing and concurring or not concurring in the recommended petition for revocation of the license or other sanctions. The Chief is responsible for approving the implementation of a revocation action and for signing the final order. The initial decision to

proceed with a revocation can be delegated to the Materials Program Supervisor.

3.0 PROCEDURE

3.1 General Provisions

The criteria for termination of a license is listed in 25 Pa Code 215.27 and 25 Pa Code 236.411. The cross-reference to the federal regulation is shown below.

Pa Code	NRC Section	Title
	10 CFR 20.1401	Radiological criteria for license termination
	10 CFR 20.1402	Radiological criteria for unrestricted use
	10 CFR 20.1403	Criteria for license termination under restricted conditions
	10 CFR 20.1404	Alternate criteria for license termination
236.411	10 CFR 20.1406	Minimization of contamination

The licensee shall determine the peak annual TEDE expected within the first 1000 years after decommissioning, when calculating TEDE to the average member of the critical group.

3.2 Request for Termination

Within **5 working days** following the receipt of the request for license termination, the receipt shall be acknowledged and the licensee informed that the Radioactive Materials Program will request additional information.

Following the receipt of a request for termination, a determination of the potential for residual radioactive contamination of the facility shall be made. The license and inspection history shall be reviewed to determine the potential risk of residual radioactive contamination.

The highest risk would be licensees that utilize significant quantities of unsealed radioactive material such as, but not limited to, nuclear pharmacies; waste disposal processing and repackaging services; manufacturing and distribution; nuclear laundries; academic, or medical type A Broad; and, research and development, Type A Broad.

The lowest risk would be licensees that utilize radioactive materials only in the form of sealed sources. Unless there has been a significant leak of a sealed source the probability of residual contamination is essentially zero. NOTE: However, there have been a number of cases of residual contamination resulting from melting sealed sources contained in measuring gauges.

For licenses that authorize both sealed and unsealed sources of radioactive material the highest risk use shall dictate the decommissioning process.

3.3 License Termination - Sealed Sources

Upon the receipt of a request for termination of a license that authorizes the possession and use of radioactive materials only in the form of sealed sources, the following information shall be requested from the licensee:

a) a listing of sealed sources currently or last possessed including type, isotope and quantity, serial number, vendor, date received and use

b) copies of the results of leak tests for each sealed source, if appropriate

c) copies of the records of disposal, decay or transfer to an authorized recipient, for each sealed source

d) copies of periodic inventories, if appropriate

e) a copy of the results of the final survey of the area where sources were used and stored. The record should include the type of instrument used and the last calibration date

f) licensee has submitted a properly completed Form 314, Request for Termination of Specific License and Disposition of Radioactive Material

If the above information, when compared to the license and the inspection history, appears to be accurate and complete, the license shall be terminated.

If the information is incomplete or appears to be inaccurate an inspection of the facility shall be conducted and if warranted, enforcement action taken prior to license termination.

3.4 License Termination - Solid, Liquid, Sealed and Gaseous Sources

Upon receipt of a request for termination of a license(s) that authorizes the possession and use of any radioactive materials in solid, liquid or gaseous form, plus sealed sources, the licensee shall be requested to submit the following information:

a) a listing of licensed radioactive materials currently or last possessed including type, isotope and quantity, serial number, vendor, date received and use, if appropriate

b) copies of the results of leak tests for each sealed source, if appropriate

c) copies of the records of disposal, decay or transfer to an authorized recipient, for each radioactive material listed in a) above

d) copies of periodic inventories, if appropriate

e) a copy of the results of the final survey of the area where radioactive materials were used and stored. The record should include the type of instrument(s) used and the last calibration dates

f) licensee has submitted a properly completed Form 314, "Request for Termination of Specific License and Disposition of Radioactive Material"

If the above information, when compared to the license and the inspection history, appears to be accurate and complete, and with the exception of sealed sources, the licensee has not possessed radioactive material with a half life greater than 30 days, the license(s) shall be terminated.

If the information is incomplete, appears to be inaccurate, the final survey revealed radioactive contamination or the licensee has possessed unsealed radioactive material with a half life greater than 30 days, an inspection of the facility shall be conducted as determined by the Chief, Decommissioning and Environmental Surveillance and/or the Regional Office.

If the inspection reveals that all radioactive material has been properly disposed of and an independent survey reveals no residual activity, the license shall be terminated. However, if items of noncompliance were noted during the inspection enforcement action shall be taken prior to license termination.

If an independent survey reveals possible residual activity the licensee shall be requested to submit a sufficient License Termination Plan (LTP) such that the facility will be decontaminated to levels acceptable for restricted use. NUREG-1575 and NUREG/CR-5849 (see sub-Section 1.2 of this procedure) can be used in the development, implementation of the LTP and the termination of the license(s). NUREG 1727 can be used to evaluate the LTP by the Radioactive Materials Program. In addition, other guidance and/or modeling codes may address specific issues and may be used as needed (see sub-Section 1.2 of this procedure).

3.5 Expired License

3.5.1 Licensee Contacted

Within ten (10) working days following the expiration date of a license without the receipt of a request for license termination or license renewal, the licensee shall be contacted by telephone or in person and informed that the license expired. The licensee shall be informed that any activity using radioactive material under the license shall cease, the licensed material shall be placed in storage or disposed of, and an application for license termination shall be submitted within 30 days.

If the licensee intends to continue license operations and states that the failure to submit an application for license renewal was just an oversight, the licensee shall be informed that operations shall cease and that an application for license renewal (extension) should be submitted as quickly as possible. The licensee shall be informed that operation without a current license constitutes noncompliance and that appropriate enforcement action will result.

The licensee shall be informed that only the Chief may authorize continued use of radioactive material without a current license, i.e., grant an exemption.

The above contact shall be recorded in a Confirmatory Action Letter and transmitted to the licensee by Registered Mail, Return Receipt Requested.
(A sample letter is attached to RMPP No. 2.03, License Renewal)

3.5.2 Licensee Not Contacted

If the licensee cannot be contacted either by telephone, visit to the address on the license or all other reasonable efforts, the authorized place of use shall be inspected and surveyed. If no radioactive materials are found and the survey indicates the facility is free of radioactive contamination, necessary legal action may proceed in order to revoke the license.

If residual contamination is discovered, the facility shall be decontaminated to acceptable levels and the license revoked.

4.0 RECORDS

4.1 Hardcopy

4.1.1 Terminated License File

4.2 Computer Based

4.2.1 Standard Termination Letter
4.2.2 Form 314, "Request for Termination of Specific License and Disposition of Radioactive Material"

Agreement State Application for Licensing the

Low-Level Radioactive Waste Disposal Facility

Commonwealth of Pennsylvania

Department of Environmental Protection

Bureau of Radiation Protection

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1. INTRODUCTION

The preparation, implementation, and completion of the low-level radioactive waste (LLRW) disposal facility licensing action is a complex and challenging task. It is imperative that appropriately trained personnel conduct a thorough, integrated review of the LLRW disposal facility license application, that the review process is controlled and documented, and that the results and conclusions of the review are clearly stated and defensible.

The purpose of this document is to describe the program that the department will follow when conducting the initial LLRW disposal facility license application review.

1.1 STATUTORY AUTHORITY

Responsibility for licensing and regulating the use and disposal of radioactive materials rests at the federal level with the U.S. Nuclear Regulatory Commission (NRC). However, under the terms of Section 274b of the Atomic Energy Act of 1954, as amended, a state that can demonstrate a regulatory program that is compatible with the federal regulatory program may receive NRC authorization to regulate the use and disposal of radioactive materials within that state.

Section 201 of the Pennsylvania Radiation Protection Act (P.L. 688, No. 147), authorizes the Governor, on behalf of the Commonwealth, to enter into agreements with federal agencies for the purpose of assuming authority to regulate the use and disposal of certain radioactive materials. In his December 1995 letter to NRC, Governor Ridge formally announced Pennsylvania's intent to assume Full Agreement State authorization from NRC, including the authority to regulate the disposal of LLRW. Pennsylvania is serving as the first host state for a LLRW disposal facility for a four-state compact comprising Maryland, West Virginia, Delaware, and Pennsylvania under the Appalachian States Low-Level Radioactive Waste Compact Act (P.L. 539, No. 120). Section 301 of the Pennsylvania Low-Level Radioactive Waste Disposal Act of 1988 (35 P.S. 7130, the Act) designates the Department of Environmental Resources, now Environmental Protection (the department), as the agency responsible for promulgating

and implementing a comprehensive program to regulate a LLRW disposal facility in the Commonwealth. Section 301 of the Act further stipulates that the regulatory program governing management and disposal of LLRW be consistent with the terms of the Agreement State Program authorized under Section 201 of the Radiation Protection Act.

Section 301 of the Low-Level Radioactive Waste Disposal Act also authorizes the department to license the regional low-level waste disposal facility operator in accordance with Section 308 of the Act and the regulations promulgated under the Act. The regulations for licensing a LLRW disposal facility are established in Title 25 of the Pennsylvania Code, Chapter 236, Low-Level Radioactive Waste Management and Disposal. NRC has found (February 4, 1993 letter) that the Chapter 236 regulations are compatible with applicable federal regulations.

1.2 CONTENTS

In addition to this Section, which identifies the statutory authority for regulating LLRW management and disposal activities within the Commonwealth, this document is composed of five sections.

Section 2 identifies the specific statutory requirements, regulations, and regulatory guidance documents that govern the application review process. Section 3 describes the structure of the LLRW licensing organization. The program and methods for controlling the license application review are summarized in Section 4.

The many steps of the license application review process are described in Section 5, beginning with receipt of the license application from the applicant. The final section (Section 6) describes preparation of the Safety Evaluation Report, license and license conditions or license denial, and a Comment and Response document.

2. STATUTORY AND REGULATORY FRAMEWORK

2.1 STATUTORY AND REGULATORY REQUIREMENTS FOR APPLICATION REVIEW

Requirements for licensing the LLRW disposal facility operator are identified in Section 308 of the Act. One of the requirements of Section 308 specifies that the department issue regulations relative to the procedure and requirements for licensing the regional facility operator.

The department has promulgated the required regulations in Title 25 of the Pennsylvania Code, Chapter 236, Low-Level Radioactive Waste Management and Disposal. The requirements for licensing the regional disposal facility operator and the license application review procedures and standards are described in Subchapter C of Chapter 236. Requirements for the content of the license application are specified in Sections 236.204 through 236.211. Review procedures and standards are presented in Sections 236.221 through 236.227 and amendments/changes to the license are contained in Sections 236.241 through 236.247.

2.2 LICENSING GUIDANCE

The department will issue three licensing documents that are directly related to the low-level radioactive waste disposal facility action. Specific information to be provided in the license application and the format for presenting the information required to fulfill the licensing requirements of Subchapter C of Chapter 236 and the Act will be presented in Format and Content of the Low-Level Radioactive Waste Disposal Facility License Application (analogous to NUREG 1199).

A companion document, Guidance for Review of the Low-Level Radioactive Waste Disposal Facility License Application (analogous to NUREG 1200), will facilitate the LLRW licensing organization's evaluation of the application. The document will be keyed to the chapters in the format and content document and it will address information such as acceptance criteria, applicable regulatory requirements and

guidance, and regulatory findings. It is anticipated that the applicant will use both of these guidance documents in preparing the license application and that the department will use both documents in reviewing the application.

A third licensing document will be used by the department for managing the license application review. The document, Licensing Management Plan, establishes the requirements and controls necessary to ensure that the department's activities associated with the licensing process are adequately and effectively carried out. Implementation of this document will enable the department to ensure that appropriately trained personnel will conduct a thorough, integrated review of the license application, that the review process is documented, and that the results and conclusions of the review are clearly stated and defensible.

3. LLRW LICENSING ORGANIZATION AND RESOURCES

3.1 DEPARTMENT ORGANIZATION

The Act designates the Secretary of the department as the individual responsible for making the final licensing decision. The Secretary designated the Bureau of Radiation Protection as the lead for conducting the LLRW disposal facility license application review. Figure 3-1 shows the organizational structure of the department and the Bureau of Radiation Protection's position within the agency. The internal organizational structure of the Bureau of Radiation Protection is shown in Figure 3-2. A description of the LLRW licensing organization and a description of the resources available to augment the LLRW Licensing Organization are presented in the sections that follow.

3.2 LLRW LICENSING ORGANIZATION

The Director of the Bureau of Radiation Protection created the LLRW licensing organization shown in Figure 3-3 for the sole purpose of recommending a licensing decision for LLRW disposal activities.

The LLRW licensing organization is made up of personnel from the department. The key management positions of Director, Bureau of Radiation Protection; Chief, Nuclear Safety Division; and Chief, Low-Level Radioactive Waste Section, are staffed from within the Bureau of Radiation Protection. Outside resources of technical support contractors and other state agencies are available to augment the management and technical capabilities of the organization.

3.3 ROLES AND RESPONSIBILITIES

3.3.1 Director, Bureau of Radiation Protection

The Director, Bureau of Radiation Protection, is responsible for recommending the approval or disapproval of the license application to the Secretary. The Director, Bureau

of Radiation Protection provides policy direction to the LLRW licensing organization and has the ultimate

Figure 0-1 DEP Organization Chart

Pennsylvania Department Of Environmental Protection

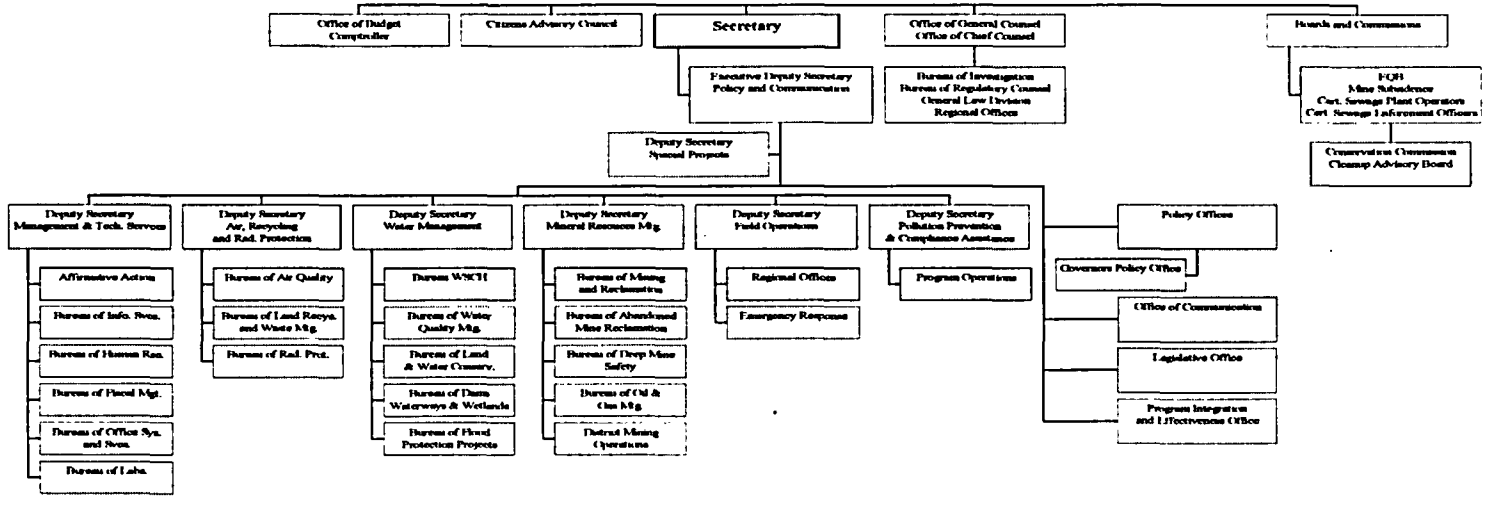


Figure 0-2 BRP Organization Chart

BUREAU OF RADIATION PROTECTION
Organizational Chart

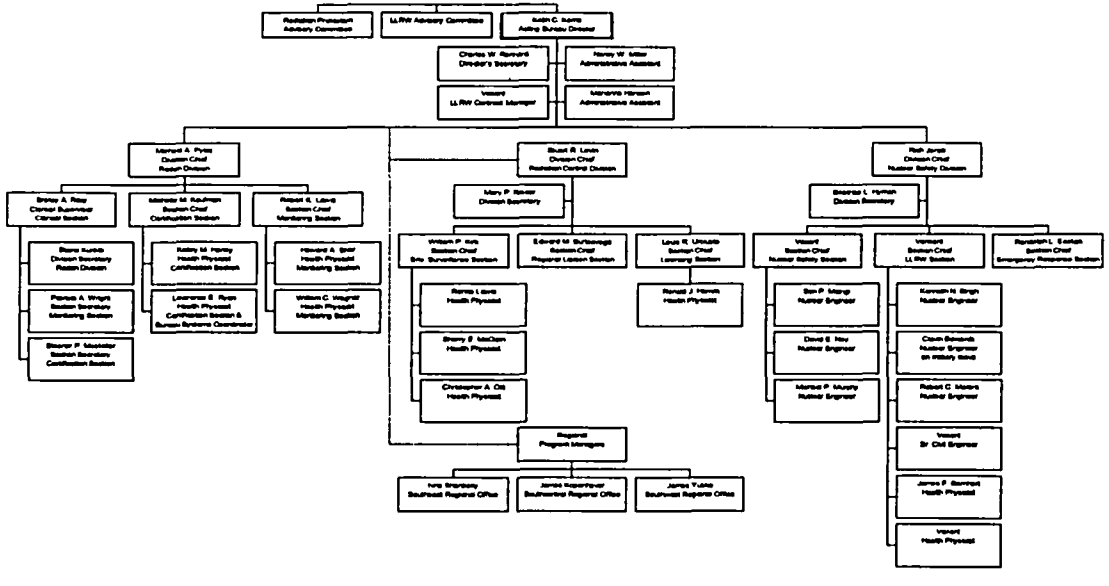
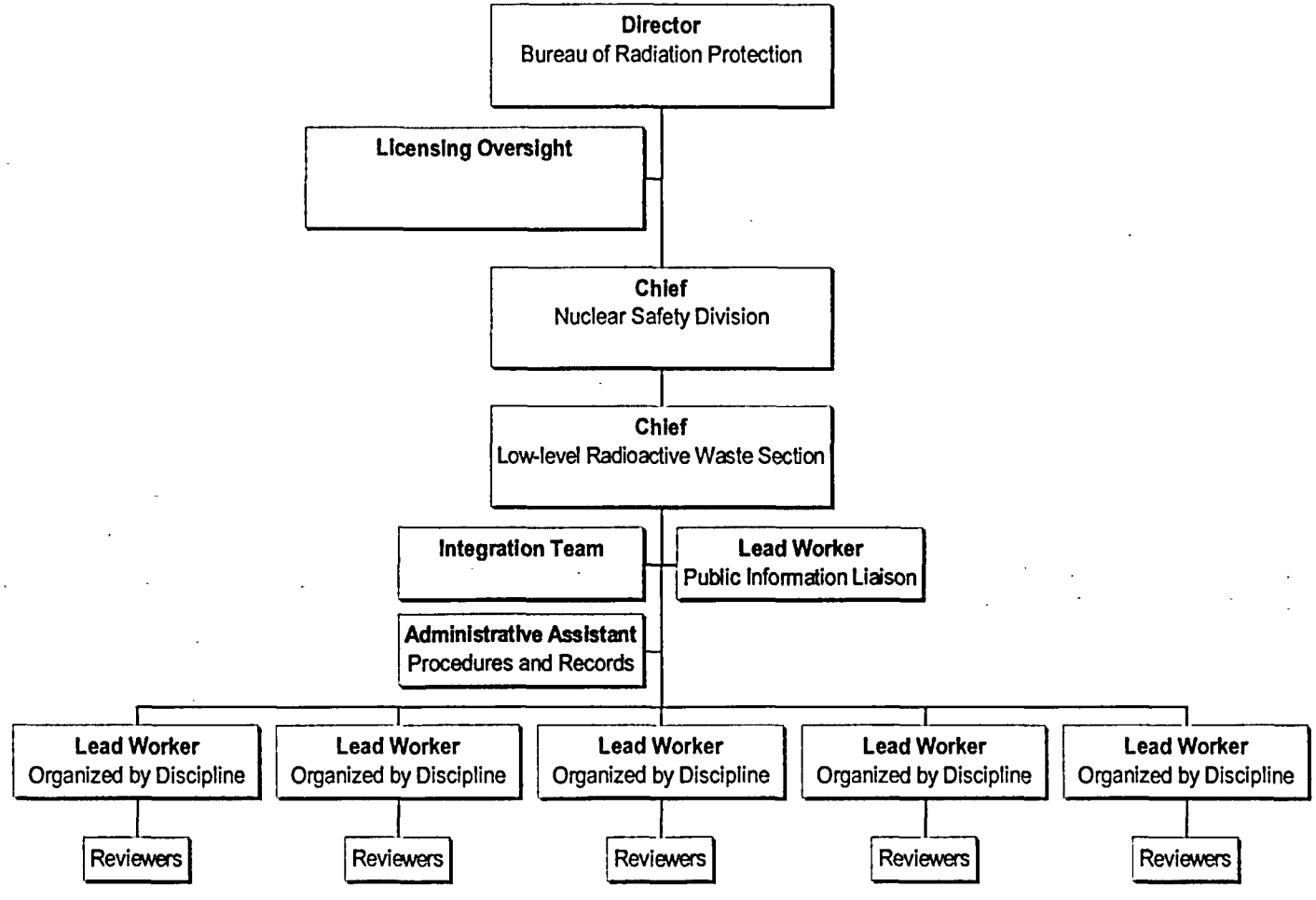


Figure 0-3 Low-Level Radioactive Waste Licensing Organization



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responsibility for making the licensing recommendation. The Director, Bureau of Radiation Protection is the primary contact between the department and the applicant on all matters regarding the license application. The Director, Bureau of Radiation Protection receives formal communication from the applicant including the license application itself.

The Director, Bureau of Radiation Protection is responsible for ensuring that the public is provided with the opportunity to review and comment on the license application and ensuring that all comments are considered prior to issuance of the licensing decision. The Director, Bureau of Radiation Protection is also responsible for ensuring that the Chief, Nuclear Safety Division, has sufficient resources for conducting a comprehensive and timely evaluation of the license application.

3.3.2 Licensing Oversight

The Licensing Oversight function is responsible for performing periodic assessments of the project to verify that all license application review activities are being conducted according to the requirements of the Licensing Management Plan and related procedures. The Licensing Oversight function is equivalent to the Division Chief level within the Bureau of Radiation Protection. Appointment to this position is made at the discretion of the Director, Bureau of Radiation Protection.

3.3.3 Chief, Nuclear Safety Division

The Chief, Nuclear Safety Division, has overall responsibility for ensuring that a comprehensive and technically adequate review is conducted on the license application in a timely manner. The Chief, Nuclear Safety Division, has the authority to plan, organize, staff, lead, and control project functions and activities. The Chief, Nuclear Safety Division, sets forth management requirements of the project with the assistance of the Chief, LLRW Section.

The Chief, Nuclear Safety Division, approves the selection of Integration Team members, Lead Workers, and Reviewers.

3.3.4 Chief, Low-Level Radioactive Waste Section

The Chief, LLRW Section, is responsible for managing the day-to-day activities of the project and the activities of the Integration Team. The Chief, LLRW Section, is responsible for ensuring that the license application review is fully integrated between disciplines, evaluating review results, making conclusions regarding performance objectives and requirements for issuing the license, and preparing licensing documents. The Chief, LLRW Section, recommends the selection of Integration Team members, Lead Workers, and Reviewers to the Chief, Nuclear Safety Division.
The Chief, LLRW Section, is also responsible for progress reporting, schedule, issue resolution, and other technical and management-related activities.

3.3.5 Integration Team

The Integration Team is made up of senior personnel representing several disciplines, legal counsel, and management with regulatory experience. The Integration Team is responsible for providing technical, legal, and management advice to the Chief, LLRW Section, ensuring proper integration during the review process, evaluating review results, and forming conclusions regarding performance objectives and requirements for issuing the license.
The Integration Team is also responsible for preparing the Safety Evaluation Report and other licensing documents.

3.3.6 Lead Workers

Lead Workers perform a technical and/or management role on the project depending on the qualifications and experience of the individual. Lead Workers are responsible for managing the day-to-day activities of assigned reviewers and conducting reviews of the license application within their area of expertise. The span of control for each Lead Worker corresponds to one or more sections of the license application as assigned by the Chief, LLRW Section (e.g., General Information, Description of Applicant, Quality Assurance/Quality Control, Site Characteristics, Waste Characteristics, Facility Design and Construction Plan, Facility Operations Plan, Health and Safety Plan, Facility

Closure and Decommissioning Plan, Monitoring and Surveillance Plans, Performance Assessment, Impact Analysis Report, etc.).

Key responsibilities of Lead Workers include:

A. Conducting completeness reviews of assigned sections of the license application,

B. Managing and/or performing the detailed review of assigned sections of the license application and preparing interrogatories,

C. Reviewing draft interrogatories prepared by the reviewers and comment resolution,

D. Submitting draft interrogatories to the Integration Team for review,

E. Developing regulatory findings for assigned sections of the license application, and

F. Supporting the Integration Team in the development of the Safety Evaluation Report and other licensing documents.

3.3.7 Reviewers

Reviewers are responsible for reviewing assigned portions of the license application, providing comments and draft interrogatories to Lead Workers, and preparing input on assigned sections of the licensing documents.

3.3.8 Administrative Assistant, Procedures and Records

The Administrative Assistant, Procedures and Records, has overall responsibility for managing project-related documents and maintaining the procedures and records management system. Specific responsibilities include maintaining the Licensing Management Plan and related procedures, distributing and tracking controlled documents, tracking license application review documents, and collecting, filing, storing, and retrieving records.

3.3.9 Lead Worker, Public Information Liaison

The Lead Worker, Public Information Liaison, is responsible for accepting, sorting, and distributing input received from the public, the Low-Level Waste Advisory Committee, and host municipality or county; ensuring that responses are prepared for public comments; and responding to public inquiries regarding licensing activities. The Lead Worker, Public Information Liaison, is also responsible for preparing the Comment and Response document.

3.4 RESOURCES

Primary personnel resources for conducting the license application review resides within the Bureau of Radiation Protection. However, other sources of personnel resources may be accessed by the Director, Bureau of Radiation Protection for purposes of filling or augmenting LLRW licensing organization responsibilities. A description of additional personnel resources follows.

3.4.1 Legal Assistance

Legal services are provided through the Bureau of Regulatory Counsel. Counsel is available to provide advice on legal and policy matters impacting the Commonwealth's radiation protection program.

3.4.2 Other DEP Bureaus and Deputates

The Director, Bureau of Radiation Protection may, through coordination with executive management and according to department policies and procedures, obtain additional personnel support throughout the department. Department personnel are organized by Deputates and Bureaus (Figure 3-1). Department Deputates include: Air, Recycling, and Radiation Protection; Water Management; Management and Technical Services; Mineral Resources Management; Field Operations; and Pollution Prevention and Compliance Assistance.

3.4.3 Contractor Technical Assistance

The Director, Bureau of Radiation Protection may, in accordance with policies and procedures contained in the Commonwealth's Contracting for Services Manual, contract the services of an independent contractor for public involvement, technical, administrative, and other support in evaluating the license application. Access and availability of contractor personnel are assured through the terms and conditions established in the agreement with the contractor.

3.4.4 Other Commonwealth Agencies

The Director, Bureau of Radiation Protection may obtain personnel resources from other Commonwealth Agencies. Access and availability of other agency personnel will be acquired and assured through Memoranda of Understanding negotiated between the department and its sister agencies.

3.4.5 Low-Level Waste Advisory Committee

The Low-Level Waste Advisory Committee (LLWAC) consists of 23 members, 19 of whom represent local government, environmental, health, engineering, business, academic, and public interest groups, and four who are members of the General Assembly. Representatives of the host municipality and host county will be added as voting members. At the request of the Department, LLWAC provides advice on policies and issues related to the implementation of the Act. LLWAC will be invited to participate in the license application review process.

4. MANAGEMENT CONTROL SYSTEM

This section describes the management control system that will be implemented to ensure that the department's responsibilities and activities associated with the license application review process are adequately and effectively carried out.

4.1 LICENSING MANAGEMENT PLAN

The management control system consists of the Licensing Management Plan and its implementing administrative procedures. The Licensing Management Plan describes the department's organizational structure and responsibilities for reviewing the license application. The plan also addresses the functional areas and topics that govern the entire license application review process. Members of the LLRW licensing organization are assigned the responsibility for implementing the various requirements. The Chief, Nuclear Safety Division approves the Licensing Management Plan.

4.2 FUNCTIONAL AREAS AND TOPICS

Functional areas and topics addressed in the Licensing Management Plan include:

- Project Organization: This section describes the function of the LLRW licensing organization and it defines the key responsibilities of project personnel.

- Document Hierarchy and Document Preparation: This section describes the document hierarchy that was created to control activities related to licensing activities. This section also establishes the requirements and assigns the responsibilities for preparing, reviewing, and approving the documents that make up the hierarchy.

- Resource Acquisition: This section establishes the requirements and assigns responsibilities for promptly acquiring the human resources needed to effectively and efficiently review the license application.

- Personnel Qualifications and Training: This section establishes the requirements and assigns the responsibilities for selecting qualified personnel, verifying the education and experience of selected personnel, and conducting general orientation and training.

- Applicant Interface Protocol: This section establishes the requirements and assigns responsibilities for documenting oral and electronic communications, developing and transmitting written correspondence, scheduling technical and management meetings, and arranging site visits.

- Public Interface: This section establishes the requirements and assigns responsibilities for interfacing with the potential host municipality, county, the public, and interested parties from license application receipt through issuance of the licensing decision.

- License Application Receipt and Review: This section establishes the requirements and assigns the responsibilities for receiving, distributing, reviewing, and tracking the license application and related documents.

- Preparing Licensing Documents: This section establishes the requirements and assigns responsibilities for preparing and issuing the Safety Evaluation Report, the Comment and Response document, and the license and license conditions or license denial.

- Records Management: This section establishes the requirements and assigns the responsibilities for generating, transmitting, collecting, storing, preserving, and retrieving records.

- Evaluations: This section establishes the requirements and assigns the responsibilities for independently evaluating compliance with and effectiveness of the administrative controls for the license application review process.

- Regulatory Interpretations: This section establishes the requirements and assigns the responsibilities for preparing and documenting regulatory interpretations.

Administrative procedures supplement the Plan where it is necessary to have written instructions to implement complex requirements. Administrative procedures are controlled and issued to LLRW licensing organization persons involved in implementing the requirements. The Licensing Oversight Function is responsible for assessing compliance with the Licensing Management Plan and the applicable administrative procedures.

5. LICENSE APPLICATION REVIEW PROCESS

Section 5 provides a description of the steps in the license application review process, from application receipt through issuance of the licensing decision. The license application review process is illustrated in Figure 5-1.

5.1 APPLICATION SUBMITTAL AND PUBLIC NOTIFICATION

5.1.1 Application Submittal

The applicant is required to submit one signed original and 35 copies of the license application package to the Secretary. Sections 236.204 and 212(c) of Chapter 236 state that the application package will consist of the license application (i.e., general information, program plans, a quality assurance/quality control program, specific technical information and technical analyses, institutional control information, and financial information), an impact analysis report, and the department license and permit applications necessary for construction and operation of the disposal facility.

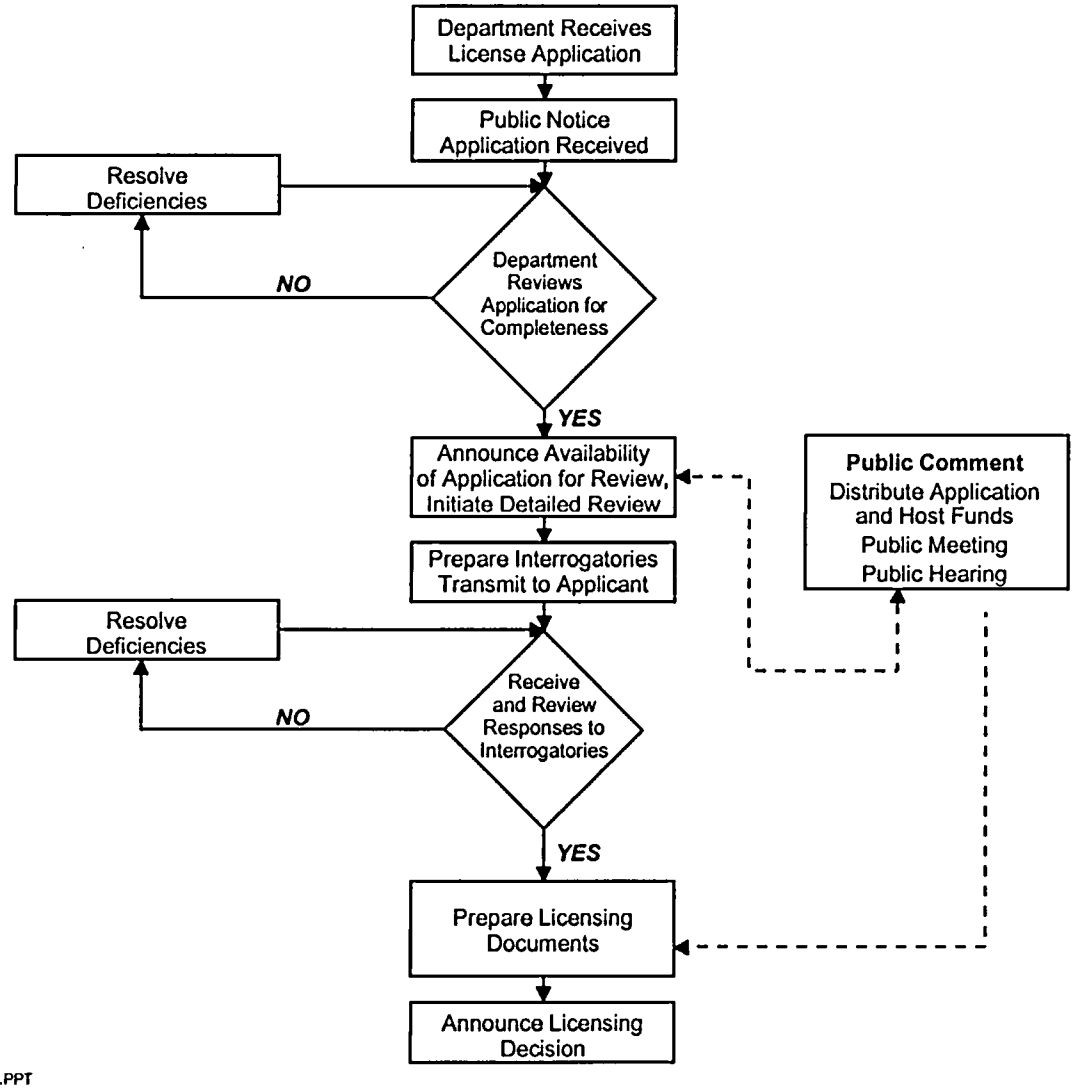
5.1.2 Public Notification

Upon receipt of the license application, the department will notify the applicant, the potential host municipality and county, the LLWAC, other interested parties, and the public that the license application was received. Public notification will be provided through media notifications, mailings, and notices in the Pennsylvania Bulletin, newspapers of wide general circulation, and newspapers in the area where the facility is proposed to be located. The notification will inform the public that the application was received by the department and that the department is reviewing the application to determine if it is complete.

A second public notification will be issued when the license application is determined to be complete. The notification will announce the availability of the application for public review and the duration of the comment period, identify the locations where the

application can be reviewed, and provide preliminary information about a public information meeting and a public hearing.

Figure 0-1 Low-Level Radioactive Waste License Application Review Process



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5.2 COMPLETENESS REVIEW

A completeness review will be performed upon receipt of the application to ensure that the necessary information, data, and analyses are included to effectively perform the detailed review.

Each Lead Worker will review his/her assigned section of the license application and determine if the following criteria have been satisfied:

- Is the section organized under the headings and sections corresponding to the Department's Format and Content of the Low-Level Radioactive Waste Disposal Facility License Application, and does the section address each area in sufficient detail to permit an in-depth review?

- Has the department received, or does the application include, all final project data upon which the application relies to reach its conclusions, or which are required in accordance with the requirements of Chapter 236? The application may incorporate by reference separate documents previously submitted to the department.

- Does the section and supporting data/information have adequate legibility and formatting for the detailed review?

Completeness review results will be documented in writing and reviewed and approved with comment resolution documented.

The Chief, Nuclear Safety Division, will make the final decision as to whether the license application is complete enough to begin the detailed review. If the Chief, Nuclear Safety Division, determines that the application is incomplete and requires supplemental information, he/she will prepare a written request to the applicant for supplemental information. The request will instruct the applicant to submit to the department any insert pages, replacement pages, and/or addenda needed as a result of the completeness review. Upon receipt of the supplemental information from the applicant, the supplemental materials will be reviewed for completeness following the same process described above.

When the license application is determined to be complete, the department will distribute the application for public review. The department will commence with a detailed application review at the same time.

5.3 PUBLIC REVIEW AND COMMENT

Upon making the license application available to the public, the department will provide funds, not to exceed $150,000, to the potential host municipality to carry out an independent evaluation of the application. At the request of the potential host county, the department also will provide a reasonable amount of funds, not to exceed $150,000, to the county to carry out an independent evaluation of the application. Within 180 days after distribution of the funding, the potential host municipality and county must present their comments to the department for inclusion in the licensing proceedings.

During the license application review process, the department will hold one public information meeting and one public hearing in the area in which the facility is proposed to be located. The department will issue 30-day public notices to announce the meeting and hearing dates and locations. The notices will be placed in the Pennsylvania Bulletin and in newspapers of general circulation in the area of the proposed host municipality. There will be a minimum of 30 days time between the public information meeting and public hearing.

The public hearing will provide a formal opportunity for the public to submit comments on the license application. A person that wishes to examine witnesses at the hearing must submit to the department a numbered list of contentions. In accordance with Section 236.222(b), these contentions must be limited to failure of the license application and its contents to conform with the Act and Chapter 236. The applicant is required to submit two copies of its testimony two weeks before the hearing date and make its staff available to answer questions. The department may establish the duration for oral testimony and may limit the scope of questioning during the hearing. The department will accept written comments regarding the application that are submitted within 180 days after the license application was made available to the public. The written comments and transcripts of the hearing will be considered in the

Secretary's decision on the application and become part of the public record. The department will provide written responses to comments and the hearing testimony at the time a licensing decision is made.

5.4 DETAILED REVIEW

The detailed review of the license application will begin when the application is deemed complete. Copies of appropriate sections of the license application will be distributed to the Lead Workers according to the applicable requirements and procedures established in the Licensing Management Plan.

5.4.1 Detailed Review Process

The objective of the detailed review is to reach a licensing decision by evaluating the information and analyses presented in the application to determine compliance or noncompliance with Chapter 236 regulatory requirements.

In performing the detailed review, Reviewers will follow the procedures presented in the Licensing Management Plan and guidance presented in, Guidance for Review of the Low-Level Radioactive Waste Disposal Facility License Application to make findings of compliance or noncompliance with regulatory requirements and to describe the basis/rationale for each of these findings. The detailed review will evaluate the adequacy and validity of the data, calculations, analyses, and conclusions of the application through a review of data, models, assumptions, and the applicant's quality assurance records.

LLRW licensing organization personnel may participate in site visits and in periodic technical meetings with the applicant to discuss issues or concerns. Coordination, conduct, and results of meetings and site visits will be documented by a designated member of the LLRW licensing organization in accordance with the procedures presented in the Licensing Management Plan.

If the Reviewer finds the information in his/her assigned section to be acceptable and sufficient to develop regulatory findings and bases, he/she will document "no comments" in writing and submit the documentation to the responsible Lead Worker. The Reviewer will then proceed to prepare regulatory findings.

If the Reviewer finds that additional information, clarification, analysis, or revision is needed to justify a regulatory finding, an interrogatory (i.e., a question or request for supplemental information or revision) will be prepared for submittal to the applicant.

5.4.2 Interrogatory Preparation and Review

The purpose of an interrogatory is to obtain from the applicant additional information to enable the Reviewer to make a determination (i.e., finding) of compliance or noncompliance with applicable regulations and to prepare a description of the bases for these findings.

Reviewers will record their draft interrogatories in a standardized format. The interrogatory will reference the appropriate regulatory requirement and include a justification for requesting the information. The interrogatory will include enough detail to allow the applicant to understand the nature of the information, clarification, justification, or revision requested. Where the interrogatory is based on a disagreement with analyses or conclusions in the application, the interrogatory will include a description of the reason for the disagreement and why the applicant needs to provide further justification for the conclusions or revise them.

To keep the number of interrogatory rounds to a minimum, an internal review and approval process will be carried out prior to submittal of the interrogatories to the applicant. The Chief LLRW Section, in conjunction with the Integration Team, will review the recommended interrogatories to identify and resolve any inconsistencies or errors and ensure that the interrogatories are directed toward making regulatory findings.

The Integration Team will prepare the interrogatories for those sections of the application in which the applicant summarizes compliance with the performance objectives and technical requirements of Chapter 236. The Integration Team also will consider public comments for inclusion in the interrogatory process. An interrogatory tracking system will be used to ensure that all interrogatories are tracked and addressed.

5.4.3 Interrogatory Transmittal

All approved interrogatories will be submitted to the Director, Bureau of Radiation Protection for formal submittal to the applicant. The submittal will include a request for responses and instructions for submitting additional information (e.g., insert pages, replacement pages, and addenda). The applicant will be requested to provide enough copies of responses and supporting materials for distribution to all persons on the license application distribution list.

5.5 REVIEW OF APPLICANT RESPONSES AND FURTHER INTERROGATORY ROUNDS

Upon receipt of the interrogatory responses and supporting materials from the applicant, each interrogatory response will be entered into the interrogatory tracking system and copies of the interrogatory responses will be distributed to LLRW licensing organization personnel and to all persons on the license application distribution list. The Reviewers will determine if the applicant's response adequately resolves the concern, and if there is sufficient information to make regulatory findings. The process for reviewing interrogatory responses will be the same as the process described in Section 5.4 (Detailed Review).

If the Reviewer finds the response to the interrogatory to be unacceptable, he/she will prepare a follow-up interrogatory that will undergo the same process as outlined in Section 5.4.2. The new, follow-up interrogatory developed for an inadequate response will be identified as a "derivative" interrogatory (i.e., one derived from a previous interrogatory that is still open).

Preparation of findings and bases will begin when sufficient information is presented in the application to make a regulatory finding. A finding is a determination of compliance or noncompliance with each regulatory requirement. A basis for a finding is a justification that summarizes pertinent supporting data and analyses for the finding. Findings and bases will be documented in a Safety Evaluation Report (SER).

6. PREPARATION OF LICENSING DOCUMENTS

This section describes the preparation, review, and approval of licensing documents including the Safety Evaluation Report (SER), the license and license conditions or the license denial, as applicable, and the Comment and Response document. This section also discusses public notification of the final licensing decision, and distribution of the licensing documents.

6.1 PREPARATION OF SER

The SER will be based on the findings/bases prepared as a result of the detailed review and on evidence presented during the public comment period. The Integration Team, in consultation with the Lead Workers, will develop a detailed outline for the SER. The SER outline will be reviewed and approved by the Chief, LLRW Section. The outline will provide for two SER volumes, as follows:

- Volume I will present an introduction that provides an overview of the proposed facility, the licensee, and the license review process. Volume I also will present integrated findings and bases for compliance with the performance objectives of Sections 236.13 - 236.16, requirements for issuance of a license under Section 236.225, and the integrated technical requirements of Chapter 236, based on the findings in Volume II. Volume I will also include the license and license conditions or notice of denial.

- Each section in Volume II will present findings stating that the pertinent technical requirements in Subchapters B and D through F and the financial arrangements of Subchapter G of Chapter 236 are satisfied, in whole or in part, by the project element reviewed by the Reviewers. Each finding will be supported by a discussion of the basis for compliance with the regulatory requirement.

The SER will be prepared by the Integration Team, and approved for release by the Chief, Nuclear Safety Division and forwarded to the Director, Bureau of Radiation

Protection for recommendation of approval or disapproval. Comment resolution will be documented and the necessary revisions will be made by the Integration Team.

6.2 PREPARATION OF LICENSE AND LICENSE CONDITIONS OR NOTICE OF DENIAL

A license will not be issued unless the department has determined that the requirements for issuance of a license under Section 236.225 have been met. If a decision is made to issue a license, it will be prepared by the Integration Team. The license may include the following information:

- Licensee and its address.
- License number.
- Expiration date.
- Issuing agency.
- Limitations on source material, special nuclear material, calibration and check sources, and any other radioactive material that may be received.
- Authorized use of the materials.
- Designation of host and affected municipalities, as required by Section 318(e) of the Act.

The Integration Team also will compile a set of license conditions. At a minimum, the license conditions will include the conditions specified in Section 236.226.
If it is determined that the requirements for issuance of a license under Section 236.225 have not been met, the Integration Team will prepare a notice of intent to deny a license. The notice of intent will document the specific negative regulatory findings/bases that are in the SER.
The draft license and license conditions or draft notice of intent to deny the license will be approved by the Director, Bureau of Radiation Protection. Comment resolution will be documented and the necessary revisions will be made by the Integration Team.

6.3 PREPARATION OF COMMENT AND RESPONSE DOCUMENT

Chapter 236.223(d) requires the department to provide a written response to public comments on the license application and on the testimony from the public hearing. These written responses will be issued by the department as part of the public record at the time the SER is released. The separate activity of considering public comments as interrogatories is described in Section 5.4.2.

The Public Information Liaison Lead Worker is responsible for compiling all public comments and hearing testimony transcripts, and distributing them to the Chief, Nuclear Safety Division for assignment to responsible Lead Workers for preparation of responses. The Lead Workers will consult with the Reviewers of their section for support in preparing responses, as necessary. Public comments/testimony on application sections addressing compliance with performance objectives and technical requirements and proposed license conditions will be assigned to the Integration Team. The Lead Workers will submit all of the comments/testimony and their recommended draft responses for their sections of the application to the Chief, LLRW Section for review. The Chief, LLRW Section will direct the Integration Team to review the recommended response for adequacy and appropriateness. The Chief, Nuclear Safety Division will approve Integration Team findings.

A comment response tracking system will be used in order to ensure that public comments are tracked and addressed. Similar public comments/testimony related to a common issue may be grouped into categories with one response prepared for each category. The Public Information Liaison must ensure, however, that each comment/testimony is addressed by a response. Final responses to public comments will be contained in a Comment and Response document and it will be issued in conjunction with the SER.

6.4 LICENSING DECISION AND PUBLIC NOTIFICATION/DISTRIBUTION

The Director, Bureau of Radiation Protection will submit the licensing recommendation, the SER, the license and license conditions or the notice of intent to deny a license and the Comment and Response Document to the Secretary for review. The Secretary's

review and decision will be documented and any necessary revisions will be made by the Chief, Nuclear Safety Division with support from the LLRW licensing organization. The Department will notify the public of its decision to issue or deny the license. The notification will be made in the Pennsylvania Bulletin, local media, newspapers of wide general circulation, and newspapers in the area where the regional facility is located.

If the Secretary determines that the license will be issued, he/she will sign the license and the SER. The Secretary will direct the Director, Bureau of Radiation Protection to distribute the licensing documents to the applicant, the LLWAC, the host municipality and county, and other parties on the controlled distribution list. Signing of the license and license conditions will constitute the department's approval to begin construction of the facility.

If the Secretary determines that the license will be denied, he/she will sign the notice of intent to deny the license and the SER. The Secretary will direct the Director, Bureau of Radiation Protection to distribute the notice of intent to deny and supporting documentation to the applicant, the LLWAC, the host municipality and county, and other parties on the controlled distribution list. In accordance with Section 236.224(a), if the license application is rejected, the applicant may choose to submit a revised application. The application resubmittal shall be accompanied by a new application fee.

6.5 APPEALING THE LICENSING DECISION

Under Section 307(i) of the Low-Level Radioactive Waste Disposal Act, a citizen of the Commonwealth, a host municipality, or a host county may appeal the issuance of the license to the Environmental Hearing Board, which is required to handle the appeal in an expedited manner. The decision of the Environmental Hearing Board is appealable to the Commonwealth Court.

STAFF TECHNICAL REPORT SERIES:

CONDUCTING RADIOLOGICAL PERFORMANCE ASSESSMENTS FOR LLRW DISPOSAL IN PENNSYLVANIA

Commonwealth of Pennsylvania
Department of Environmental Protection
Bureau of Radiation Protection
Harrisburg, PA

http://www.dep.state.pa.us/
(choose information by subject/choose Radiation Protection)

June 1998

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GLOSSARY

Container—The first enclosure that encompasses the radioactive waste.

Containment—The function of isolating radioactive waste from the biosphere by emplacement of the waste within a container, waste module, or disposal unit.

Custodial agency—An agency of the government designated by the Governor to act on behalf of the government owner of the disposal site. The agency is responsible for the long-term monitoring and care of the disposal site. The term does not include the department.

Disposal facility—The buildings, equipment, and other engineered features, including disposal units and temporary holding facilities, within the disposal site that are used for the disposal of low-level radioactive waste.

Disposal site—The property, including improvements thereon, that is used for disposal of low-level radioactive waste. The term consists of the disposal units and the buffer zone.

Disposal unit—A discrete portion of the disposal site into which waste is placed for disposal.

Hazardous life—The time required for radioactive materials to decay to safe levels of radioactivity, as defined by the time period for the concentration of radioactive materials within a given container or package to decay to maximum permissible concentrations as defined by federal law or by standards to be set by the host state, whichever is more restrictive.

Hazardous life standard—The hazardous life of the waste is the amount of time that it takes for the disposed low-level radioactive waste to decay to levels so that it can be demonstrated that unrestricted use of the site would result in a dose to a member of the public using the site that is no greater than the dose from natural background radioactivity, in the soil, prior to the site being used for disposal (236.508 relating to determination of hazardous life of the waste).

Inadvertent intruder—A person who might occupy the disposal site after closure and engage in normal activities, such as agriculture, dwelling construction, or other pursuits in which an individual might be unknowingly exposed to radiation from the waste.

Long-term care period—The period of time that includes both the active and passive institutional control periods.

i) Active institutional control period—The period of time following site closure and the post-closure observation and maintenance period during which active access control, surveillance, monitoring, and custodial care are maintained. This period will last for a minimum of 100 years.

ii) Passive institutional control period—The period of time after the active institutional control period during which monitoring and passive access control of the facility is maintained. This period will be at least as long as the hazardous life of the radioactive waste.

Monitoring—Observing and making measurements to provide data to evaluate the performance and characteristics of the disposal site.

Stability—Structural stability.

Surveillance—Monitoring and observation of the disposal site for purposes of visual detection of need for maintenance, custodial care, evidence of intrusion, and compliance with other license, permit, and regulatory requirements.

Waste module—A discrete assembly of waste containers within a disposal unit.

1. INTRODUCTION

The regulations in Title 25 of the Pennsylvania Code, Chapter 236, "Low-Level Radioactive Waste Management and Disposal" (25 PA 236), identify the need for performance assessment in developing and licensing a low-level radioactive waste (LLRW) disposal facility. Although the regulations address general aspects of performance assessment, they do not discuss the associated technical complexities and issues.

This report focuses on LLRW facility performance assessment as it applies to protection of the public (25 PA 236.13 and 236.15) and inadvertent intruders (25 PA 236.14). Specifically, it addresses radiation exposures that the public could receive from accidental or otherwise unintended releases of radioactive contaminants during and following disposal facility operations, and it addresses radiation exposures that an inadvertent intruder could receive after the facility's institutional control period ends.

Section 2 of this report presents a summary of the Pennsylvania regulations applicable to assessing the performance of LLRW disposal facilities. Section 3 discusses in detail the elements and steps of the performance assessment process.

2. REGULATORY REVIEW

2.1 CAPSULIZED REVIEW

Subchapters B and D of 25 PA 236 establish the technical requirements for the LLRW disposal site and facility. These criteria require that:

(a) The disposal site be capable of being modeled and analyzed (236.142).

(b) The disposal facility complement and augment the site's ability to meet the performance objectives (236.301).

(c) The facility independently comply with the performance objective relating to protection of the public through the active institutional control period (236.314).

Numerous regulatory requirements can be satisfied only through the use of the performance assessment process. The performance assessment process may be used to justify selection of the disposal site, to demonstrate that the disposal system will meet or contribute to meeting all the performance objectives, and to determine whether constraints must be placed on waste to be received at the disposal facility in order to meet the hazardous life standard (236.508).

2.1.1 Justifying Site Suitability

The use of the performance assessment process should be a consideration in justifying the selection of the disposal site (236.204(2)(vi)). Even without detailed and final information about the waste to be disposed of and the disposal facility to be constructed, the performance assessment process provides indications of the relative merits of individual sites. If the assumed characteristics of waste to be disposed of and the selected disposal facility are used in assessing the relative performance of the three potentially suitable sites, the performance assessment process will produce estimates of relative performance for each site being considered.

2.1.2 Guiding Site Characterization

A license applicant can ensure that limited resources are committed most effectively during site characterization through the use of the performance assessment process. The applicant also can ensure that the site information required as input to performance assessments presented in the license application is obtained in adequate detail during site characterization. More detailed guidance on this potential application of the performance assessment process is presented in a future staff technical report, *Characterization of Sites for Low-Level Radioactive Waste Disposal in Pennsylvania* (PADEP, 1997c).

2.1.3 Demonstrating That Performance Objectives Are Met

The applicant must demonstrate that the proposed disposal system (i.e., site, waste, and facility) will satisfy all four performance objectives contained in 25 PA 236.13 through 236.16. Two of the four performance objectives (236.13 and 236.14) can be shown to be satisfied through the use of the performance assessment process.

- Concentrations of radioactive material that may be released to the general environment in groundwater, surface water, air, soil, plants, or animals may not result in an annual dose exceeding an equivalent of 25 millirems to the whole body, 75 millirems to the thyroid, and 25 millirems to any other organ of any member of the public. Releases of radioactivity in effluents to the general environment shall be as low as reasonably achievable and within the most restrictive Federal and Commonwealth regulations and standards that are applicable (25 PA 236.13).

- Design, operation, and closure of the disposal facility shall ensure protection of an individual from inadvertently intruding into the disposal site and occupying the site or contacting the waste after active institutional controls over the disposal site have been removed (25 PA 236.14).

A portion of the third performance objective (i.e., 25 PA 236.15) can be shown to be satisfied through the use of the performance assessment process.

- Operations at the disposal facility shall be conducted in compliance with the standards for radiation protection in Chapter 219 (relating to standards for protection against radiation), except for releases of radioactivity in effluents from the disposal facility, which shall be

governed by § 236.13 (relating to protection of the general population and environment from releases of radioactivity). Effort shall be made to maintain radiation exposures as low as is reasonably achievable (25 PA 236.15).

This performance objective addresses exposures that members of the public could receive during disposal facility operations (e.g., accidents, spills, and direct radiation). While the license applicant must address potential exposures to disposal facility workers to completely demonstrate compliance with this performance objective, worker safety is not addressed in this staff technical report.

The fourth performance objective (25 PA 236.16) requires that the disposal site be stable in the long-term without relying on ongoing active maintenance. As with the other performance objectives, this requirement must be shown to be satisfied. However, performance assessments are not required to demonstrate compliance with 25 PA 236.16.

In addition to the general statements of the performance objectives, the regulations require that specific pathway analyses be conducted and included in the license application (25 PA 236.209).

2.1.4 Determining the Need for Constraints on Waste To Be Disposed of

The hazardous life standard must be satisfied before the license for an LLRW facility may be terminated (25 PA 236.247(c)). The regulatory decision to terminate the license will not be made for many years. However, the department (by policy) has determined that the hazardous life of disposed waste must not exceed the expected performance of the disposal facility. This potentially imposes constraints on the facility's waste acceptance criteria. The applicant must demonstrate that the hazardous life of waste it will accept for disposal will not exceed the expected performance of the disposal facility. This can be accomplished only through the use of the performance assessment process.

2.1.5 Preparing the Impact Analysis Report

The applicant must include in its license application an Impact Analysis Report that addresses radiological and nonradiological impacts, impacts on groundwater and surface water quality, and long-term public health and environmental impacts (25 PA 236.204(2)). Many of these topics can be addressed only through the use of the performance assessment process.

2.2 TECHNICAL REQUIREMENTS AND ANALYSES

Radiological performance assessments are conducted to demonstrate that an LLRW disposal facility will meet all applicable performance objectives. The performance of the disposal facility must be assessed and reported in connection with several licensing decisions. The 25 PA 236 requirements that directly apply to the performance assessment process are described in this subsection.

To meet the site suitability requirements, the applicant "...shall clearly demonstrate that the preferred site meets the Phase I and Phase II siting requirements and contributes to compliance with the performance objectives of Subchapter A..." (25 PA 236.141(b)). Satisfaction of the site suitability requirements requires that the site be capable of being characterized, modeled, analyzed, and monitored. Specifically, "...characterization shall be adequate to define characteristics and conditions, both onsite and offsite, through monitoring, analysis, modeling and demonstration, to substantiate that the site can satisfy site suitability requirements and meet the performance objectives" (25 PA 236.142). The required "modeling" refers directly to the performance assessment process.

Subchapter D of 25 PA 236 establishes the design requirements for the LLRW disposal facility. The design criteria "...require the applicant to demonstrate that the disposal technology can complement and augment the site's ability to meet the performance objectives of Subchapter A..." (25 PA 236.301(b)). Section 236.314(c) states that the disposal facility must independently comply with the performance objectives that concern protecting the public through the active institutional control period. Furthermore, the "...facility design shall, to the extent practicable, limit radiation exposures to the inadvertent intruder to an annual whole body dose equivalent of 25 millirems" (25 PA 236.320(c)). The performance assessment process must be used to demonstrate compliance with these performance objectives and criteria (25 PA 236.330).

Having addressed the site suitability and facility design requirements, the applicant must obtain a license to construct and operate the LLRW disposal facility. The applicant must prepare and submit a license application for department review.

The applicant also must include in the license application the technical analyses necessary to demonstrate that the performance objectives of Subchapter A will be met. Specific technical analyses that are pertinent to protecting the public and inadvertent intruders include the following:

- Pathway analyses demonstrating protection of the general population from releases of radioactivity. Pathways must include air, soil, groundwater, surface water, plant and animal uptake, and exhumation by burrowing animals. These analyses must clearly identify and differentiate between the roles that natural site characteristics and design features perform in isolating and segregating the wastes (25 PA 236.209(1)). These analyses must also provide assurance that exposures to humans from the release of radioactivity will not exceed the limits stated in 25 PA 236.13.

- Analyses of the protection of individuals from inadvertent intrusion. These analyses must ensure that waste classification and waste segregation requirements will be met and that barriers to inadvertent intrusion will be provided (25 PA 236.209(2)).

- Analyses of the protection provided to individuals during operations. These analyses must assess expected exposures resulting from routine operations and likely accidents during waste handling, storage, and disposal. Exposures to members of the general public must satisfy the standards of 25 PA 236.13, while those to workers at the facility must satisfy the requirements of 25 PA 219 (25 PA 236.209(3)).

These requirements can be satisfied only through modeling and simulation activities that are integral to the performance assessment process.

The license application must include the Impact Analysis Report, which addresses the impact of licensing the disposal facility. This report must include several evaluations and discussions of human health and environmental impacts. Evaluations that must be provided by applying the performance assessment process include the following:

- A detailed assessment of the radiological impacts on public health and the environment (25 PA 236.204(2)(i)).

- A discussion of long-term public health and environmental impacts, including those from closure, decommissioning, decontamination, and reclamation of the site and facilities associated with the licensed activities and management of radioactive materials that will remain on-site after closure, decommissioning, decontamination, and reclamation (25 PA 236.204(2)(iii)).

- A justification for the choice of the proposed site over other preferred, potentially suitable sites (25 PA 236.204(2)(vi)).

The department will not issue a license unless the applicant demonstrates the following:

- The operation will not endanger public health, safety, and welfare, or the environment (25 PA 236.225(1)).

- The proposed disposal site; disposal facility design; disposal facility operations, including equipment, facilities, and procedures; disposal site closure; and post-closure institutional control are adequate to protect public health and safety by providing assurance that the general population will be protected from releases of radioactivity as specified in the performance objective in 25 PA 236.13 (relating to protection of the general population and environment from releases of radioactivity) (25 PA 36.225(4)).

- The applicant's proposed disposal site; disposal facility design; disposal facility operations, including equipment, facilities and procedures; disposal site closure; and post-closure institutional control are adequate to protect public health and safety by providing assurance that individual inadvertent intruders are protected in accordance with the performance objective in 25 PA 236.14 (relating to protection of individuals from inadvertent intrusion) (25 PA 236.225(5)).

These demonstrations can be accomplished only through use of the performance assessment process, which is described in Section 3.

3. PERFORMANCE ASSESSMENT PROCESS

The performance assessment process is used to project the performance of an LLRW disposal system under current and possible future conditions. Performance assessment plays an important role in all phases of the life of the disposal facility, including siting, design, construction, operation, and closure. This section describes the steps required to conduct a performance assessment and discusses specific issues that affect the conduct of various activities in the performance assessment process.

The performance assessment process consists of a sequence of technical activities that are coordinated to produce estimates of the potential impact of the disposal system on human health and the environment (see Figure 3-1). The major steps of a performance assessment are as follows:

- Characterize the disposal system (i.e., the waste, natural site, and disposal facility).
- Identify potential radiation exposures (i.e., potential receptors, exposure scenarios, and exposure pathways).
- Develop conceptual exposure models (i.e., contaminant release mechanisms, transport pathways, and uptake modes).
- Develop calculational tools (i.e., mathematical models and computer codes).
- Estimate and evaluate potential radiation exposures (using baseline results, sensitivity analyses, uncertainty analyses, and review of results).
- Revise inputs, models, and assumptions as appropriate.

The performance assessment process is iterative. The quantity and quality of data and information that it requires generally increase as the development of the disposal facility progresses. The growing availability of information will generally require that the performance assessment process be repeated with revised inputs and/or conceptual models. Subsections 3.1 through 3.7 of this document discuss these steps.

Appendix A lists reports from several state and federal agencies on various aspects of the performance assessment process. Several of these reports have been issued by agencies that have

Figure 0-1 Sequence of Activities Involved in the Performance Assessment Process

no regulatory standing in the Commonwealth or address types of radioactive waste other than LLRW. These resources are included because they help provide a broad perspective on the current level of expertise on the performance assessment process. Reading and reviewing the documents listed in Appendix A will provide more detailed information on the purpose and nature of performance assessment.

Commonwealth regulations require the applicant to develop and implement a quality assurance/quality control (QA/QC) program (25 PA 236.207) that will, in part, control the collection and management of data and information used in siting. Data that may influence the performance assessment results should be acquired and managed according to provisions of the QA/QC program. The applicant should ensure that any revised data or results are properly incorporated into the database for use in future assessments.

3.1 CHARACTERIZE THE DISPOSAL SYSTEM

A disposal system consists of three physical components: the waste inventory, natural site, and disposal facility (see Figure 3-2). Each of these components must be thoroughly understood for the performance assessment to accurately represent the performance of the disposal system. The following subsections discuss the steps required to characterize these elements. Additional guidance on the types of data needed to characterize the disposal system is provided in PADEP, 1997d and PADEP, 1997e.

3.1.1 Characterize the Waste

An accurate assessment of the potential impacts of the disposal facility on human health and the environment requires a thorough understanding of the nature of the waste to be disposed of. Radionuclide inventories and leaching characteristics should be developed for each combination of waste stream, waste class, and waste form that will be disposed of at the facility. Other important waste stream parameters also should be provided, including disposal volumes and physical, chemical, waste container, and waste stability characteristics. The potential for gas generation in the waste, including radon, carbon dioxide, methane, and hydrogen gases, also should be addressed.

Figure 0-2 Disposal System Components of an LLRW Disposal Facility

In addition to the aforementioned characteristics, information on the radiation levels at the surfaces of the waste containers is required. This information is used to characterize potential exposures to members of the public adjacent to the disposal facility, direct exposures to disposal facility workers, and exposures that occur during waste transport and handling.

Actual waste characteristics information will be available only after disposal facility operations begin. Prior to that time, information should be collected from expected LLRW generators to develop the best possible estimates of the types and quantities of waste requiring disposal. These estimates should be updated as appropriate to maintain an accurate understanding of the waste to be disposed of at the facility. All projected waste characteristics must be provided in the license application. Radionuclide concentrations, waste volumes, and radiation levels should be presented for each combination of waste form, waste stream, and waste class.

3.1.2 Characterize the Natural Site

The site characteristics that must be considered in the performance assessment are geology, groundwater hydrology, surface water hydrology, meteorology, soil features, biotic features, and demography. See PADEP, 1997c for additional guidance on characterizing the natural site. The following specific site characterization data are required for the performance assessment:

- Geology—Topography, stratigraphy, structure, and soil characteristics.
- Groundwater—Hydraulic conductivity, hydraulic potential, porosity, flow directions, water-bearing capacity, moisture content, ion exchange characteristics, pH, depth to local groundwater, and groundwater chemistry.
- Surface water hydrology—Runoff rates, runoff drainage patterns, the potential for flooding, indications of surface water discharge, and other surface water characteristics (e.g., dimensions, flow rates, temperatures, mixing characteristics, and water chemistry).
- Site meteorology—Wind speed, direction, and frequency; atmospheric stability classes; air temperature; precipitation; evapotranspiration; and atmospheric water content.
- Biota—Potential for plant uptake of radionuclides, evapotranspiration effects, and the potential for animal intrusion into the facility.

- Demography—Population distribution by distance and direction from the site, projected growth patterns, potable water sources, food production patterns, and food consumption patterns.

Based on the results of the site characterization, design basis conditions and their effects on the facility's projected performance should be identified. These conditions may include the probable maximum precipitation event, probable maximum flood, design wind speed, critical temperatures, and seasonally high water tables.

3.1.3 Characterize the Disposal Facility

Characterization of the disposal facility should address all principal design features or features that contribute to the facility's ability to satisfy performance objectives and technical requirements (PADEP, 1997d and PADEP, 1997e). The principal design features to address are the engineered cover system, disposal units, waste modules, intruder barriers, percolating water drainage systems, contaminant retarding components, surface water drainage systems, disposal unit monitoring systems, environmental monitoring systems, and the buffer zone. Guidance on designing engineered structures to provide enhanced containment is provided in PADEP, 1998.

The descriptions of principal design features should include the following elements:

- Textual descriptions.
- Layout drawings (to scale).
- Plan views (to scale).
- Cross-sectional views (to scale).
- Design details and justifications.
- Material specifications.

The license applicant also should describe the relationship of the disposal facility to the natural site, including existing water wells, the potential for natural resource exploitation, topography, the potential for surface water runon, and the potential for flooding of the site.

A general understanding of key operating activities and practices should be demonstrated. Descriptions of these activities should include the movement of waste containers from arrival at the receiving area until

the disposal unit is closed, with no intention of further contact with the waste. Of particular importance are the waste handling or processing operations that have the greatest potential for accidental releases.

The general condition of the disposal facility following its closure must be defined to allow an accurate assessment of performance. Issues such as facility decontamination and decommissioning, engineered cover system integrity, surface drainage, erosion protection, intruder protection, subsidence, settlement, and geotechnical stability should be addressed when defining these conditions. Information on the conditions of the facility following decommissioning will become more detailed as decommissioning approaches.

3.2 SYSTEM PERFORMANCE ASSUMPTIONS

Though not explicitly shown in Figure 3-1, an important step must be taken after the disposal system is characterized but before the balance of performance assessment activities commence. This step has far-reaching effects on all subsequent activities because it determines the range of conditions under which the disposal system's performance will be assessed.

As part of the uncertainty analyses (described in Subsection 3.6.2), the applicant should assess disposal system performance under three major sets of system performance assumptions that affect the results of radiation exposure scenarios. These sets of assumptions correspond to three possible conditions in which the disposal system may exist:

- Expected performance.
- Design basis performance.
- Degraded performance.

The characteristics of these three sets of system performance assumptions are described generally in the following paragraphs.

Under expected performance, the applicant should take account of all design features provided and their expected performance capacity. Typically, engineered components are designed to a particular standard or set of criteria. To provide assurance that a design component is likely to perform as required, the component is provided with capacity beyond that required to achieve the design standard

or satisfy design criteria. This excess capacity is referred to as the design margin. The applicant may account for the beneficial effects of this excess design capacity in projecting the expected performance of the disposal system. Also, the applicant may take credit for the extended duration of the passive institutional control period and the beneficial effects that monitoring and associated maintenance activities would have on the performance of the disposal facility.

Under design basis performance, the applicant should impose the unique requirements of Pennsylvania regulations as they relate to design goals and service life (25 PA 236.314(d) and 236.322(b)). Under these conditions, the applicant may take credit for the extended duration of the passive institutional control period and the beneficial effects that monitoring and associated maintenance activities would have on the performance of the disposal facility.

Under degraded performance, the applicant should apply the philosophy that the U.S. Nuclear Regulatory Commission (NRC) outlines in 10 Code of Federal Regulations (CFR) 61. That is, the applicant should not take credit for the beneficial effects of any maintenance activities that might be planned for the first 100 years after facility closure. Although the principal design features will have been designed with substantially longer service lives, conservative assumptions, consistent with those expected by NRC, should be made to discount the beneficial effects of the extended service lives.

Initially many aspects of a performance assessment (e.g., waste site and facility) must be evaluated individually. However, all aspects must be combined eventually in a comprehensive, integrated analysis to demonstrate that the entire disposal system will perform as required. Once the behavior and performance of individual components are determined, their influence on other components must be considered. The constraints on assumed conditions imposed by interfaces between various components must be considered in the comprehensive, integrated analyses of system performance, and the comprehensive, integrated performance of the system must be assessed under each set of system performance assumptions.

3.3 IDENTIFY POTENTIAL RADIATION EXPOSURES

The potential for human exposures to radiation depends on the extent and nature of human activity in areas containing or potentially contaminated with radioactivity. The assessment of these exposures requires identifying the potential receptors and defining the applicable exposure scenarios. These aspects of the performance assessment are discussed in the following subsections.

3.3.1 Identify Potential Receptors

The performance objectives for an LLRW disposal facility require that members of the public be protected from the effects of potential releases of radioactivity from the facility and that potential inadvertent intruders be protected from the waste. The performance assessment for the facility must provide reasonable assurance that these objectives will be met.

The applicant should identify and characterize those persons who may be exposed to the waste itself or to radioactivity released from the waste. Persons whose potential for exposure should be evaluated include:

- Persons residing at or near the boundary of the disposal facility during and following disposal operations.
- Persons who inadvertently intrude into the disposal site (whether or not into the waste itself) following an assumed loss of active institutional control (nominally, 100 years after facility closure).

The department has determined that only those persons considered by other regulatory agencies (such as NRC and U.S. Environmental Protection Agency), and for whom assumptions are internally consistent, need be considered in the performance assessment process. Furthermore, the department does not require that intentional intruders be protected following the site's assumed loss of institutional control.

Internal consistency refers to conditions inherent in defining the potentially exposed individual. If a particular scenario assumes a condition or characteristic in defining one aspect of the scenario, it should not violate that condition or characteristic in defining another aspect. For example, Commonwealth

regulatory siting requirements disallow construction of the facility within a coastal floodplain (25 PA 236.126(a)(2)). Therefore, it would not be internally consistent to postulate conditions at the disposal site that are typical of a coastal floodplain.

In identifying potentially exposed individuals, the applicant should consider the effects of the three sets of system performance assumptions described in Subsection 3.2.

3.3.2 Define Radiation Exposure Scenarios

Having identified the potential receptors as described in Subsection 3.3.1, the applicant should characterize situations in which persons may be exposed to the waste or to releases from the disposal facility. These situations, or exposure scenarios, should be broad enough in scope to reasonably demonstrate that no individual will receive radiation exposures greater than those received by the individuals chosen for evaluation. Exposure scenarios should address the potential for both acute and chronic exposures. The exposure scenarios that should be considered in a performance assessment include the following:

- Normal Operations—Adjacent Resident.
- Accidental Operating Conditions—Adjacent Resident.
- Post-Closure—Adjacent Resident.
- Passive Institutional Control Intruder—Drilling.
- Passive Institutional Control Intruder—Construction.
- Passive Institutional Control Intruder—Discovery.
- Passive Institutional Control Intruder—Agriculture.

The likely radiation exposures to members of the public residing near the disposal facility should be estimated for normal operations (Normal Operations—Adjacent Resident). Normal operational releases such as those from contaminated surfaces, although they may be extremely small, should be estimated and shown to satisfy the performance objective stated in 25 PA 236.13. Radiation exposures from normal operations may also occur from the external gamma radiation levels of the waste containers and modules being handled at the facility. Exposure of members of the public residing adjacent to or near the disposal facility to external gamma radiation that originates from waste containers should be estimated.

Radioactive releases during accidental operating conditions, whether of natural or artificial origin (Accidental Operating Conditions—Adjacent Resident), also should be estimated. The applicant should identify a set of accidents that involve a variety of waste containers and waste types (i.e., waste streams, waste forms, and waste classes). Bounding conditions within the set of accidents should be identified and worst cases evaluated to determine limiting potential radiation exposures to those residing near the facility. Accidental operational conditions may also exist in which members of the public may receive abnormal external radiation exposures because of the accident conditions. These exposures also should be evaluated.

The Post-Closure—Adjacent Resident scenario considers the impact from waste disposal on the nearest potential resident. Contaminated water from the disposal units is assumed to flow vertically to the regional aquifer, then horizontally to a well. The well is assumed to supply the resident with water for direct consumption, irrigation or watering of crops, and watering cattle raised as a source of food. The resident receives doses from external radiation, ingesting contaminated water and foodstuffs, and inhaling airborne radionuclides transported from the disposal site or suspended from soil surfaces following irrigation or watering.

A unique aspect of Pennsylvania regulations is the explicit requirement that the license applicant demonstrate that potential radiation exposures to inadvertent intruders will not exceed 25 millirems per year (25 PA 236.320(c)). To satisfy this requirement, each of the intrusion scenarios described in the paragraphs that follow (and others that are reasonable, considering the characteristics of the disposal facility and natural site) must be characterized sufficiently to allow radiation exposures to be calculated.

In the Passive Institutional Control Intruder—Drilling scenario, the intruder is assumed to come onto the site after the end of active institutional control to develop a water well. In the well drilling process, the driller encounters the waste and unknowingly brings a small amount of it to the surface, where it is spread over a limited area. However, members of the drilling crew eventually recognize the unusual character of the material being brought to the surface, terminate drilling activities, and move away from the waste. Before withdrawing, the crew members are exposed briefly to direct external gamma radiation, and may inhale or ingest suspended radionuclides.

The Passive Institutional Control Intruder—Construction scenario involves an intruder who comes onto the site after the end of active institutional control and constructs a home at a location adjacent to that where Passive Institutional Control Intruder—Drilling activities occurred. The individual is assumed to excavate a basement for the house and, depending upon the relative depths of the basement excavation and disposed waste, may encounter the disposal unit during excavation. If the disposal unit is structurally intact, the intruder recognizes an unusual condition, ceases excavation activities, and withdraws after only brief exposure to external gamma radiation, shielded by the disposal unit roof. If, however, the disposal unit is not structurally intact, the intruder continues excavation to the desired depth for the home's basement. If the intruder contacts the waste, he or she may inhale and ingest suspended radionuclides and be exposed to external gamma radiation from the excavated material and waste.

The Passive Institutional Control Intruder—Discovery scenario is similar to the Passive Institutional Control Intruder—Construction scenario. In this scenario, however, the intruder recognizes that he or she is digging into very unusual material as soon as the waste is encountered. The individual abandons construction efforts and, consequently, is exposed for a much shorter period. Exposures to the intruder would most likely be limited to inhalation of suspended radionuclides and external radiation from the waste.

In the Passive Institutional Control Intruder—Agriculture scenario, the intruder is assumed to take residency in the home constructed under the Passive Institutional Control Intruder—Construction scenario. The individual grows crops in contaminated material brought to the surface during basement excavation and well drilling activities, and irrigates or waters the crops with contaminated well water. Animals consume contaminated pasture grass and water from the well. Water drawn from the well serves as a source of drinking water for the intruder. The individual is assumed to inhale suspended radionuclides, consume contaminated foodstuffs and water, and receive external radiation from excavated and buried waste.

The preceding scenario descriptions should not be rigidly applied. Rather, they should be modified as necessary to account for the specific characteristics of the disposal site and facility. For example, drilling techniques used in a locale for well development may typically involve sufficient amounts of water that

suspension of radionuclides in the air is not reasonable. To account for this fact, the characteristics of the Passive Institutional Control Intruder—Drilling scenario should be appropriately revised.

For all intrusion scenarios, the applicant should consider the effects that variations in waste characteristics could have on the projected radiation exposures to inadvertent intruders. Overall waste concentrations must satisfy waste characteristics requirements of 25 PA 236, Subchapter F. However, because the radionuclide concentrations are not likely to be constant across all wastes, these variations should be addressed. Intrusion into waste of atypical but acceptably high concentrations should be evaluated. To the extent that such variations affect the projected radiation exposures to members of the public, their effects on these projections should also be considered.

In describing exposure scenarios, the applicant should consider the effects and constraints associated with the three sets of system performance assumptions described in Subsection 3.2.

3.4 DEVELOP CONCEPTUAL EXPOSURE MODELS

Conceptual models should be developed for each of the exposure scenarios defined in the previous step (see Subsection 3.3 and Figure 3-1). The development of conceptual models defines the release mechanisms, transport pathways, and modes of uptake that combine to produce the postulated exposures. The following subsections discuss typical release mechanisms, transport pathways, and uptake modes, as well as the information required to evaluate them.

3.4.1 Identify Radionuclide Release Mechanisms

The applicant should identify and describe the phenomena and processes that control or influence the release of radionuclides from the disposal facility, including:

- Water infiltration.
- Disposal unit and waste module degradation.
- Leaching.
- Gas generation.

Estimating water infiltration requires knowledge of site meteorological conditions, facility surface water control and drainage features, engineered cover system design, waste characteristics, disposal unit structural features, and groundwater system characteristics. Water infiltration can be estimated only with some knowledge or indication of the condition of the engineered cover system. The condition of the cover system depends directly upon the condition and function of the disposal unit, upon which it is constructed and upon which it depends for stability and integrity. Conversely, the disposal unit depends upon the cover system for protection from conditions that induce degradation processes. These effects should be considered in projecting infiltration through the cover system.

Disposal unit and waste module degradation is influenced by several factors. These include concrete characteristics, the environment in which the structures are placed, the physical loads to which the structures are subjected, and the characteristics of the waste (NRC, 1991c). Additional guidance on projecting disposal unit and waste module degradation is provided in PADEP, 1998.

In the performance assessment, the applicant should take no credit for any beneficial effects of the container in which the waste arrives at the disposal facility (i.e., the shipping container). However, the applicant may take credit for the beneficial effects of the engineered cover, disposal unit, and waste module (to the extent that such effects are justified by qualified data, technical analyses, or reference to work by others) in conducting radiological performance assessments. In contrast, the applicant may only consider the beneficial effects of the disposal unit in demonstrating leak resistance as required by 25 PA 236.314(b)(1).

Leaching of radioactive contaminants from the waste into water is especially important where the potential exists for contaminant migration through the groundwater pathway (NRC, 1991c). Leaching of radioactive contaminants depends on the physical waste form, chemical characteristics of each radionuclide, and availability of water in the disposal unit. Mechanisms for radioactive releases from the waste include distribution-coefficient (K_d) leaching, diffusion, and leaching resulting from corrosion. The applicant should carefully consider the applicability of these mechanisms to ensure that release projections are conservative yet realistic.

Gas generation may occur if the waste contains tritium, carbon, or radium. Carbon and tritium may be generated from biological or chemical decomposition. Radon is a product of radioactive decay within the uranium and thorium decay chains. The applicant should assess releases of radioactive gases from the disposal unit directly to the atmosphere.

3.4.2 Identify Radionuclide Transport Pathways

For each radiation exposure scenario considered, the applicant should identify and describe pathways by which radionuclides released from the disposal unit may be transported away from the disposal unit (PADEP, 1997d and PADEP, 1997e). These include:

- Groundwater.
- Surface water.
- Atmospheric diffusion and dispersion.
- Gaseous releases through the cover system.
- Intrusion into the waste.
- Food chain transport.

The groundwater pathway may be especially important in assessing the performance of a disposal system in areas characterized by high precipitation and shallow regional aquifers. In such areas, radionuclides released from the waste may migrate vertically through the unsaturated zone and horizontally in saturated media to a nearby well or point of discharge. Factors that should be considered in assessing the transport of contaminants from the disposal unit via the groundwater pathway include water infiltration, geologic characteristics, hydrologic characteristics, and sorption phenomena.

The surface water pathway includes the transport of radionuclides to both moving and standing water bodies. Factors requiring consideration include flow rates, mixing characteristics, water chemistry, and water body dimensions. The applicant also should consider contaminant deposition to sediments.

Gases generated by chemical decomposition of the waste (tritium or carbon) or radioactive decay (radon) can diffuse through disposal structures and the engineered cover system and be released. The factors that influence the diffusion of such gases include the diffusion coefficient of the gas in the

construction materials and soils and the design of the structures and cover systems. Variations in barometric pressure also may affect the rate at which gases are transported from the disposal unit.

Atmospheric diffusion and dispersion involve the transport of radionuclides released from the disposal unit into the atmosphere. The releases may be gaseous or particulate in form. The applicant should consider wind speed distribution, wind direction distribution, stability conditions, resuspension, deposition, and washout in assessing the behavior of contaminants in the atmosphere.

Intrusion into the waste may result in the accumulation of waste constituents at the surface of the disposal facility. Intrusion may occur from human activities or biointrusion. Primary modes of human intrusion include excavation into the disposal unit and drilling. Biointrusion may occur from plant root penetration into the waste or animal burrowing. These models of intrusion are of lesser significance because the waste will be contained inside engineered structures into which biointrusion is less likely. The extent of root penetration is influenced by moisture conditions at the site, soil characteristics, the presence of engineered structures, and the plant species that are indigenous to the area, including those plants that establish themselves over the stabilized facility, or those that may grow as a result of plant succession. The extent of animal burrowing depends on the species indigenous to the area and their typical behaviors.

The food chain pathway is a potentially important means of radionuclide transport. Plants may become contaminated by extending their roots into the waste, growing in contaminated soil, or consuming contaminated water. Animals may become contaminated through direct contact with waste or by consuming contaminated water or plants. Information needed to assess the effects of the plant and animal food chains includes:

- Plant species.
- Animal species.
- Cover systems characteristics.
- Water and food consumption rates.
- Plant uptake factors (e.g., from soil to plant tissue).

Transport of radioactive contaminants from the waste form through surrounding materials (such as grout, concrete, and sand backfill) and environmental media must be closely coordinated and integrated with

the modeling of water infiltration, structural stability, and releases from waste forms. The applicant should ensure that assumptions made in evaluating each aspect of release and transport from the disposal unit are internally consistent. Further, the applicant should consider and evaluate the system performance conditions, as described in Subsection 3.2.

3.4.3 Identify Radionuclide Uptake Modes

The applicant should identify and describe all phenomena that influence human exposure to external radiation or human uptake of radionuclides, including:

- Water ingestion.
- Food ingestion.
- Inhalation.
- External radiation.
- Dermal absorption.

Ingestion of contaminated water and food results in internal doses. The magnitude of the dose received by an individual who consumes contaminated water or food depends on several factors, including the radionuclides present in the water or food and their concentrations in each, the water or food consumption rate, and the fraction of the person's diet that consists of contaminated foodstuffs.

Internal doses may also result from the inhalation of radioactivity. The dose received from inhalation is a function of the radionuclide concentration in the air, inhalation rate, particle size distribution, distribution of radionuclides by particle size, and length of time a person breathes contaminated air.

An individual may receive external radiation from waste being handled at the disposal facility or from radionuclides that have migrated from the site. The magnitude of the exposure through this mode is determined by:

- Radionuclide concentrations in the waste or contaminated media.
- The configuration of the waste or contaminated media.
- Characteristics of shielding provided by operational activities, contaminated media, and material between the source and the exposed individual.

- The distance between the source and the exposed individual.
- The length of time the individual is exposed to the radiation.

Absorption of radiological contaminants through the skin is not expected to be significant unless tritium is present. Nevertheless, the applicant should assess the extent to which this uptake mode may influence the performance of the disposal facility.

3.5 IDENTIFY AND/OR DEVELOP CALCULATIONAL TOOLS

Once a conceptual exposure model is developed, the applicant should determine appropriate mathematical representations of each model component (see Figure 3-1). This process involves identifying models available for each phenomenon, evaluating model characteristics and capabilities, comparing model characteristics and capabilities to the most important aspects of the phenomena, and selecting the preferred model. Typical categories include:

- Site characterization.
- Waste characterization.
- Facility design.
- Structural degradation.
- Infiltration and water management.
- Radionuclide release from the waste.
- Radionuclide transport.
- Food chain.
- Radionuclide uptake.
- Dose.
- Risk.

In general, there are several mathematical representations or models for each release mechanism, transport pathway, and uptake mode. Some models of a given phenomenon are simpler than others, and each has its own data requirements. The applicant should evaluate the ability of each model to represent the actual phenomenon, considering the limitations and strengths of each. Normally, one model will offer advantages for a particular aspect of the performance assessment. Occasionally, multiple models may be used to represent a single aspect of the analysis to provide perspective in the performance assessment process.

Most models of release mechanisms, transport pathways, and uptake modes have been implemented as computer codes and are widely available. Computer codes may be dedicated to evaluating a single phenomenon or may analyze the performance of the entire disposal system under certain conditions. Codes with a narrow scope tend to be more complex, while those that address the entire disposal system typically are more superficial. Highly specialized codes usually have very detailed data requirements, while system-level codes require less detailed data requirements.

As the amount of site-specific data increases, existing codes may require modification to adequately represent the phenomena at the disposal facility. When such modifications are necessary or preferable, the applicant should ensure that the resulting code is properly implemented and documented. The performance of the code should be benchmarked and validated to the extent practical. The applicant also should provide and describe all code modifications for department review and evaluation.

As a general rule, the model selected should be no more sophisticated than is necessary to adequately represent the actual phenomenon. Furthermore, the sophistication of the model(s) used in the performance assessment should be consistent with the level of detail of data available for input.

In developing calculational tools, the applicant should ensure that all phenomena and processes possible under the three sets of system performance assumptions described in Subsection 3.2 are addressed.

3.6 ESTIMATE AND EVALUATE POTENTIAL RADIATION EXPOSURES

Once the first four major steps of the performance assessment have been completed, the applicant can begin to evaluate the performance of the LLRW disposal system (see Figure 3-1). The assessment will project the extent to which the disposal system satisfies the performance objectives, identify key input parameters used in the analysis, and examine the effects of uncertainty on the projected results. Following the assessment, the applicant should review the results for reasonability and for consistency with data collected during characterization efforts. These aspects of the performance assessment are discussed in the following subsections.

3.6.1 Calculate Radiological Performance

Performance assessment simulations project the extent of compliance with the performance objectives under the three major sets of system performance assumptions described in Subsection 3.2. Under each set of system performance assumptions (i.e., expected, design basis, and degraded), the applicant must justify or assume many conditions of the environmental or disposal features. The applicant should ensure that these justifications and assumptions and the associated simulations are conservative (i.e., that the projected radiation exposures will not be understated), but also realistic. Extreme levels of conservatism may not be useful.

The groundwater pathway typically is of great interest in the LLRW disposal facility licensing process and has a substantial potential to produce the most restrictive radiation exposures to members of the public. Therefore, the applicant should ensure that releases to and transport through the groundwater pathway are thoroughly and comprehensively evaluated. The hydraulic performance of the engineered cover system, disposal unit, waste modules, and waste form has critical effects on the performance of the groundwater pathway. Thus, the applicant should address the performance of each of these components under the three major sets of system performance assumptions. That is, the applicant should project radiation exposures under expected conditions, design basis conditions, and degraded conditions.

The applicant should ensure that water balance calculations are performed, justified, and reported under the three sets of assumptions that affect the evaluation of all radiation exposure scenarios (again, see Subsection 3.2). The effects between the cover system, disposal unit, and waste module must be addressed in detail in evaluating water infiltration into the waste module and releases of radioactive material from the disposal unit. The applicant should address in detail the effects of structural and hydraulic degradation. Phenomena and effects such as concrete degradation, cover settlement, cover differential settlement, desiccation cracking of clay, freeze-thaw damage to low-permeability (clay) layers, intrusion by plants and animals, plant succession, and the increase of effective layer permeability over time should be taken into consideration.

Performance assessments (i.e., radiation exposure simulations) should provide assurance that projected peak exposure rates will not exceed the limits of 25 PA 236.13 for at least 1,000 years following cessation of disposal operations. Thus, for the purpose of determining compliance with the quantitative limits of Pennsylvania regulatory requirements (i.e., 25 PA 236.13) to protect members of the general public, the applicant must project radiation exposure rates and explain in detail the performance assessment results for at least 1,000 years following cessation of disposal operations. Performance assessment results within this time horizon also form the basis for judging acceptability of efforts to design and construct the disposal facility to meet the zero-release goal of Pennsylvania regulations (25 PA 236.301(b)).

Quantitative radiation exposure projections for times following 1,000 years after cessation of disposal operations, although characterized by larger uncertainties, also provide useful information that should be considered in the design process and in making licensing decisions. Therefore, the department will view these results from a broader perspective than implied by the quantitative dose limits of the performance objectives of 25 PA 236. The department will consider radiation exposure projections for times later than 1,000 years after cessation of disposal operations to gain needed perspective and understanding about the relative contributions the site and the facility design make toward meeting performance objectives. Thus, for the purpose of conveying a broader perspective on the long-term performance of the disposal facility, the applicant must present and explain projections of radiation exposures for 10,000 years following cessation of disposal operations. In addition, the applicant must carry out quantitative analyses until changes in projected radiation exposure rates with time have stabilized.

In assessing the performance of the disposal facility, the applicant should not take credit for the integrity of containers in which waste is received at the disposal facility (i.e., shipping containers). The period over which the integrity of these containers can be assured is sufficiently short that the containers can have no appreciable effect on disposal system performance in the time frames over which performance must be projected and reported. In contrast, the applicant should demonstrate that the disposal unit will retain its integrity (with regard to its structural and hydraulic properties) for a time sufficient to provide reasonable assurance that leak resistance will be provided for at least 100 years, as required by 25 PA 236.314(b)(1).

The applicant should ensure that radiation exposures are estimated using standard methodologies, assumptions, and conversion factors, as appropriate. For example, the dose conversion factors published in Federal Guidance Reports 11 and 12 (EPA, 1988 and EPA, 1993) should be used. Assumptions about the mass and consumption rates of persons assumed to potentially be exposed to radioactive contaminants should be consistent with guidance provided in EPA, 1991, or should be justified using site-specific conditions, information, and data.

The assessment of radiation exposures should be conducted in sufficient detail that the relative contributions of the disposal facility and the natural site can be distinguished, as required by Pennsylvania regulations (25 PA 236.209(1)). To comply with this requirement, the applicant may need to model the disposal system iteratively. In each iteration, the applicant might account for only those physical components whose contribution is being evaluated in that iteration.

In calculating projected exposures, the applicant should ensure that the effects of all conditions defined or inferred by the three sets of system performance assumptions are assessed (see Subsection 3.2).

3.6.2 Perform Sensitivity and Uncertainty Analyses

A significant element of the performance assessment is the analysis of its sensitivities and uncertainties (NRC, 1990 and DOE, 1990). Sensitivity analyses are conducted to identify important elements and parameters of the system, and involve estimates of changes in performance measures produced by changes in the variables of the system. Uncertainty analyses are conducted to identify uncertainties associated with the important elements and parameters of the system, and understand the impacts these uncertainties have on the conclusions drawn from the calculated performance measures. The disposal system can be judged to comply with the performance objectives only after all relevant uncertainties in analyses have been considered.

Sensitivity analyses typically involve changing each model parameter while leaving all other parameters at their nominal values, and then quantifying the relative effect of this change on the model projection. Through this process, the parameters having the greatest influence on the model projections are identified.

The sensitivity analysis may be conducted before or after the uncertainty analysis is conducted. When conducted prior to the uncertainty analysis, the sensitivity analysis may help limit the scope of the uncertainty analysis by determining which model input parameters significantly affect the projected facility performance. In this sequence of events, the uncertainty analysis considers only the most sensitive parameters in the model. In other situations, a sensitivity analysis will use simulation results from an uncertainty analysis as input to statistical software to determine parameter sensitivities.

Sensitivity analysis allows the applicant and the department to focus on the model parameters of greatest consequence to the projected results. The results of the analysis may justify the use of simpler models, or they may provide insights into how the disposal system functions.

The need for uncertainty analysis arises from the fact that environmental and dose assessment models are inherently uncertain. Uncertainty in model projections arise from a number of sources. NRC has categorized these uncertainties as follows (NRC, 1994):

- Uncertainty in conceptual and mathematical models (model uncertainty).
- Uncertainty about the future state of the site (scenario uncertainty).
- Uncertainty in the input data used in the models (parameter uncertainty).

Model uncertainty pertains to the uncertainty associated with formulating the conceptual models of the disposal system and implementing those models as analytical or numerical solutions in computer codes. Uncertainties in the conceptual models may arise from limitations in the site data, ambiguities in interpreting site features, or inadequacies in the knowledge of relevant site processes. Sources of mathematical model uncertainties include the use of inappropriate mathematical approximations of environmental phenomena and errors introduced during coding. The analysis of model uncertainty generally involves collecting data to test or validate specific submodels or developing alternative models for possible future site conditions.

Analysis of scenario uncertainty considers errors introduced in model projections resulting from incorrect assumptions about the future state of the disposal site. The assumed future state of the site used in defining and justifying the exposure scenarios may not correspond to all possible future site conditions. The effects of scenario uncertainty typically are evaluated by selecting a comprehensive set

of exposure scenarios that accounts for disturbances to the disposal system that result from unanticipated processes and events.

In addressing scenario uncertainty, the applicant must project facility performance under the three major sets of system performance assumptions defined in Subsection 3.2 of this document. As a minimum, the applicant must evaluate the disposal system performance under the various constraints of the expected, design basis, and degraded conditions. Such evaluations will necessitate that the applicant project or assume (and justify) performance of principal design features under philosophical conditions consistent with and comparable to those of the three major sets of system performance assumptions.

Parameter uncertainty deals with the input parameters used in the mathematical models. Sources of parameter uncertainty include uncertainty associated with laboratory and field measurements, uncertainty in determining parameter values for use in a model, and uncertainty associated with the intrinsic variability of natural systems. Parameter uncertainties could be evaluated using one of several methods (NRC, 1994), including:

- Analytical methods and stochastic approaches.
- Monte Carlo methods, which include random and Latin Hypercube sampling approaches.
- Response surface methodology, which requires development of a simple approximation of a complex model.

3.6.3 Review Calculated Results for Reasonability and Consistency with Assumed Conditions/Preliminary Data

The applicant should review the results of all performance assessment calculations to ensure that they are reasonable and internally consistent. The results should be compared with assumed conditions to ensure that no logical contradiction exists. If calculated results infer a condition that is different from an assumed condition, the applicant should pursue the issue to determine whether the assumed condition should be revised, or whether aspects of the modeling process should be questioned.

The process of judging the reasonability of calculated results requires knowledge of the sensitivities and uncertainties. The results of the sensitivity and uncertainty analyses, and the perspective they provide, can help in evaluating whether calculated results are reasonable or require revision.

3.7 REVISE INPUTS, MODELS, AND ASSUMPTIONS

Upon reviewing the results of the performance assessment, the applicant should determine the need for revisions to the modeling process (see Figure 3-1). The extent of revisions may be as superficial as revising selected input parameter values. However, the review of the results may also reveal that the entire performance assessment process should be revised.

The applicant should consider the potential effects that any data revisions may have on performance assessment results. If the revisions are expected to have important effects, the assessment should be revised for consistency with the data revisions. The applicant also should subject the revised performance assessment to similar scrutiny to ensure that it is reasonable and internally consistent.

Revisions in the performance assessment process may be made within a particular stage of the facility life, or as the facility evolves from one stage to the next. If the revisions are made within a single facility stage, they may be made to virtually any step in the performance assessment process (see Figure 3-1). If the facility is progressing from one stage to the next, all steps in the process should be reviewed and previous decisions evaluated according to the most recent and complete information available.

REFERENCES

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PADEP (Pennsylvania Department of Environmental Protection). 1997c. *Staff Technical Report: Characterization of Sites for Low-Level Radioactive Waste Disposal in Pennsylvania.* (in preparation).

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EPA (U.S. Environmental Protection Agency). 1988. "Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion, and Ingestion." Prepared by Oak Ridge National Laboratory, Federal Guidance Report No. 11.

EPA (U.S. Environmental Protection Agency). 1991. *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual, Supplemental Guidance — Standard Default Exposure Factors.* OSWER Directive 9285.6-03.

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NRC (U.S. Nuclear Regulatory Commission). 1990. "A Performance Assessment Methodology for Low-Level Waste Facilities." Prepared by Science Applications International Corporation. NUREG/CR-5532. July 1990.

NRC (U.S. Nuclear Regulatory Commission). 1991. "Selection of Models to Calculate the LLRW Source Term." Prepared by Brookhaven National Laboratory. Upton, NY, NUREG/CR-5773. October 1991.

NRC (U.S. Nuclear Regulatory Commission). 1994. *Branch Technical Position on Performance Assessment for Low-Level Radioactive Waste Disposal Facilities.* Draft Report. January 1994.

APPENDIX A

TECHNICAL RESOURCES ON PERFORMANCE ASSESSMENT

APPENDIX A TECHNICAL RESOURCES ON PERFORMANCE ASSESSMENT

The following publications provide guidance for conducting radiological performance assessments. Several of these reports have been issued by agencies that have no regulatory standing in the Commonwealth or address types of radioactive waste other than low-level radioactive waste (LLRW). These resources are included because they help provide a broad perspective on the current level of expertise on the performance assessment process. Reading and reviewing these documents will provide more detailed information on the purpose and nature of performance assessment.

U.S. Nuclear Regulatory Commission

> Kozak, M.W. et al., 1990. "Background Information for the Development of a Low-Level Waste Performance Assessment Methodology, Computer Code Implementation and Assessment." Prepared by Sandia National Laboratories for the U.S. Nuclear Regulatory Commission, NUREG/CR-5453.

This document provides the implementation and assessment of computer codes for an LLRW performance assessment methodology. It presents a comparison between simple and complicated codes for groundwater transport, source term, surface water transport, air transport, food chain, and dosimetry analyses. Details of recommended analytical methods are given, along with sensitivity analyses that demonstrate important aspects of the solutions.

> Davis, P.A. et al. 1990. *Uncertainties Associated with Performance Assessment of High-Level Radioactive Waste Repositories, A Summary Report.* Prepared by Sandia National Laboratories for the U.S. Nuclear Regulatory Commission, NUREG/CR-5211.

This publication summarizes work in the topical area of uncertainty associated with performance assessments of high-level radioactive waste repositories. Three major categories of uncertainty covered in this report are uncertainty in the future state of the disposal system; uncertainty in models needed to simulate the behavior of disposal systems; and uncertainty in data, parameters, and coefficients needed for the analysis of systems.

Kozak, M.W. et al. 1990. *A Performance Assessment Methodology for Low-Level Waste Facilities.* Prepared by Sandia National Laboratories for the U.S. Nuclear Regulatory Commission, NUREG/CR-5532.

This report provides a summary of background reports on the development of the methodology for LLRW facility performance assessment, as well as an overview of the models and codes selected for the methodology. It includes a discussion of models and associated assumptions appropriate for each phase of the methodology.

Sullivan, T.M. 1991. "Selection of Models to Calculate the LLW Source Term." Prepared by Brookhaven National Laboratory for the U.S. Nuclear Regulatory Commission, NUREG/CR-5773.

This document provides a brief overview of disposal practices and reviews existing source-term models as background for selecting appropriate models for estimating the source term. It presents the rationale for selecting and mathematical details of the models, and provides guidance on combining the inventory data with appropriate mechanisms describing release from the disposal facility.

Sullivan, T.M. and C.J. Suen. 1991. *Low-Level Waste Source Term Model Development and Testing.* Prepared by Brookhaven National Laboratory for the U.S Nuclear Regulatory Commission, NUREG/CR-5681.

This publication develops a system model capable of predicting radionuclide release rates from a shallow land burial facility. It discusses models that predict water flow and radionuclide transport in detail, and presents results obtained from applying the models to shallow land burial trenches over a range of expected conditions.

Walton, J.C. et al. 1990. "Models for Estimation of Service Life of Concrete Barriers in Low-Level Radioactive Waste Disposal." Prepared by the Idaho National Engineering Laboratory, EG&G Idaho, Inc., for the U.S. Nuclear Regulatory Commission, NUREG/CR-5542.

This report reviews mathematical models for estimating the degradation rate of concrete in typical LLRW disposal facility service environments. The bases for models taken from the literature are explained. Example calculations are included to illustrate the application of the models and to indicate the types of predictions that can be expected from the models.

U.S. Nuclear Regulatory Commission. 1994. "Draft Branch Technical Position on Performance Assessment for Low-Level Waste Disposal Facilities." Low-Level Waste Management Branch, January 1994.

NRC developed this technical position paper to provide license applicants, licensees, states, and compacts with an acceptable strategy and methodology for performing the technical analysis required to demonstrate compliance with 10 CFR 61.

Pommersheim, J.M. and J.R. Clifton. 1991. "Models of Transport Processes in Concrete." Prepared by the National Institute of Standards and Technology for the U.S. Nuclear Regulatory Commission, NUREG/CR-4269.

This report discusses and presents models suitable for modeling the long-term performance of concrete structures. Conceptual and mathematical models for modeling the ingress of aggressive ions into the structures and the leaching of constituents from the concrete are presented. The application of these models to long-term performance assessments is discussed.

MacKenzie, D.R. et al. 1986. "Preliminary Assessment of the Performance of Concrete as a Structural Material for Alternative Low-Level Radioactive Waste Disposal Technologies." Prepared by Brookhaven National Laboratory for the U.S. Nuclear Regulatory Commission, NUREG/CR-4714.

This study develops information required to evaluate the long-term performance of concrete as a structural material for LLRW disposal. Information in the literature is reviewed and analyzed, and criteria for evaluating the performance of concrete are identified. The properties of coatings and their possible use in protecting the concrete are discussed. Accelerated and long-term testing of concrete is discussed, with emphasis on its application to modeling long-term performance.

Walton, J.C. and R.R. Seitz. 1991. "Performance of Intact and Partially Degraded Concrete Barriers in Limiting Fluid Flow." Prepared by EG&G Idaho, Inc. for the U.S. Nuclear Regulatory Commission, NUREG/CR-5614.

This document examines the factors that control fluid flow through intact and degraded concrete disposal facilities. Simplified models are presented for estimating the buildup of fluid above a vault; fluid flow through and around intact vaults; through flaws in coatings/liners applied to a vault; and through

cracks in a concrete vault; and the influence of different backfill materials around the outside of the vault. Example calculations are provided to illustrate the parameters and processes that influence fluid flow.

> U.S. Nuclear Regulatory Commission. 1991. *Standard Format and Content of a License Application for a Low-Level Radioactive Waste Disposal Facility, Safety Analysis Report.* NUREG-1199, Rev. 2, January 1991.

This document explains what information must be provided in a Safety Analysis Report for an LLRW disposal facility. The section on safety (performance) assessment discusses the release of radioactivity from the facility, intruder protection, and long-term stability of the disposal site.

> U.S. Nuclear Regulatory Commission. 1991. "Standard Review Plan for the Review of a License Application for a Low-Level Radioactive Waste Disposal Facility." NUREG-12009, Rev. 2, January 1991.

This report provides guidance to NRC staff reviewers who perform safety reviews of applications to construct and operate LLRW disposal facilities. It describes the types of performance assessment analyses it expects to be performed, reported, and justified. Important aspects of the performance assessment considered in the report include characteristics of the waste, infiltration, potential releases under normal and accident conditions, transfer of releases to human access locations, intruder protection, and long-term stability.

U.S. Department of Energy

> Case, M.J. and M.D. Otis. 1988. "Guidelines for Radiological Performance Assessment of DOE Low-Level Radioactive Waste Disposal Sites," U.S. Department of Energy, DOE/LLW-62T.

This document provides guidance for conducting radiological performance assessments of U.S. Department of Energy LLRW disposal facilities. Discussions on performance assessment criteria, screening techniques used to focus resources on critical components, selection and/or development of suitable models, and techniques for comparing assessment results with performance objectives are included.

Maheras, S.J. and M.R. Kotecki. 1990. *Guidelines for Sensitivity and Uncertainty Analyses of Performance Assessment Computer Codes*. U.S. Department of Energy, DOE\LLW-100.

This report discusses the steps taken in performing sensitivity and uncertainty analyses of a LLRW disposal facility performance assessment. Techniques for conducting the uncertainty analysis, including analytical Monte Carlo, response surface, and differential methods, are discussed. Sensitivity analysis techniques discussed include coefficient and correlation methods.

Kennedy, W.E. Jr. and R.A. Peloquin. 1988. *Intruder Scenarios for Site-Specific Low-Level Radioactive Waste Classification.* U.S. Department of Energy, DOE\LLW-71T.

This report describes the types of intruder scenarios that should be considered when assessing potential intruder doses. It provides the results of generic calculations performed using unit concentrations of various radionuclides as a comparison of the magnitude of importance of the various intruder exposure scenarios, and shows the relationship between the generic doses and waste classification limits for defense wastes.

State Agencies

New York State Department of Environmental Conservation. 1988. *Supplement to the July 1987 Draft Environmental Impact Statement for Promulgation of 6NYCRR Part 382: Regulations for Low-Level Radioactive Waste Disposal Facilities, Modeling and Dose Assessment of Alternative Low-Level Radioactive Waste Disposal Methods in New York State.* Division of Hazardous Substances Regulation, Bureau of Radiation.

This report discusses modeling and dose assessment techniques of alternative LLRW disposal methods in accordance with the New York State regulations for LLRW disposal facilities (6NYCRR Part 382).

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STAFF TECHNICAL REPORT SERIES:

USING ENGINEERED STRUCTURES TO PROVIDE ENHANCED CONTAINMENT

Commonwealth of Pennsylvania
Department of Environmental Protection
Bureau of Radiation Protection
Harrisburg, PA

http://www.dep.state.pa.us/
(choose information by subject/choose Radiation Protection)

June 1998

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APPENDIX A—TECHNICAL RESOURCES FOR THE DESIGN AND CONSTRUCTION OF ENGINEERED STRUCTURES

List of Figures

GLOSSARY/definitions

Concrete structure—A general term for any number of elements that comprise the disposal unit, such as floors, walls, and ceilings.

Container—The first enclosure that encompasses the low-level radioactive waste. In demonstrating compliance with enhanced containment requirements a concrete overpack, or similar package, is considered to be a container.

Containment—The function of isolating radioactive waste from the biosphere by emplacement of the waste within a container, waste module, or disposal unit.

Disposal facility—The buildings, equipment, and other engineered features, including disposal units and temporary holding facilities, within the disposal site that are used for the disposal of low-level radioactive waste.

Disposal site—The property, including improvements thereon, that are used for disposal of low-level radioactive waste. The term consists of the disposal units and the buffer zone.

Disposal unit—A discrete portion of the disposal site into which waste is placed for disposal.

Engineered structure—A manmade state-of-the-art barrier designed to:

1. Provide additional measures for containment of radioactive waste from the environment.

1. Provide protection for an inadvertent intruder.

1. Provide stability of the disposal facility.

1. Prevent radioactive release.

In demonstrating compliance with enhanced containment requirements, the disposal unit must function as the engineered structure.

Enhanced containment—Additional isolation of the radioactive waste from the environment as provided by engineered structures.

Leak resistance—The material properties of the disposal facility design that retard or prevent migration of water.

Post-closure observation and maintenance period. The period of time following site closure during which the site operator is preparing the site for transfer to the custodial agency.

Waste—Low-level radioactive waste.

Waste module—A discrete assembly of waste containers within a disposal unit. A waste module is established when two interior walls are constructed within a disposal unit. The purpose of a waste module is to enable detection and identification of water or leached radioactive materials within a disposal unit.

1. INTRODUCTION

The Pennsylvania Department of Environmental Protection (the Department) is responsible for promulgating regulations that govern the siting, design, construction, operation, closure, and post-closure maintenance of a low-level radioactive waste (LLRW) disposal facility in the Commonwealth of Pennsylvania (the Commonwealth) (CPA 88). These regulations are contained in Title 25 of the Pennsylvania Code, Chapter 236, entitled "Low-Level Radioactive Waste Management and Disposal" (25 PA 236) (CPA 89).

Subchapter D of 25 PA 236 identifies the design criteria for the Pennsylvania LLRW disposal facility. General design criteria call for an above-grade disposal facility designed, constructed, and operated with a goal of zero release of radioactive material. Furthermore, the disposal facility must be designed to complement and augment the ability of the disposal (natural) site to meet the performance objectives contained in 25 PA 236.13 through 236.16. Among the specific design requirements of 25 PA 236 is one that calls for the use of engineered structures in the design and construction of the disposal facility. The function of these engineered structures is to provide enhanced containment, or additional isolation, of the LLRW from the environment.

In compliance with the general design guidance, the Pennsylvania LLRW disposal facility will consist of a series of above-grade concrete disposal units. Packaged waste will be placed in reinforced concrete overpacks which, in turn, will be placed in the disposal units.

The Department considers the concrete overpacks to be the first enclosure, or container, that contains the radioactive waste. Since Pennsylvania regulations do not allow reliance on the waste container as a means of meeting the requirements for enhanced containment, only the disposal units can be relied upon to provide enhanced containment of the waste therein.

Justifying the use of the concrete disposal units to provide enhanced containment is the subject of this staff technical report. This report discusses important issues in designing, constructing, monitoring, and closing the LLRW disposal facility. Key aspects of the long-term performance of engineered concrete structures are also addressed.

Section 2 of this report begins with a review of the regulatory requirements that apply to the use of engineered structures, in general, and the concrete disposal units, in particular, to provide enhanced containment of LLRW. Section 3 presents a number of issues related to the design and construction of concrete disposal units, monitoring of the structures, and the evaluation of the long-term performance of the disposal units. Section 4 provides regulatory guidance on the design, construction, monitoring, and long-term performance modeling of the concrete disposal units for LLRW disposal.

It is envisioned that the applicant will reference and utilize this staff technical report in the following manner:

- Utilize the regulatory requirements (summarized in Section 2) and the regulatory guidance (Section 4) as the focal point for demonstrating compliance with enhanced containment requirements and ensuring long-term performance of the disposal facility.

- Review the various degradation mechanisms that can affect concrete and disposal unit performance (i.e., Subsection 3.4), when evaluating the natural site conditions and available cement pastes and aggregates for the concrete.

- Consider and implement the necessary codes and standards, quality programs, and monitoring techniques (i.e., Subsections 3.1, 3.2, 3.3, and 3.5) required to mitigate potential degradation mechanisms and conditions and to ensure the long-term performance of the engineered structures and disposal units.

2. REVIEW OF COMMONWEALTH REGULATORY REQUIREMENTS

The Pennsylvania Code (25 PA 236) establishes the requirements for LLRW disposal in the Commonwealth (CPA 89). It is based on Title 10 of the Code of Federal Regulations, Part 61 (10 CFR 61), "Licensing Requirements for Land Disposal of Radioactive Waste" (NRC 82). While 25 PA 236 is compatible with 10 CFR 61, it contains additional requirements specific to the development of a LLRW disposal facility in Pennsylvania. 25 PA 236 forms the sole basis for regulating LLRW disposal in the Commonwealth.

25 PA 236 establishes the requirement that enhanced containment be provided through the use of engineered structures (25 PA 236.314(a)). Enhanced containment is defined as "Additional isolation of the radioactive waste from the environment..." (25 PA 236.2). An engineered structure, in turn, is defined as a manmade, state-of-the-art barrier that is "...intended to improve the disposal facility's ability to meet the performance objectives [of 25 PA 236.13 through 25 PA 236.16]" (25 PA 236.2). The structure is designed to provide:

- Additional measures for containing radioactive waste from the environment.
- Protection for inadvertent intruders.
- Stability to the disposal facility.
- Prevention of radioactive releases.

Special requirements are placed upon the engineered structures used to provide enhanced containment. At a minimum, these structures shall provide the following:

- Leak resistance for at least 100 years following the post-closure observation and maintenance period (25 PA 236.314(b)(1)).
- Structural stability to the disposal units (25 PA 236.314(b)(2)).

The design goal of the engineered structures must be such that stability of the Class A LLRW disposal unit is provided for 100 years. Stability of the Class B disposal units must be provided for 300 years, while provisions must be made to ensure structural stability of disposal units containing Class C LLRW and mixed waste for 500 years (25 PA 236.314(d)).

As stated earlier, enhanced containment requirements cannot be satisfied by the waste container itself (25 PA 236.314(a)). The waste container is defined as the first enclosure that contains the LLRW (25 PA 236.2), and is interpreted by the Department to be the concrete overpacks included in the conceptual design of the disposal facility. Based on this interpretation, the concrete overpacks cannot satisfy the requirements for enhanced containment. Thus, the concrete disposal units included in the facility design must be capable of meeting the requirements discussed above. Consequently, this report focuses on key design, construction, and performance issues as they relate to the disposal units.

RELYING ON THE DISPOSAL Unit TO PROVIDE ENHANCED CONTAINMENT

25 PA 236 requires that engineered structures be used to enhance the containment of LLRW in the disposal facility. However, it provides no information on how to design or build these structures, or on how to assess their performance to demonstrate that they satisfy the minimum performance requirements. The following discussion provides background information on these topics and supplies the perspective necessary to understand the regulatory guidance provided in Section 4. Subsection 3.1 addresses important aspects of the design of the concrete disposal units, while Subsection 3.2 presents issues related to disposal unit construction. Subsection 3.3 presents monitoring approaches that may be used to verify proper functioning of the disposal units. Subsection 3.4 considers the durability of concrete, the processes by which concrete degrades, and the types of long-term performance modeling that are generally used to demonstrate that the disposal units function properly. Subsection 3.5 presents the importance of formal quality assurance (QA) and quality control (QC) programs. Appendix A lists several technical resources that consider in greater detail many of these aspects of engineered structures.

DISPOSAL UNIT DESIGN

The ability of the concrete disposal units to provide satisfactory long-term performance will depend on the manner in which they are designed and constructed. This section discusses several aspects of the design process that are unique to using concrete as a building material in LLRW disposal applications. Unique aspects of the construction process are presented in Subsection 3.2.

The codes, standards, and guidance established for the design of reinforced concrete structures are discussed below. The codes and standards established by the American Concrete Institute (ACI) address most of the state-of-the-art technologies for the design and construction of reinforced concrete structures. These codes and standards are presented in Subsection 3.1.1, while pertinent codes and standards issued by other organizations and regulatory agencies are presented in Subsection 3.1.2. General design approaches applicable to the concrete disposal units are presented in Subsection 3.1.3.

American Concrete Institute Codes and Standards

ACI has developed several codes and standards for the design of reinforced concrete structures (ACI 90). While the majority of these codes and standards pertain to the design of reinforced concrete structures in general, others specifically address the use of reinforced concrete in the nuclear industry. The following paragraphs summarize the principal ACI codes and standards.

ACI 350R-89, "Environmental Engineering Concrete Structures," provides recommendations for structural design, materials, and construction of concrete tanks, reservoirs, and other structures commonly used in water containment and in industrial and domestic water and wastewater treatment works. In these applications, dense, impermeable concrete with high resistance to chemical attack is required. Given the emphasis this code places on the low permeability of the concrete and its resistance to chemical attack, it is directly applicable to the design of concrete engineered structures as they are used in LLRW disposal facilities.

ACI 350R-89 also provides recommendations to maximize the watertightness and durability of the concrete. Important mechanisms of environmental attack are noted, including freeze-thaw attack, sulfate attack, and corrosion processes. Emphasis is placed upon structural design that minimizes the possibility of cracking. The code also discusses the design of construction joints for watertightness. Important material properties of admixtures, water, and aggregates, as well as construction details for placing concrete, for placing formwork, and for curing, are discussed. Finally, the code identifies ways to protect the reinforced concrete against chemical attack.

The ACI Guide to Durable Concrete (ACI 201.2R-77(82)) discusses significant causes of concrete deterioration and gives recommendations on how such damage may be avoided. Topics of discussion include freeze-thaw cycling, chemical exposure, abrasion, corrosion of steel reinforcement and other materials embedded in concrete, and chemical reactions of aggregates. The repair of damaged concrete and the use of coatings to enhance concrete durability are also discussed.

ACI Code 224.1R-89, "Causes, Evaluation, and Repair of Cracks in Concrete Structures," discusses the principal causes of cracking in concrete and recommends procedures for crack control. The code discusses the mechanisms of cracking in concrete, ways to control cracking due to drying shrinkage, and crack control for flexural members. Long-term effects of cracking are also addressed, including the long-term effects of an adverse environment in producing and enlarging concrete cracks. The primary environmental effect considered in the code deals with freeze-thaw cycling. The potential effects of alkali-aggregate reactions and applying de-icing salts to the concrete also are briefly considered.

The ACI 349-90 Series, "Code Requirements for Nuclear Safety Related Concrete Structures and Commentary," provides the minimum requirements for the design and construction of nuclear-safety-related concrete structures and structural elements for nuclear power generating stations. These structures and elements include concrete structures that support, house, or protect nuclear safety systems or components, or which are component parts of nuclear safety systems.

ACI 349-90 also discusses standards for tests and materials, construction requirements, general requirements, and structural systems or elements. It addresses specific topics such as materials, concrete quality, mixing and placement of concrete, construction

joints, details of reinforcement, analysis and design, strength and serviceability requirements, and flexural and axial loading. ACI 349-90 is more conservative than ACI 318 in terms of structural design requirements and, as such, is an excellent resource for the design of the disposal units. This code, however, is less conservative than ACI codes 224.1R-89 and 350R-89 with respect to limiting stresses and controlling cracking in structural elements. Consequently, it is important to consult these latter codes.

The ACI 318 Series, "Building Code Requirements and Commentaries for Concrete Structures," addresses the proper design and construction of reinforced concrete structures. The code discusses standards for tests and materials, construction requirements, general requirements, and structural systems and elements. Specific topics include permits and drawings, inspections, specifications, materials, concrete quality, mixing and placing, construction joints, reinforcement details, strength and serviceability, flexural and axial loads, and shear and torsion.

Other Codes and Standards

The NRC provides specific guidelines for the design of below-ground vaults and earth-mounded concrete bunkers in "Recommendations to the NRC for Review Criteria for Alternative Methods for Low-Level Radioactive Waste Disposal" (De 87). The recommendations and technical guidance given in these reports are based on civil and structural engineering experience that can be used for similar, reinforced concrete disposal structures.

American National Standards Institute ANSI A58.1-1982 (ANSI 82) gives structural design requirements for various loads, including dead, live, soil, wind, snow, rain, and earthquake loads under normal conditions. If structural steel is involved, the design guidance issued by the American Institute of Steel Construction's Manual of Steel Construction (AISC 89) is applicable for use in the design and construction of steel members.

General Design Approach

In designing concrete structures for use in LLRW disposal units, conservative but reasonable assumptions and approaches are used. Strategically selecting a design philosophy and design methods that provide assurance of long structural life is an important aspect of the design approach. These aspects of the design approach are discussed below.

An effective design will provide reasonable assurance that the disposal units will fulfill their long-term performance goals. To provide this assurance, long-term performance modeling of the disposal units is generally undertaken during the design phase. The results of the modeling are used to refine the basic design of the units to address disposal facility and site characteristics that may compromise the units' performance. Design modifications and modeling analyses are performed in an iterative fashion until an efficient, cost-effective design is identified. While the following discussion focuses on design, additional information about long-term performance modeling is presented in Subsection 3.4.

Design Philosophy

A design philosophy that has been used to ensure long structural life considers design conditions at early and late stages of the structure's life. During the structure's early years, while reinforcing steel is in generally excellent condition, the tensile strength of the steel is taken into account in designing the structure. Late in the life of the structure, when the reinforcing steel may not be sound, the design is based on a plain concrete structure (core) capable of bearing all loads that may exist at that time. Using this approach, the structural safety factor (i.e., the ratio of the structural strength and the forces and moments resulting from applied loads) can decline with time due to degradation mechanisms without jeopardizing structural stability.

Figure 3-1 illustrates some of the results of the general design philosophy described above. In the figure, the safety factor substantially exceeds unity in the early portion of the structure's life (from time 0 to time T_1), as long as reinforcing steel is intact. The safety factor declines slowly from time 0 to time T_1, the time at which corrosion of the steel reinforcement begins. Corrosion proceeds until the steel reinforcement makes no contribution to structural stability at time T_2. The period during which the steel corrodes, from T_1 to T_2, is characterized by a rapid decline in the safety factor. From time T_2 on, only a core of plain concrete remains, which must be capable of bearing all loads that may exist for the remaining life of the facility. Concrete degradation continues until time T_3, at which point the safety factor approaches unity and the structure is assumed to fail structurally.

The onset of steel corrosion can be controlled by specifying concrete with characteristics that retard the diffusion of oxygen and chlorides and by providing adequate concrete cover over the reinforcement. By selecting the design life to coincide with the onset of steel corrosion, when the structural safety factor is still well in excess of unity, assurance is provided that the disposal units will perform as required throughout their design life. In all likelihood, this approach will ensure that the disposal units will actually perform as required long beyond their design life. Such additional assurance will contribute to public and regulatory confidence that the disposal facility will adequately protect public health and the environment.

Figure -1 Summary of Safety Factor vs. Time for a Reinforced Concrete Structure

Design Method

The NRC recommends the strength design method for the design of reinforced concrete structures (De 87). In this approach the required strength, U, is set equal to or greater than the greatest of the following load combinations:

$U_1 = 1.4D + 1.4F + 1.7L + 1.7H + 1.7E$		(3-1)
$U_2 = 1.4D + 1.4F + 1.7L + 1.7H + 1.7W$		(3-2)
$U_3 = D + F + L + E + H + T$		(3-3)
$U_4 = D + F + L + W + H + T$		(3-4)

where

D = dead loads or related moments and forces

F = loads due to lateral and vertical pressure of incidental liquids, if applicable

L = live loads

H = loads due to earth pressure, if applicable

E = loads generated by the design-basis earthquake

W = loads from design wind pressure

T = loads from temperature differences within the structure

Any load that reduces the effects of other loads is assigned a coefficient of 0.9 if it can be demonstrated that the load is always present or occurs simultaneously with other loads.

In general, the thermal loads on the concrete disposal units, specified in Equations (3-3) and (3-4), are not expected to be great enough to dominate the design process. Consequently, the loading conditions represented by the first two equations will most likely prove limiting. Nevertheless, all loading conditions are typically evaluated to ensure the validity of this expectation and to allow appropriate response if the expectation is not supported.

In designing disposal units, the cover system self weight is considered to be a live load (with a load factor of 1.7), rather than a dead load (with a load factor of 1.4), for two reasons. First, the density of the soil used in cover construction can vary seasonally with water content. Second, because the construction tolerances are greater for earthwork than for concrete work, the as-built cover thickness may be greater than the design cover thickness.

The concrete elements and the reinforcement provided in the structure are designed to control cracking by considering the following two extreme cases:

1. The tensile strength of reinforcement is conservatively ignored in evaluating structural response under unfactored service load conditions. The concrete element thicknesses necessary to prevent potential cracking are determined using this case as the basis.

1. The tensile strength of concrete is conservatively ignored in evaluating structural response under service conditions so that the reinforcement bears all tensile forces. Reinforcement for Class A disposal units is designed to limit cracking under "normal exposure" and for other waste classes under "severe exposure" as specified in ACI 224 and ACI 350. The permissible values stated in these codes are compatible with the objective of minimizing concrete permeability and ensuring long-term durability.

An alternate design method, defined in ACI 318, may be used to calculate stresses in the concrete and reinforcement under service load conditions. This method is suitable for estimating potential cracking in concrete members while the reinforcement is in good condition. However, because the reinforcing steel will eventually corrode, the structure can be modeled as a plain concrete structure, as described above. The permissible stresses in the plain concrete due to factored loads are provided in ACI 318.1-83 (revised 1987). It is important that the expected strength of plain concrete structures, without reliance on reinforcement, be sufficient to withstand the factored service loads over the desired service life of the structure.

Concrete is typically designed with a compressive strength and water-to-cement ratio adequate to maintain its strength and minimize its permeability. Concrete that will be exposed to ambient weather conditions for long periods is air-entrained to provide additional protection from freezing. All construction joints are keyed and treated according to ACI recommendations. Continuous waterstops of 316L stainless steel may be provided at all construction joints in exterior members of the structure.

The concrete disposal units are designed to be stable against overturning and sliding under lateral loading conditions. Accordingly, the structural design is compatible with foundation soil conditions to prevent any adverse effects. Specifically, the maximum bearing on soil, maximum deformation or settlement, and maximum differential settlement are specified to preclude structural damage and damage to water barrier components (e.g., structural members, coatings, membranes, and the cover system).

Site characteristics, including site geology, seismology, meteorology, climatology, and hydrology, will influence the performance of the disposal units. The potential effects of these factors are considered in the facility design. Specifically, the design ensures that the disposal units can perform adequately under routine and extraordinary environmental conditions. As stated earlier in this section, the structure is designed with safety margins or factors that ensure it will perform adequately through the end of its design life, even under potentially adverse conditions.

DISPOSAL UNIT CONSTRUCTION

Proper construction practices take into account the quality of the materials used in the disposal units and the methods used to construct the units. Subsection 3.2.1 presents important aspects of selecting and testing materials suitable for construction. Codes and standards for construction techniques are addressed in Subsection 3.2.2.

Concrete Mix Characteristics

Numerous technical publications are available on selecting and testing materials for use in the construction of reinforced concrete structures. These resources include codes, tests, standards, specifications, guides, standard practices, special publications, and recommended practices issued by the American Society for Testing and Materials (ASTM, e.g., ASTM 93), the ACI (ACI 90), and the Nuclear Regulatory Commission (De 87). Key aspects of material quality and testing found in these publications are discussed below; however, it is important that a more complete review of these codes and standards be made before using them in the design of the reinforced concrete structure.

Portland cement concrete used to build the reinforced concrete structure typically is air-entrained and composed of a type of Portland cement, water, coarse and fine aggregate, and admixtures that will enhance the quality and durability of the concrete. High-range, water-reducing admixtures (HRWRA) may be added to reduce the water-cement ratio to 0.4 or less while maintaining a workable slump. A suitable slump range for the concrete is 5 to 7.5 cm (2 to 3 in.) without HRWRA, and 15 to 23 cm (6 to 9 in.) with HRWRA. The unconfined compressive strength of the concrete is at least 28 mPa (4000 psi) at 28 days, and the concrete contains 6 to 7 percent air by volume. The physical and mechanical properties of the concrete are established by an approved and certified testing laboratory based on trial mixtures and using the appropriate test methods and standards.

The Portland cement is chosen taking into account the environmental, loading, and durability requirements. The type of cement selected meets the appropriate requirements of ASTM C 150, "Standard Specification for Portland Cement." The coarse and fine aggregates used in the concrete are hard, durable aggregates that meet the requirements of ASTM C 33, "Standard Specification for Concrete Aggregates," while the mixing water is free of oils, organic matter, and other deleterious materials. Potable water is generally acceptable for mixing water, provided that chlorine content is limited to levels that do not compromise the durability of the structure.

Finely divided mineral admixtures that are cementitious, pozzolanic, or both may be used for partial replacement of Portland cement. Admixtures considered for use in the concrete meet the applicable requirements for the admixtures, "Chemical Admixtures for Concrete" (ACI 212.3R-91). A demonstration of the admixture's ability to enhance the quality and durability of the concrete is submitted to the regulatory agency before the start of construction. All admixtures are submitted for acceptance and evaluated for effectiveness and feasibility as recommended in ACI 212.3R-91.

Admixtures serve at least one of the following functions:

1. Ensure the proper entrainment of air.

1. Allow regulation of the amount of water in the mix.

1. Control the time of set.

1. Act as a void filler (e.g., as with mineral admixtures).

All admixtures used in the mix are composed of quality materials to ensure that the concrete will perform as expected and to obtain the desired engineering, physical, and mechanical properties.

If fly ash is used as a blend material, its volume is generally limited to less than 25 percent of the volume of cement. Similarly, when silica fume is used as a blend material, its volume is usually restricted to less than 15 percent of the volume of cement. To achieve adequate compressive strength, the ratio of water to cement plus blend material is typically between 0.2 and 0.3. This necessitates the use of an HRWRA to increase the slump to a value that produces a workable mixture compatible with placement requirements. The amount of HRWRA necessary to achieve this workability depends upon the amount of silica fume used. The relative quantities of fly ash, silica fume, and HRWRA required in the mix are typically determined by testing trial batches.

Reinforcing steel typically meets the requirements of ASTM A 615, A 616, and A 617, as appropriate, and may be epoxy-coated in accordance with the requirements of ASTM A 775. Bar supports and wire ties may also be epoxy-coated. Structural steel typically meets the requirements of ASTM A 36 and may be coated with epoxy or other acceptable coating material for protection against oxidation, corrosion, sulfate and chloride attack, and other degradation mechanisms.

Construction Methods for Reinforced Concrete Structures

The ACI has issued codes and standards on several aspects of the construction of reinforced concrete structures, including formwork; concrete measuring, mixing, placement, transport, consolidation, and curing; and reinforcing steel detail and construction (ACI 90). The following paragraphs summarize the important aspects of these codes and standards.

Guidelines for the layout, design, and construction of formwork are contained in ACI 347. This code includes design criteria for vertical and horizontal forces and lateral pressures, capacities of formwork accessories, preparation of formwork design drawings, construction and use of forms, and materials for formwork. The forms are constructed and erected in a manner consistent with industry standards that will facilitate a logical, well-engineered construction sequence that will produce the finished structure as required. Forms, shoring, and bracing are inspected to verify (1) the adequacy of their number and type, (2) their correct location, and (3) their required dimensions, alignment, and surface finish. The re-use of forms and formwork is typically limited to applications that will duplicate or equal the required quality of workmanship and finished structure.

Forms are properly supported, braced, and tied to maintain position and shape. Completed concrete work typically has a smooth finish and uniform color, and is level, plumb, and true. Forms are substantial and sufficiently tight to prevent leakage of cement paste or mortar. The exposed surfaces of the forms produce smooth, dense, and true finishes free of fins, imperfections, and other defects. The forms are not removed until the concrete has acquired sufficient strength to safely support its own weight and any loads placed on it. It is important that the methods for removing formwork prevent marring, breakage, and other damage to concrete.

Steel reinforcement includes reinforcing bars, stirrups, spirals, and other reinforcement materials with necessary wire ties, bar supports, spacers, block supports, and other devices required to install and properly secure reinforcement. Fabrication and placement of the reinforcement typically conform to the appropriate sections of ACI 318 or ACI 349 and ACI SP 66(88). Reinforcement is installed or placed in a manner consistent with good workmanship and applicable standards. It is free of loose rust or scale, grease, dirt, and any other coating that could reduce or destroy the bond between the steel and the concrete. The reinforcement is anchored so it does not move during concrete placement and vibration operations. The quality, location, and alignment of the reinforcement are confirmed prior to concrete placement.

The concrete mixture is proportioned as described in Subsection 3.2.1 of this staff technical report and in accordance with the provisions of ACI 211.1, Chapter 5. Concrete is mixed until the materials are uniformly distributed and is discharged completely before the mixer is recharged. Production of concrete proceeds in accordance with the applicable requirements of ACI 301.

The casting operations for the floors, walls, partitions, and roofs of concrete structures include the production, hauling, placement, vibration, finishing, and curing of the concrete. Whether the concrete is produced on-site or at an off-site plant, the production, transportation, and placement of concrete typically conform to the recommendations and provisions of ACI 304. Ready-mixed concrete complies with ASTM C 94. If the concrete is pumped into the forms, the pumping operations and equipment conform to the provisions of ACI 304.2. If the concrete is placed in the forms by conveyor belt, the operations and equipment conform to the provisions of ACI 304.4.

Mixed concrete is placed in the forms as quickly as possible to prevent segregation or loss of ingredients. Concrete is placed in a continuous and uninterrupted operation to form a monolithic structure, the components of which are securely bonded together. Concrete operations during hot or cold weather typically conform to ACI 305 or ACI 306, respectively.

Proper consolidation or vibration of concrete is essential to the construction of a durable concrete structure. Concrete is consolidated by vibration sufficient to work the concrete around reinforcement, around embedded items, and into corners of forms, thereby eliminating air or stone pockets. Consolidation operations conform to the provisions of ACI 309.

Following placement and finishing of the concrete, curing operations begin as appropriate, generally as soon as the concrete has lost its surface sheen. Curing operations conform to the provisions of ACI 308. If defects exist in the concrete, they are repaired according to the provisions of ACI 309.2R-90 or reconstructed.

A QA/QC program conforming with that described in "Quality Assurance Guidance for Low-Level Radioactive Waste Disposal Facility" (Pe 87) also is implemented. This program specifies the frequency of sampling or testing to verify the design specifications during mixing and placement of concrete. The results of tests used to verify material characteristics and structural properties are included in the design documents.

MONITORING OF CONCRETE DISPOSAL UNITS

As discussed earlier, the concrete disposal units will deteriorate over time from loads, stresses, and chemical attack. The degradation of these structures will compromise their ability to resist leakage and provide structural stability and, therefore, to provide enhanced containment. The monitoring program provides information required to verify the ability of the disposal units to fulfill their intended functions.

The concrete disposal units may contribute to leak resistance directly or indirectly. The low permeability of good-quality concrete directly resists leakage by limiting the movement of water through the structure and thus through the waste. The disposal units may also contribute indirectly to leak resistance through their support of the cover system, which directs water away from the disposal system. Given the dual role of the disposal units, the monitoring program is designed to provide information about both the hydraulic and structural performance of the disposal units.

The ACI provides guidance for developing state-of-the-art concrete testing programs using nondestructive means ("In-Situ Non-Destructive Testing of Concrete," ACI SP-82). The available methods take two approaches to concrete testing. Under the first approach, one or more properties of the concrete are measured and used to estimate the material's strength, durability, and elastic parameters. The measured properties may include the concrete's hardness, its rebound number, its resistance to penetration, and its ability to propagate ultrasonic pulses. The second type of nondestructive test includes methods that determine the location and size of defects in the steel reinforcement, the moisture content of the concrete, and the existence of voids, cracks, honeycombing, and areas of poor consolidation in the concrete.

Reinforced concrete structures can be monitored to verify design assumptions about loads, stresses and strains, deflection, and settlement, and to evaluate performance. Strain measurements can be conducted to assess the stresses that develop at various locations within a structure. Relatively long-term measurements of strain in concrete or reinforcement can be made using several types of gauges, including Carlson strain meters, vibrating wire strain gauges, and Carlson reinforced concrete meters. Short-term measurements can be made with various embedded gauges such as Ailtech embeddable strain gauges and strain-gauged steel reinforcement.

Deflection measurements of a disposal unit can be made to determine its load-deformation characteristics. Generally, this involves taking measurements from observations made through geodetic triangulation of external targets attached to the structure. Settlement of the structural foundation can be monitored to detect potentially unsafe conditions before structural distress occurs.

Construction joints in the disposal structures will expand and contract with changes in temperature. Joint expansion may allow water to seep into the vaults and radionuclides to be released into the environment. This movement can be monitored with strategically placed meters or gauges. Joints can be monitored electrically with Carlson joint meters.

Different monitoring approaches are used to detect changes in humidity within the disposal units early in their lifetimes and to measure the rate at which water may flow through the units much later. Methods available for monitoring humidity in the disposal units include:

1. Soil gas sampling—Soil gas samples can be collected from several representative locations within the vault, at a frequency ranging from quarterly to annually. Gas can be withdrawn through small-diameter stainless-steel tubing and passed over a condensing coil until an adequate condensate volume is obtained. The humidity or moisture content of the gas can be inferred using the total volume of gas withdrawn and gas temperature.

1. Epithermal neutron logging—Access tubes can be installed to accommodate neutron density gauge probes, which measure the moisture content of soils inside the disposal unit.

By taking such measurements periodically, the temporal behavior of moisture within the disposal units can be determined.

For saturated conditions, monitoring wells can be incorporated in the disposal units for the collection and analysis of liquids in the drains and sumps of the disposal units and in the foundation. Monitoring wells can be designed and installed to last many years with minimal maintenance requirements. Monitoring wells placed in drain sumps provide an opportunity for determining the amount and characteristics of effluent from individual disposal units. These wells also permit the removal of leachate through pumping or bailing, if such measures become necessary.

Coatings, sealants, membranes, and joint materials used to construct the disposal units will eventually be covered and not be available for monitoring and inspection. Therefore, emphasis is placed on the initial fabrication, construction, and installation of these design features. Quality control measures for material type, quantity, quality, specification, and installation can be implemented during the construction period to maximize the likelihood that these barriers will perform suitably over extended periods.

LONG-TERM PERFORMANCE MODELING OF THE DISPOSAL UNITS

The engineered disposal units will function properly for extended periods to meet the requirements for the provision of enhanced containment. As discussed in Section 2, leak resistance is provided for at least 100 years following the post-closure observation and maintenance period. The time over which structural stability of the disposal units is demonstrated is specific to the type of waste, and ranges from 100 to 500 years.

The ability of the monitoring program discussed in Subsection 3.3 to demonstrate that the disposal units will fulfill their intended roles is limited because it indicates only past and current performance. Long-term performance modeling of the engineered structures, through its ability to project future performance, complements facility monitoring efforts. Together, monitoring and performance modeling provide a comprehensive approach for understanding the performance of the disposal units.

The ability to model or project the long-term performance of the engineered disposal units requires an understanding of the processes by which the concrete structures may deteriorate and fail. Toward this end, a summary of the primary mechanisms of concrete degradation is provided in Subsection 3.4.1. Subsection 3.4.2 considers the effects that degradation has upon the ability of the disposal units to perform their intended functions. Subsection 3.4.3 uses this information as the basis for discussing the considerations involved in long-term performance modeling of the disposal units.

Mechanisms of Concrete Degradation

Mechanisms of concrete degradation may be categorized in terms of how they attack concrete structures. The following discussion is organized in terms of three such mechanisms. Section 3.4.1.1 discusses surface attack mechanisms, which start at the surface of a concrete structure (e.g., roof or floor) and progress inward over time. Bulk attack mechanisms, which modify the properties of the concrete throughout the structure uniformly, are discussed in Subsection 3.4.1.2. Subsection 3.4.1.3 discusses the deterioration of steel reinforcement due to corrosion. Reinforcement corrosion differs from surface and bulk attack mechanisms in that it does not directly alter the material properties of the concrete itself.

Surface Attack Mechanisms

Sulfate attack is generally considered the most significant surface attack mechanism for concrete used in waste disposal facilities (At 84). In areas characterized by cold winters, freeze-thaw cycling may also present a serious threat to concrete used in disposal facilities. Impacts from freeze-thaw cycling are greatest for above-ground disposal facilities, or for below-ground facilities during the construction phase for as long as the concrete structures are exposed to freezing temperatures. Acid and microbiological attack of concrete are generally less significant. Each of these surface attack mechanisms is discussed briefly below.

Sulfate Attack—Sulfate attack generally manifests itself as expansion of the concrete and, ultimately, cracking. As the concrete cracks, its permeability increases, allowing water to penetrate more easily and thus accelerate deterioration. Sulfate attack can also result in a progressive loss of strength and mass due to deterioration in the cohesiveness of hydration products in the cement. Degradation of concrete from sulfate attack may occur through two distinctly different mechanisms. The mechanism that will predominate in a given situation depends upon the concentration and source of sulfate (i.e., the associated cation) in the groundwater and the composition of the cement paste in the concrete.

In the first mechanism of sulfate attack, alumina-bearing hydrates in the concrete are converted to ettringite ($3CaO \cdot Al_2O_3 \cdot 3CaSO_4 \cdot 32H_2O$) upon contact with sulfate in the presence of calcium hydroxide. The ettringite causes the concrete to expand, although the mechanism of this expansion is not well understood (pressure exerted by growing ettringite crystals and pressure exerted by poorly crystalline ettringite swelling as it adsorbs water in the alkaline environment are two prominent hypotheses [Me 86]).

In the second mechanism, sulfate attack converts the calcium hydroxide and the calcium-silicate-hydrate (C-S-H) phase of Portland cement paste to gypsum. The formation of gypsum may reduce the stiffness and strength of the concrete, followed by expansion and cracking. Eventually, the material may be transformed into a noncohesive mass. The severity of the damage inflicted on the concrete depends upon the cation (i.e., Na^+ or Mg^{2+}) associated with the sulfate. Sodium sulfate attack results in the formation of sodium hydroxide, which maintains the high alkalinity of the concrete and promotes the stability of the C-S-H phase. On the other hand, a reaction product of magnesium sulfate attack is magnesium hydroxide, which is relatively insoluble and less alkaline. This byproduct adds to the deleterious effects of sulfate by undermining the stability of the C-S-H phase in the concrete.

Freeze-Thaw Damage—Damp concrete may deteriorate when subjected to cycles of freezing and thawing. When water freezes in the pore system of the concrete, expansive stresses develop which, if greater than the concrete tensile strength, can result in severe cracking. Theories on the cause of these expansive stresses range from the volume expansion of water upon freezing (Po 45, Po 55) to the development of osmotic pressures within the concrete (Po 56, He 62).

The susceptibility of concrete to freeze-thaw damage is, in part, a function of the material's moisture content. Generally, concrete must be at least 70 to 80 percent saturated for freeze-thaw damage to occur (Me 86). The pore structure of the concrete also influences its susceptibility to freeze-thaw attack. Numerous uniformly spaced pores help minimize the buildup of expansive stresses within the concrete, thereby helping to prevent severe cracking. Thus, freeze-thaw damage can be limited or precluded by entraining air into the concrete mixture.

Acid Attack—In general, acid attack of a good-quality concrete will not occur if the concrete pH is 5 or greater. Acids are among the most aggressive of chemicals that attack concrete. Mineral acids such as sulfuric and nitric acids are extremely destructive and can rapidly destroy concrete. Other acids (namely, organic acids; water-soluble, low-molecular-weight acids; and insoluble, high-molecular-weight acids) attack concrete more slowly.

Acids react with the calcium hydroxide in the hydrated cement paste, producing water-soluble calcium compounds that are readily leached from the concrete. The dissolution of the concrete matrix destroys the binding ability of the cement paste, undermining the concrete's strength and potentially increasing its permeability. Sulfuric acid attack on concrete may cause additional deterioration due to sulfate attack.

The rate at which concrete deteriorates when subjected to acid attack depends upon the properties of the concrete, acid concentrations, and the diffusivity of acids in the concrete. The resistance of concrete to acid attack depends primarily on the properties and amount of cement, while the aggregate has only secondary effects.

Microbiological Attack—Concrete degradation due to microbial activity is thought to occur when microorganisms present in the environment produce mineral or organic acids that dissolve or disintegrate the concrete matrix (Ro 93). While the mechanism of attack is the same as that described for acid attack, some evidence exists that the presence of microorganisms greatly magnifies the intensity of attack.

Microorganisms that may have adverse effects on concrete include sulfur oxidizers, nitrifiers, and many species of heterotrophs (Ro 93). Sulfur-oxidizing bacteria are most often associated with the microbial degradation of concrete. These bacteria produce sulfuric acid as a metabolic end product, which is one of the more aggressive acids in terms of concrete attack. Nitrifiers obtain energy required for cell synthesis by oxidizing inorganic nitrogen compounds to nitrite and nitrate. The formation of nitrite and nitrate is accompanied by the release of hydrogen ions, forming nitrous and nitric acids. Heterotrophs include a variety of fungi, as well as anaerobic and aerobic bacteria that obtain energy by assimilating organic carbon sources. Many species of heterotrophs generate organic acids as metabolic byproducts, including lactic, citric, gluconic, and malic acids (Ro 93).

Bulk Attack Mechanisms

Bulk attack differs from surface attack in that the reactive components are wholly contained within the concrete. Bulk attack mechanisms include alkali and calcium hydroxide leaching, and alkali-aggregate reactions. Radiation damage to the structural characteristics of concrete are not credible at the low radiation levels that will characterize the Pennsylvania LLRW disposal facility (Ch 90).

Alkali and Calcium Hydroxide Leaching—Alkali hydroxides (NaOH and KOH) and calcium hydroxide ($Ca(OH)_2$) are leached from the cement phases when concrete is exposed to water. The loss of the alkalis and calcium from the concrete lowers the pH of the concrete, which, in turn, may hasten the onset of steel reinforcement corrosion. The loss of calcium also reduces concrete strength and increases the permeability of the concrete. Reductions in the strength of the concrete may undermine the ability of the disposal units to withstand the loads placed upon them. The amount of water contacting the waste may also increase as the permeability of the concrete increases, thereby hastening radionuclide leaching.

Alkali and calcium hydroxides may be leached from concrete due to diffusive and advective processes. Prior to significant deterioration and cracking of the concrete, diffusive losses are generally more significant. Following the loss of structural integrity and the subsequent increase in the amount of water penetrating the concrete, advective leaching will generally dominate.

The rates at which alkali and calcium hydroxides are leached from concrete are influenced by the concentrations of these compounds in the pore solution of the concrete, the percolation rate through the material, the chemistry of the groundwater, and the thickness of the concrete member. In general, alkali hydroxides are leached more quickly than calcium hydroxide because of their higher pore solution concentrations. Little or no dissolution of calcium hydroxide will occur if the groundwater is saturated or super-saturated with calcium carbonate. Reactive chemicals in the groundwater, such as magnesium and carbonate, accelerate the loss of calcium hydroxide (At 85).

Alkali-Aggregate Reaction—Alkali-aggregate attack refers to a class of deleterious reactions between the cement-phase alkalis and minerals in the aggregates used in the concrete mix. These reactions result in the formation of expansive products within the concrete matrix which, depending upon their distribution, may result in localized cracking or uniform expansion of the concrete structure. Cracking may be cosmetic or may compromise the integrity of the concrete vaults. Increases in the permeability of the concrete due to cracking may also occur.

Essentially all aggregates react to some degree with alkalis in the cement paste. These reactions are generally benign, and may even be favorable because they strengthen the bond between the aggregate and the hydrated paste. Damaging expansive reactions are known to occur, however, with certain siliceous and dolomitic limestone aggregates.

The alkali-aggregate reaction appears to begin when hydroxide ions split silica-oxygen bonds of the aggregate's silicate network. The depolymerized species then dissolve to form a hydrous alkali silicate gel, which promotes the absorption of water and swelling of the gel. The swelling reduces the rigidity of the aggregate, thereby allowing deeper diffusion of hydroxide ions into the aggregate. As the alkali-aggregate reaction proceeds, the amount of water absorbed increases and a dilute suspension of colloidal particles is formed. This dilute suspension can move into the surrounding concrete matrix. If sufficient expansive products form, the resulting internal pressures can cause the concrete to crack.

The extent of damage due to alkali-aggregate reaction is a function of many factors. The dissolution of the depolymerized aggregate depends strongly upon concrete pH, increasing by more than 1,000 times as pH increases from 12.5 to greater than 13. The extent of expansion due to water absorption depends upon the availability of water in the concrete. Finally, the structure of the aggregate and the distribution of the reactive material in the aggregate play important roles in the alkali-aggregate reaction.

Corrosion of Steel Reinforcement

Damage to concrete resulting from the corrosion of steel reinforcement manifests itself in expansion, cracking, and spalling of the concrete structure. In addition, the reinforced-concrete member may suffer structural damage due to the loss of bond between steel and concrete and the loss of reinforced cross-sectional area. Damage may proceed to the extent that structural failure occurs.

Corrosion of reinforcing steel is primarily an electrochemical process. An anode, a cathode, an electrical conductor, and an aqueous medium must be present for the process to occur. The metal surface upon which corrosion takes place is a composite of anodes and cathodes electrically connected through the body of the metal itself. At the anode, iron is electrochemically oxidized to ferrous ions, which are subsequently changed to oxides of iron through several complex reactions. Electrochemical reduction occurs at the cathode, which removes electrons from the oxidation site, thereby permitting additional production of ferrous ions.

Reinforcing steel is protected through passivation. In highly alkaline environments thin, continuous films of Fe_2O_3 and Fe_3O_4 form on the steel surface during the cement hydration process. As long as it is passivated, steel reinforcement does not undergo corrosion. If the steel is depassivated corrosion may begin.

The two major mechanisms of depassivation are carbonation and chloride ion penetration. Depassivation of steel reinforcement due to carbonation occurs as a result of a direct lowering of the pH of the concrete. Carbonation occurs as carbon dioxide diffuses into the concrete. Depassivation may also occur as chloride ions internal to, and at the surface of, concrete structures diffuse to the steel reinforcement. If chloride levels at the steel reinforcement reach sufficiently high levels, depassivation of the protective layer will occur and corrosion may commence. The concentration of chloride ions at the steel reinforcement that is required to depassivate the steel appears to be a function of the pH of the concrete (Ha 67). As discussed earlier, the pH of concrete is largely governed by the concentrations of alkali and calcium hydroxides in the material, and declines as these species are leached from the concrete. Reductions in pH tend to accelerate depassivation of the steel reinforcement.

The time to onset of corrosion depends upon several factors, including the thickness of the concrete cover over the reinforcing steel, the initial chloride concentration in the concrete, the effective diffusivity of chloride and carbon dioxide in the material, and the pH of the concrete. The penetration of chloride ions to the steel reinforcement is usually responsible for depassivation of the steel. Depassivation due to carbonation is generally a second-order effect.

Once initiated, the corrosion of steel reinforcement propagates at a rate determined by several factors, including the supply of oxygen at the reinforcement and the electrical resistance of the concrete. If the flux of oxygen at the steel reinforcement is limited, the corrosion rate will be slowed. Similarly, if the electrical resistance of the concrete is great enough, electron flow between the cathode and anode may slow or cease, thereby reducing rates of corrosion. In general, however, the time required to corrode the steel reinforcement is short compared to the time to onset of corrosion.

The Impacts of Concrete Degradation on Disposal Unit Performance

Subjected to continued physical and chemical deterioration, the concrete disposal units will eventually reach a point where they can no longer perform their intended function of providing enhanced containment. The extent and nature of the concrete failure will determine the severity of the damage inflicted and its impact on structure function.

The loads placed upon the concrete disposal units will vary with the facility configuration and the disposal units' locations relative to natural grade. The roof is subject to uniform loading due to the weight of the cover materials, and the weight of the roof itself. The walls of the vaults are subject to uniform loads due to the weight of the roof and walls and hydrostatic pressures resulting from lateral pressures from the soil backfill and waste. The floor is subject to the uniform loads from the disposed-of waste and the floor itself. The floor must also bear loads from the walls, including wall weight and loads transmitted to the walls from the roof and cover materials.

Cracking of concrete structures will occur when stresses in the disposal units resulting from the loads placed upon them exceed the tensile strength of the reinforced concrete. The extent of the cracking (as characterized by crack depth, width, and spacing) will depend upon the applied loads and characteristics of the structure being considered. Cracking due to shear or compressive forces placed on a concrete member will penetrate the entire structure at the time of crack initiation. In contrast, flexural cracking will extend through only a portion of a structure's thickness unless the force exceeds the structure's ultimate strength.

Cracks formed as a result of steel reinforcement corrosion will propagate outward from the site of corrosion to the surface of the concrete structrure. Consequently, in a concrete structure with a layer of steel reinforcement near each face, corrosion cracking will not penetrate the entire structure; an intact central portion of the component will remain. In contrast, cracks extending outward from a centrally placed, single layer of reinforcement will effectively penetrate the entire structural member.

The concrete disposal units can directly limit the passage of water through waste and can provide structural support to the cover, allowing that component to effectively exclude water. These two functions are affected differently when cracks are initiated and propagate through the roof, walls, and floor of a disposal unit. The ability of a concrete disposal unit to provide structural stability will generally not be compromised when cracks initially propagate through the concrete structures. Loss of the disposal unit's ability to support the cover system may occur if extensive or complete failure of the unit occurs and the backfill within the structure undergoes significant subsidence. Under these conditions, the concrete roof of the disposal unit may collapse, resulting in subsidence of the overlying cover system.

The propagation of cracks through a concrete disposal vault may have more immediate impacts upon the ability of the structure to directly resist leakage. That is, increased amounts of water may percolate through the newly formed cracks as soon as the cracks propagate through the disposal unit, even though the disposal unit remains structurally stable. The amount of water actually entering the failed disposal unit will depend upon the prevailing hydrologic conditions at the disposal site. If the soils surrounding the concrete structure are saturated, water may indeed flow through the newly formed cracks. On the other hand, water will continue to slowly percolate through the concrete matrix, rather than the cracks, if the soils surrounding the disposal unit are unsaturated.

Modeling the Long-Term Performance of the Disposal Units

The ability of the disposal units to resist leakage and provide structural stability is a direct function of the condition of the concrete of which they are constructed. Consequently, performance modeling of the disposal units requires that the degradation of the concrete by chemical and physical environmental agents be projected. Projected rates of degradation are used in conjunction with structural and cracking analyses to determine the extent and pattern of structure cracking. This information is used, in turn, to estimate rates of water percolation through the waste and the consequent radionuclide release rates, and to determine whether the structural stability of the disposal units has been compromised. The synergistic and interacting effects of concrete degradation, structural capacity, and water and contaminant transport must be addressed because of the potential to significantly affect the results and conclusions of long-term performance modeling.

Accurate projections of concrete degradation rates account for all degradation processes that pose a significant threat to the performance of the disposal units. These processes may include, but are not limited to, the mechanisms discussed in Subsection 3.4.1. Many of the degradation processes discussed there may not apply under the environmental conditions found at the disposal site. In this case, justification is provided that establishes the negligible effect the degradation processes are expected to have on the long-term performance of the disposal units.

The models and data required to project rates of concrete degradation depend upon those degradation processes deemed important. Many of the concrete degradation mechanisms, in turn, depend upon the rate of transport of aggressive chemicals into, or of constituents of the concrete out of, the concrete structures of the disposal units. Consequently, it is reasonable to expect that the models will need to be capable of projecting rates of advective and diffusive transport of various chemical compounds in the concrete. Data generally required in concrete degradation modeling include complete specifications of the concrete mix used in construction, selected properties of the completed concrete structures (e.g., pH, structure thickness, compressive strength, density, and porosity), rates of water percolation through the concrete, diffusion coefficients for the concrete and soils adjacent to the disposal units, and the chemical characteristics of liquids or vapors contacting the concrete structures. To the extent possible, all data used in the analysis are specific to the disposal site and materials used in disposal unit construction.

The structural and cracking analyses use the projected cumulative extent of deterioration to evaluate the ability of the concrete disposal units to bear design loads and, therefore, resist cracking. Basic structural information about the units is used in conjunction with loading data to determine the extent to which the concrete structures must deteriorate to permit cracking to begin. Depending upon the design of the disposal units, the analysis may require assessment of flexural, shear, tensile, and compressive crack development.

Once initiated, the propagation of the cracks through the affected structures may be tracked to estimate the structural and hydraulic impacts on the disposal units. Cracking will generally start at different times in the roofs, walls, and floors of the units because of the different structural characteristics and different loading conditions on these components. The overall impact of cracking on the performance of the disposal units will depend on which of the structures fail and the extent of the failure.

The results of the long-term performance modeling will allow an applicant to demonstrate compliance with the requirements calling for structural stability of the disposal units and leak resistance. The projected state of the disposal units within the 100- to 500-year time frame will provide information necessary to demonstrate that the structural stability requirement is met for the appropriate periods for the different classes of LLRW. The extent, or lack of, cracking projected to occur within 100 years of facility closure may be used to demonstrate satisfaction of the leak-resistance requirement. For instance, it may be concluded that leak resistance is achieved if it can be demonstrated that no cracks will penetrate the concrete structures of the disposal units at the end of this period.

The results of the long-term modeling of disposal unit performance will also play an important role in the radiological performance assessment conducted in support of the disposal facility license. The time(s) at which the disposal units are projected to structurally fail will play a role in evaluating potential exposures to persons who inadvertently intrude into the disposed-of waste. The results of the concrete-cracking analyses will provide information needed to estimate the amount of water contacting the waste and, hence, radionuclide release rates.

The models and data used to estimate the long-term performance of the concrete disposal units typically are expected to introduce a significant amount of uncertainty into the performance projections. It is important that efforts be made to quantify these uncertainties through the application of sensitivity and uncertainty analyses. These analyses account for errors that may be introduced by the models used in projecting disposal unit performance and the variability in the input parameters used in said models. The results of the analyses are used to estimate the impact these uncertainties have on the ability of the disposal units to provide enhanced containment of the disposed-of LLRW. It is important that the design of the sensitivity and uncertainty analyses be such that it fulfills the needs of the radiological performance assessment as well.

Long-term performance modeling of the disposal units is an important activity throughout the entire lifetime of the disposal facility. It will be used to help justify the selection of a suitable disposal site, to guide site characterization activities, to optimize disposal unit design and construction, and to formally demonstrate compliance with the performance objectives specified in 25 PA 236.11 through 236.16. Performance modeling will also play a role in the interpretation of disposal unit monitoring results and refinement of the monitoring program.

The amount and quality of information available to conduct long-term modeling of the disposal units generally increase as the development of the disposal facility progresses. Consequently, the modeling tends to be iterative to ensure that performance projections reflect the best available information about the disposal site and the disposal units. A more detailed discussion about the iterative nature of the performance modeling is provided in the Staff Technical Report entitled "Conducting Radiological Performance Assessments for LLRW Disposal in Pennsylvania" (CPA 97).

QA/QC PROGRAM

It is important that all activities involving the design, construction, monitoring, and long-term performance modeling of the concrete disposal units be performed properly and be well documented. Consequently, capable quality assurance (QA) and quality control (QC) programs are essential (Pe 87). The QA program documents the activities that will be undertaken and demonstrates that these activities will satisfy applicable criteria, procedures, and standards. The QC program causes confirmatory activities to be undertaken to ensure that all work is performed correctly, without errors, and with appropriate accuracy, completeness, and consistency.

The features of the QA and QC programs depend upon the stage of the disposal facility life cycle. During design, the emphasis of these programs is on ensuring that all data defining the site at which the disposal units will be constructed are properly considered in the design process. Additionally, attention is focused on the design calculations and evaluation to ensure that they are performed without procedural, methodological, and calculational error. During the construction phase, the QA and QC programs are concerned with ensuring that the design plans and specifications are properly incorporated and implemented in the construction activities. The focus of the QA and QC programs during monitoring is on ensuring that samples are collected and processed properly, that surveys are performed as specified, and that accountability for samples can be demonstrated. The QA and QC programs applied to long-term performance modeling concentrate on ensuring that the methods used to estimate facility performance are valid and implemented correctly.

REGULATORY GUIDANCE ON THE DESIGN, CONSTRUCTION, AND ASSESSMENT OF CONCRETE DISPOSAL UNITS

This section provides regulatory guidance with respect to important issues relevant to using concrete disposal units to provide enhanced containment of disposed-of LLRW. This guidance informs applicants of the types of information the Department will consider in its license application review with respect to fulfilling the requirement for enhanced containment of the disposed-of waste.

The guidance is organized in terms of the subject areas discussed in Section 3. Subsection 4.1 provides guidance on the design of the concrete disposal units, while Subsection 4.2 addresses disposal unit construction. Guidance on monitoring the engineered disposal units and modeling disposal units and modeling their long-term performance is provided in Subsections 4.3 and 4.4, respectively. Finally, guidance on the development and implementation of QA and QC programs is provided in Subsection 4.5.

REGULATORY GUIDANCE ON DISPOSAL UNIT DESIGN

The design of the concrete disposal units should be conducted taking into consideration the issues discussed in Subsection 3.1. The structural design of the vaults should maximize the ability of the structures to resist leakage. Furthermore, it should provide long-term stability of the cover system, thereby maximizing that component's ability to divert water from the disposed-of waste. The design and construction of the disposal units should be safe, practical, and based on proven engineering technology.

The design criteria, models, assumptions, data, analytical methods, and justifications used to develop the structural design for the disposal units should be reliable and well documented. Descriptive information, including plans, sections, and associated specifications, should be provided. Design documentation should include the following information:

1. Codes, standards, and guidance for the design of steel-reinforced concrete disposal units under an appropriate range of loading and environmental conditions.

1. Engineering drawings containing plans, elevations, sections, details, and notes.

1. Design criteria with justification.

1. Design calculations and analyses.

1. Assumptions and associated justifications.

Documentation of analyses should include, but not necessarily be limited to, the following items:

1. Structural description, geometry, and boundary or support conditions.

1. Material properties of concrete, steel, and foundation media.

1. Structural loading conditions, including a description of the method used to calculate the design-basis earthquake and associated structural responses.

1. Design calculations of critical elements, including the method of design analysis, assumptions, and demonstration of structural stability at the end of the design life.

1. Structural analysis and internal forces calculations for applied loads.

1. Steel reinforcement design justification.

1. Stress and strength calculations.

1. Cracking analyses.

1. Deflection analyses.

1. Structure and foundation stability analyses, including reaction calculations, static and dynamic settlement, differential settlement, and long-term consolidation analyses.

1. Radiation shielding analyses.

1. Structural degradation analyses and service-life projection.

1. A description of computer programs used in the design and analyses, including methods of validation.

1. A summary of verification results and comparisons with design acceptance criteria.

REGULATORY GUIDANCE ON DISPOSAL UNIT CONSTRUCTION

The regulatory guidance on disposal unit construction addresses the techniques and materials used in disposal unit fabrication. Subsection 4.2.1 discusses requirements as they pertain to the selection and use of concrete and concrete materials. Subsection 4.2.2 addresses the methods used to construct the disposal units.

Guidance on Concrete and Concrete Materials

Concrete and other materials used in the construction of the disposal units should be qualified and selected as described in Subsection 3.2.1 of this report. Materials should be capable of safely supporting the design loads and resisting deterioration due to chemical and physical attack from the environment. The concrete itself should be of low-permeability to minimize the potential for water percolation.

The engineering properties of the construction materials should be specified and verified. Materials intended for use in the disposal units should be tested and demonstrated to meet quality and durability specifications. Testing should be conducted to provide reasonable assurance that the materials and structures will contribute to long-term stability and integrity. Methods and procedures used to conduct these tests should be identified and evaluated to determine their applicability and adequacy.

The ability of the concrete disposal units to meet their design criteria while subjected to environmental degradation should be demonstrated. Aspects of material quality and durability should be specified and verified, including the resistance or response of the materials to deterioration or damage by freeze/thaw cycling; humidity; aging; fatigue; sulfate, chloride, and acid attack; abrasion; thermal fluctuations; wetting and drying; radiation; biodegradation; electrolysis; shrinkage; and cracking.

Verification of the engineering properties of the construction materials should be achieved through material testing. These tests should be performed as part of the design evaluation and be furnished as a part of the design package. Documentation of these tests should include the test name, the code or specification defining the test protocol and requirements, and the personnel and laboratory conducting each test.

Concrete testing should include determination of slump, air content, unit weight, unconfined compressive strength, and other physical properties as required to assess stability, durability, and serviceability. All constituents of the mix should be tested according to applicable code requirements and specifications, and should conform to the applicable specifications and standards.

All reinforcement and structural steel should be sampled, tested, and certified for use prior to its application at the construction site. Tests should be conducted in accordance with applicable regulations. Compliance of the steel products with applicable standards and specifications should be verified. All other materials used in the construction of the disposal units should be sampled and tested in accordance with approved and specified methods. These materials include chemical admixtures, curing compounds, membranes, moisture barriers (coatings, sealants, and membranes), and water. All materials should conform with the appropriate specifications and standards.

Guidance on Construction Methods

Construction of the disposal units should focus on controlling all conditions that affect construction quality, with reasonable concern for cost-effectiveness. These conditions are described in Subsection 3.2.2 of this report. Important aspects of the construction process that need to be considered include the sequence of construction activities, construction methods, equipment usage, quality control, and testing requirements. Construction, operational, closure, and maintenance activities may be conducted to the extent permitted by the design of the facility provided that conflicts between such activities are avoided. For example, construction, operation, and closure of different disposal units may occur simultaneously, provided that these activities do not interfere with one another and do not compromise the performance capabilities of the closed units.

Vehicular traffic and other construction activities should not adversely affect completed disposal units or those being constructed or operated. Structures, systems, and components should be constructed using methods and equipment that provide reasonable assurance of a high level of workmanship and competence consistent with established construction industry standards.

Construction documentation should include methods and procedures used to:

1. Prepare structural foundations.

1. Form or place formwork.

1. Place reinforcement.

1. Place construction joints, control joints, and expansion joints.

1. Proportion, batch, and mix concrete.

1. Transport and consolidate concrete.

1. Place, finish, and cure concrete.

1. Remove forms.

1. Seal access openings and joints.

1. Place moisture barriers.

REGULATORY GUIDANCE ON DISPOSAL UNIT MONITORING

The performance of the disposal units should be monitored, tested, and evaluated as discussed in Subsection 3.3 of this report. Results of monitoring, testing, and evaluation should be used to verify the validity of design assumptions and to provide reasonable assurance that the engineered structures will perform their regulatory functions. Monitoring should occur during the construction, operational, closure, and institutional control periods to demonstrate acceptable performance.

Monitoring should provide data and information sufficient to allow the effectiveness and performance of the disposal units to be assessed considering all known or suspected degradation mechanisms and forces. Structural monitoring should measure stresses within the structural members of the disposal units, deflections within key structural members, and pore pressures in the concrete. Differential settlement of backfill, the disposal units, and the cover system also should be monitored.

The performance of the reinforced concrete should be assessed using prototype disposal units and concrete samples at the disposal site. These prototype units and samples should be exposed to the same conditions as the actual disposal units (excluding disposed-of LLRW), thereby permitting assessment of performance under the actual chemical and physical conditions that prevail at the site.

Prototype disposal units or concrete samples should be tested using destructive and nondestructive methods. These units and samples should be sacrificed to evaluate penetration depths of aggressive ions (e.g., chloride, sulfate, and magnesium ions) and to assess the extent of corrosive processes. Visual inspection should be used to assess surface deterioration of the concrete, while the effects of freeze-thaw cycling should be assessed by measuring the concrete's modulus of elasticity. Measurements of the compressive strength and the permeability of the concrete to chloride ions and air should also be undertaken as part of the evaluation.

Provisions should be made to monitor the water content in disposal units under unsaturated and saturated conditions. Under unsaturated conditions, soil gas samples and neutron density gauges should be used to determine the water-vapor content inside the structures. For saturated conditions, monitoring wells should be incorporated in the disposal units and in the foundation. Monitoring should occur during the facility's construction, operating, closure, and institutional control periods.

The monitoring wells should be designed and constructed to minimize problems associated with sampling and interpreting the sample data. The wells should, at a minimum, permit measurement of water levels, allow water samples to be collected, and water to be pumped. Placement and characterization of the wells should allow water from around the disposal units (e.g., groundwater, rainwater, etc.) to be distinguished from that percolating through the structures.

Acceptable performance limits for the concrete vaults should be defined to aid in interpreting the performance monitoring results. These performance limits should be specific to the provision of leak resistance and structural stability. However, these limits should also be defined to meet a common goal, which is to ensure that the facility satisfies the performance objectives of 25 PA Code 236 (CPA 89). Performance limits should be based on appropriate regulations, codes, standards, and accepted engineering practices. Performance limits for structural stability should address permissible loads, stresses, deformations, and strains on the structure, foundation, backfill, and cover system. Performance limits for the materials used in construction may include acceptable rates of deterioration, corrosion, and cracking.

Failure to meet established performance limits during or following operations does not necessarily indicate facility failure. Rather, failure to meet the established limits aids in identifying potentially unacceptable conditions and indicates a need for additional information gathering, decision-making, and response. Appropriate responses include monitoring with increased intensity and implementing a variety of remedial actions.

REGULATORY GUIDANCE ON LONG-TERM PERFORMANCE ASSESSMENT

Long-term performance modeling of the disposal units should be conducted consistent with the discussion provided in Subsection 3.3. Performance modeling should provide a means for projecting the effectiveness of the disposal units over their service life, which may extend beyond 500 years. Modeling should provide information in addition to that gained through performance monitoring, which indicates only past and current performance. This information should be used to project the effects of facility construction, operation, closure, and long-term maintenance on facility workers, members of the public, and the environment. Modeling results should also be used to demonstrate compliance with the enhanced containment requirement of 25 PA 236.314(a).

The ability of concrete disposal units to resist leakage and remain structurally stable depends upon a host of facility- and site-specific factors. Important facility-specific factors include those discussed with respect to performance monitoring, such as structural attributes of the engineered system, properties of the materials used to construct the disposal units, and site meteorology and hydrology.

Performance modeling of the disposal units should consider all of the facility- and site-specific aspects that define the effectiveness of the disposal facility. Specifically, performance modeling of the concrete disposal units should account for the following:

1. Changes in the characteristics and capacities of the disposal units with time due to degradation.

1. The ability of the disposal units to bear design loads with changes in construction materials properties.

1. The ability of the disposal units to resist water movement through them.

1. Patterns of groundwater flow around and through the vaults.

Performance modeling should address the dynamic individual, synergistic, and interacting effects of concrete degradation, structural capacity, and water and contaminant transport over the life of the disposal units. Performance modeling should consider the effects of important concrete degradation mechanisms, including but not limited to sulfate attack, freeze-thaw cycling, calcium hydroxide leaching, and corrosion of steel reinforcement. Other degradation mechanisms may require consideration depending upon site environmental conditions and the characteristics of the materials used in the concrete mix. The dependency of structural performance on concrete durability should also be addressed in performance modeling. The relationship between the condition of the disposal units and the rates of water percolation through the structures should be established as part of the long-term performance modeling.

REGULATORY GUIDANCE ON QA/QC

The role of the QA/QC programs in the design, construction, monitoring, and long-term performance modeling of the concrete disposal units is discussed in Subsection 3.5. QA and QC programs must be developed and implemented to ensure that these activities are performed

properly and thoroughly documented. The QA program will ensure that the documentation needed to demonstrate what was done and whether work activities satisfy applicable criteria, procedures, and standards is generated. The QC program will ensure that confirmatory activities are performed to ensure that all work is done correctly, without errors, and with appropriate accuracy, completeness, and consistency.

The QA and QC programs should ensure that all site data are considered in the design of the disposal units. Furthermore, they should ensure that the design calculations and evaluation are performed properly, without procedural, methodological, and calculational errors. During the construction phase, the QA and QC programs should demonstrate that the design plans and specifications are properly incorporated and implemented in the construction activities. In terms of monitoring, the QA and QC programs should ensure that samples are collected and processed properly, that surveys are performed as specified, and that sample accountability can be demonstrated. Finally, the QA and QC programs should ensure that all methods used in long-term performance modeling are valid and that the calculations are performed without error.

A.

APPENDIX A

TECHNICAL RESOURCES FOR THE DESIGN AND CONSTRUCTION OF ENGINEERED STRUCTURES

The following publications provide additional guidance on various aspects of engineered structures and their application in LLRW disposal facilities. The topics they address include:

- Design and construction of disposal facilities using engineered structures.
- Selection of suitable materials for construction.
- Long-term performance of engineered structures.
- Issues relating to the licensing of the completed disposal facility.

These publications represent state and federal agency expertise with respect to designing, constructing, and evaluating the performance of engineered structures. As such, these publications provide applicants with a valuable resource on using engineered structures to provide enhanced containment at a Pennsylvania LLRW disposal facility.

The technical resources include technical position papers, regulatory guides, engineering codes and standards, and other guidance documents. Several of the technical resources are issued by agencies that have no regulatory standing in the Commonwealth, or address types of radioactive waste other than LLRW. These resources have been included because they provide a broad perspective of the current level of expertise in the use of engineered structures in LLRW disposal facilities.

No effort has been made to ensure that all such references have been included in this listing. Rather, those included are representative of the guidance available from existing sources.

A.1 U.S. NUCLEAR REGULATORY COMMISSION

The U.S. Nuclear Regulatory Commission (NRC) has published a number of topical reports, technical position papers, and regulatory guides on the use of concrete engineered structures and waste overpacks. These are summarized below.

A.1.1 Topical Reports

Walton, J.C., et al., 1990, "Models for Estimation of Service Life of Concrete Barriers in Low-Level Radioactive Waste Disposal," prepared by the Idaho National Engineering Laboratory, EG&G Idaho, Inc., for the U.S. Nuclear Regulatory Commission, NUREG/CR-5542.

> This report reviews mathematical models for estimating the degradation rate of concrete in typical LLRW disposal facility service environments. It explains the bases for models taken from the literature and includes example calculations to illustrate the application of the models and indicate the types of predictions that can be expected.

Pommersheim, J.M., and J.R. Clifton, 1991, "Models of Transport Processes in Concrete," prepared by the National Institute of Standards and Technology for the U.S. Nuclear Regulatory Commission, NUREG/CR-4269.

> This report discusses and presents models suitable for modeling the long-term performance of concrete structures. Conceptual and mathematical models for modeling

the ingress of aggressive ions into the structures and the leaching of constituents from the concrete are presented. The report also discusses the application of these models to long-term performance assessments.

MacKenzie, D.R., et al., 1986, "Preliminary Assessment of the Performance of Concrete as a Structural Material for Alternative Low-Level Radioactive Waste Disposal Technologies," prepared by Brookhaven National Laboratory for the U.S. Nuclear Regulatory Commission, NUREG/CR-4714.

This study develops information required to evaluate the long-term performance of concrete as a structural material for LLRW disposal. It reviews and analyzes information in the literature and identifies criteria for evaluating the performance of concrete. The properties of coatings and their possible use in protecting concrete are also discussed. Finally, the study discusses accelerated and long-term testing of concrete, with special reference to its application to modeling long-term performance.

Walton, J.C., and R.R. Seitz, 1991, "Performance of Intact and Partially Degraded Concrete Barriers in Limiting Fluid Flow," prepared by EG&G Idaho, Inc., for the U.S. Nuclear Regulatory Commission, NUREG/CR-5614.

This document examines the factors controlling fluid flow through intact and degraded concrete disposal facilities. It presents simplified models for estimating the buildup of fluid above a vault; fluid flow through and around intact vaults, through flaws in coatings/liners applied to a vault, and through cracks in a concrete vault; and the influence of different backfill materials around the outside of a vault. Example calculations are also provided to illustrate the parameters and processes that influence fluid flow.

U.S. Nuclear Regulatory Commission, 1991, "Standard Format and Content of a License Application for a Low-Level Radioactive Waste Disposal Facility, Safety Analysis Report," NUREG-1199, Rev. 2, January 1991.

This document describes the information that a Safety Analysis Report must contain. The chapter on safety (performance) assessment discusses the release of radioactivity from the facility, intruder protection, and long-term stability of the disposal site.

U.S. Nuclear Regulatory Commission, 1991, "Standard Review Plan for the Review of a License Application for a Low-Level Radioactive Waste Disposal Facility," NUREG-1200, Rev. 2, January 1991.

This report provides guidance to NRC staff reviewers who perform safety reviews of applications to construct and operate LLRW disposal facilities. It describes the types of performance assessment analyses the NRC expects to be performed, reported, and justified. The report considers several important aspects of performance assessment, including characteristics of the waste, infiltration, potential releases under normal and accident conditions, transfer of releases to human access locations, intruder protection, and long-term stability.

Cerven, F., and M.D. Otis, 1987, "Safety Assessment of Alternative to Shallow-Land Burial of Low-Level Radioactive Waste," NUREG/CR-4701, prepared for the U.S. Nuclear Regulatory Commission by EG&G Idaho, Inc., September 1987.

This document evaluates the relative importance of engineered barriers used in enhancements and alternatives to traditional shallow land burial of LLRW. The analysis

presented in the document ranks the contribution of various components to the performance of each disposal system by examining the failure of all possible combinations of components.

Denson, R.H., et al., 1987, "Recommendations to the NRC for Review Criteria for Alternative Methods of Low-Level Radioactive Waste Disposal," NUREG/CR-501, prepared for the U.S. Nuclear Regulatory Commission by the U.S. Army Engineer Waterways Experiment Station, December 1987.

This report presents general and specific design criteria for disposing of LLRW in earth-mounded concrete bunkers. It presents eight major review criteria categories and gives specific design review criteria for each of the eight major review criteria categories.

Soo, P., and L.W. Milian, 1989, "Sulfate Attack Resistance and Gamma Irradiation Resistance of Some Portland Cement Based Mortars," NUREG/CR-5279, prepared for the U.S. Nuclear Regulatory Commission by Brookhaven National Laboratory, March 1989.

This document reports the results of tests conducted to determine the effects of sulfate attack and gamma irradiation on cement mortar. Test measurements include the extent of change in the mortar and the time required for the change to occur.

Clifton, J.R., and L.I. Knab, 1989, "Service Life of Concrete," NUREG/CR-5466, prepared for the U.S. Nuclear Regulatory Commission by the National Institute of Standards and Technology, November 1989.

This report examines the basis for predicting the service life of concrete vaults used for LLRW disposal from accelerated testing and mathematical modeling of factors that affect the durability of concrete buried in the ground. It examines concrete degradation processes and recommends a research plan for developing methods for predicting the service life of concrete.

A.1.2 Technical Position Papers

U.S. Nuclear Regulatory Commission, 1994, "Draft Branch Technical Position on Performance Assessment for Low-Level Waste Disposal Facilities," Low-Level Waste Management Branch, January 1994.

This paper presents license applicants, licensees, states, compacts, and NRC staff with an acceptable strategy and methodology for performing the technical analysis required to show compliance with the performance objective in 10 CFR 61. The performance objective pertains to protecting the general public from radiological exposure.

A.1.3 Regulatory Guides

U.S. Nuclear Regulatory Commission, 1973, "Concrete Radiation Shields for Nuclear Power Plants," Regulatory Guide 1.69, December 1973.

This guide describes acceptable bases for implementing the radiological protection requirements of 10 CFR 20 and 10 CFR 50 with regard to designing and constructing concrete radiation shields in nuclear power plants.

U.S. Nuclear Regulatory Commission, 1976, "Quality Assurance Requirements for Installation, Inspection, and Testing of Structural Concrete and Structural Steel During the Construction Phase of Nuclear Power Plants," Regulatory Guide 1.94, April 1976.

This guide describes an acceptable method for complying with NRC regulations regarding quality assurance requirements for installing, inspecting, and testing structural concrete and steel during the construction phase of nuclear power plants.

A.2 STATE AGENCIES

New York State Department of Environmental Conservation, 1988, "Supplement to the July 1987 Draft Environmental Impact Statement for Promulgation of 6 NYCRR Part 382: Regulations for Low-Level Radioactive Waste Disposal Facilities, Modeling, and Dose Assessment of Alternative Low-Level Radioactive Waste Disposal Methods in New York State," Division of Hazardous Substances Regulation, Bureau of Radiation.

This report documents the environmental pathway and dose analyses presented in the 1987 New York Department of Environmental Conservation report entitled "Draft Environmental Impact Statement for Promulgation of 6 NYCRR Part 382: Regulations for Low-Level Radioactive Waste Disposal Facilities (Certification of Proposed Sites and Disposal Methods)." It also reports changes made in the parameters and calculations of the analyses.

A.3 AMERICAN SOCIETY FOR TESTING AND MATERIALS

The following publications provide guidance and requirements for selecting and testing concrete materials. They provide information needed for controlling the quality and durability of concrete and concrete materials used to build reinforced concrete structures.

- **ASTM A36-81a,** Standard Specification for Structural Steel.
- **ASTM A185-79,** Standard Specification for Welded Steel Wire Fabric for Concrete Reinforcement.
- **ASTM A496-78,** Standard Specification for Deformed Steel Wire for Concrete Reinforcement.
- **ASTM A497-79,** Standard Specification for Welded Deformed Steel Wire Fabric for Concrete Reinforcement.
- **ASTM A615-82,** Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
- **ASTM A616-82a,** Standard Specification for Rail-Steel Deformed and Plain Bars for Concrete Reinforcement.
- **ASTM A617-82a,** Standard Specification for Axle-Steel Deformed and Plain Bars for Concrete Reinforcement.
- **ASTM A775-81,** Standard Specification for Epoxy-Coated Reinforcing Steel Bars.
- **ASTM C33-84,** Standard Specification for Concrete Aggregates.
- **ASTM C39-83b,** Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
- **ASTM C88-83,** Standard Method of Test for Soundness of Aggregates by the Use of Sodium Sulfate or Magnesium Sulfate.

- **ASTM C94-83,** Standard Specification for Ready-Mixed Concrete.
- **ASTM C127-84,** Standard Test for Specific Gravity and Absorption of Coarse Aggregate.
- **ASTM C128-84,** Standard Test for Specific Gravity and Absorption of Fine Aggregates.
- **ASTM C136-83,** Standard Test for Sieve or Screen Analysis of Fine and Coarse Aggregate.
- **ASTM C138-81,** Standard Test Method for Unit Weight, Yield, and Air Content (Gravimetric) of Concrete.
- **ASTM C150-84,** Standard Specification for Portland Cement.
- **ASTM C173-78,** Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
- **ASTM C227-81,** Standard Test for Potential Alkali Reactivity of Cement-Aggregate Combination (Mortar-Bar Method).
- **ASTM C231-82,** Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
- **ASTM C233-78,** Standard Method of Testing Air-Entraining Admixtures for Concrete.
- **ASTM C260-77,** Standard Specification for Air-Entraining Admixtures for Concrete.
- **ASTM C289-81,** Standard Method of Test for Potential Reactivity of Aggregates (Chemical Method).
- **ASTM C309-81,** Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
- **ASTM C494-82,** Standard Specification for Chemical Admixtures for Concrete.
- **ASTM C496-71,** (Reaffirmed 1979) Standard Method of Test for Splitting Tensile Strength of Cylindrical Concrete Specimens.
- **ASTM C512-82,** (Reaffirmed 1983) Standard Test Method for Creep of Concrete in Compression.
- **ASTM C618-84,** Standard Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.
- **ASTM C666-84,** Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing.
- **ASTM D994-71,** (1982) Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).
- **ASTM D1751-73,** (1978) Standard Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
- **ASTM D3744-79,** Standard Test Method for Aggregate Durability Index.

A.4 U.S. ARMY ENGINEER WATERWAYS EXPERIMENT STATION

The publications listed in this subsection pertain to selecting and testing concrete materials.

- **CRD-C 20,** Test Method for Resistance of Concrete to Rapid Freezing and Thawing.
- **CRD-C 48,** Method of Test for Water Permeability of Concrete.
- **CRD-C 52,** Test Method for Abrasion Resistance of Concrete or Mortar Surfaces by the Rotating-Cutter Method.
- **CRD-C 54,** Test Method for Creep of Concrete in Compression.
- **CRD-C 71,** Test Method of Ultimate Strain Capacity of Concrete.
- **CRD-C 400,** Requirements for Water for Use in Mixing or Curing Concrete.

A.5 AMERICAN CONCRETE INSTITUTE

The following publications provide guidance and requirements for selecting and testing concrete materials and constructing reinforced concrete structures. They include information on a number of construction aspects, including formwork, mixing and placement of concrete, curing of concrete, and steel reinforcement design and construction.

- **ACI 117-90/117R-90,** Standard Tolerances for Concrete Construction and Materials.
- **ACI 201.2-77 (82),** Guide to Durable Concrete.
- **ACI 209R-82 (86),** Prediction of Creep, Shrinkage, and Temperature Effects in Concrete Structures.
- **ACI 211.1-91,** Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete.
- **ACI 212.3R-91,** Chemical Admixtures for Concrete.
- **ACI 216R-89,** Guide for Determining the Fire Endurance of Concrete Elements.
- **ACI 221R-89,** Guide for Use of Normal Weight Aggregate in Concrete.
- **ACI 224R-89,** Control of Cracking in Concrete Structures.
- **ACI 301-89,** Specifications for Structural Concrete for Buildings.
- **ACI 304R-89,** Guide for Measuring, Mixing, Transporting, and Placing Concrete.
- **ACI 304.2R-91 Revised 1982,** Placing Concrete by Pumping Methods.
- **ACI 305R-91,** Hot Weather Concreting.
- **ACI 306R-88,** Cold Weather Concreting.
- **ACI 306.1-90,** Standard Specification for Cold Weather Concreting.

- **ACI 308-81 (86),** Standard Practice for Curing Concrete.
- **ACI 309R-87,** Guide for Consolidation of Concrete.
- **ACI 318.1-89/318.1R-89,** Building Code Requirements for Structural Plain Concrete and Commentary.
- **ACI 347R-88,** Guide to Formwork for Concrete.
- **ACI 349-90/349R-90,** Code Requirements for Nuclear Safety Related Concrete Structures and Commentary.
- **ACI 350R-89,** Environmental Engineering Concrete Structures.
- **ACI 439.4R-89,** Steel Reinforcement-Physical Properties and U.S. Availability.
- **ACI 503R-89,** Use of Epoxy Compounds with Concrete.
- **ACI 504R-90,** Guide to Joint Sealants for Concrete Structures.
- **ACI 515.1R-79,** (85) A Guide to the Use of Waterproofing, Dampproofing, Protective, and Decorative Barrier Systems for Concrete.
- **ACI SP-66 (88),** ACI Detailing Manual Includes 315-80 (Revised 1986), 315R-80 (Revised 1988), and Supporting Reference Data.
- **ACI SP-79,** Fly Ash, Silica Fume, Slag, and Other Mineral By-Products in Concrete (1984).
- **ACI SP-91,** Fly Ash, Silica Fume, Slag, and Natural Pozzolan in Concrete (1986).

appendix a

technical resources for the design and construction of engineered STRUCTURES

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Requirements for Low-Level Radioactive Waste Minimization Plans

Pennsylvania Department of
Environmental Protection
Bureau of Radiation Protection

July 1998

Low-Level Radioactive Waste Minimization Program Plans (Final July 1998)

This document serves two purposes: 1) establish guidelines and criteria that department personnel can convert to regulatory requirements in a future rulemaking (i.e., generator permitting regulations as specified at Section 310 of Act 1988-12); and 2) provide low-level radioactive waste generators with advance notice of the department's intended approach for regulating waste minimization programs. The rulemaking process will be completed immediately prior to the start-up of regional disposal facility operations.

These preliminary activities will serve to provide all interested parties the opportunity to participate in establishing the framework of the future rulemaking package and to provide generators time to develop waste minimization program plans in advance of anticipated regulations, without worry of unreasonable schedules or regulatory oversight during plan development. It also provides a time period to determine if the criteria will serve the intended function (i.e., minimizing the toxicity and volume of low-level radioactive waste that must be disposed) prior to implementing regulations.

It is important to note that the document is directed at all generators that produce waste that must be disposed at the regional facility because the Low-Level Radioactive Waste Disposal Act (Act 1988-12) does not include a provision exempting small quantity generators from preparing waste minimization plans. However, the document does include provisions to minimize the administrative burden of preparing waste minimization plans or reports.

This document also may be used outside of the anticipated rulemaking process. Generators are encouraged to use this document as a guideline for designing and implementing voluntary waste minimization programs.

This final document is a revision of documents presented to the department's Low-Level Waste Advisory Committee (LLWAC) on December 12, 1997, March 12, 1998 and June 11, 1998. The document is organized according to the following sections: 1.0 Statutory Authority; 2.0 General Provisions; 3.0 Waste Minimization Plan Requirements; and 4.0 Oversight and Enforcement.

1.0 Statutory Authority

1. Waste minimization plan requirements will be included as part of the generator permitting regulations. The rulemaking package will be promulgated under the authority of the following statutes:

   Sections 310 and 302 of the Low-Level Radioactive Waste Disposal Act.

   Section 302 of the Radiation Protection Act.

   Section 1920-A of The Administrative Code of 1929.

   1.2 The following words and terms have the following meanings unless the context clearly indicates otherwise:

   Broker - Any intermediate person who collects, consolidates, handles, treats, processes, stores, packages, ships or otherwise has responsibility for or possesses low-level radioactive waste.

   Commission - The Appalachian States Low-Level Radioactive Waste Commission.

   Department - The Pennsylvania Department of Environmental Protection of the Commonwealth.

   Generator - A person whose activity results in the production of low-level radioactive waste requiring disposal.

Person - Any individual, corporation, partnership, association, public or private institution, cooperative enterprise, municipal authority, public utility, trust, estate, group, Federal Government or agency, other than the United States Nuclear Regulatory Commission or any successor thereto, state institution and agency, or any other legal entity whatsoever which is recognized by law as the subject of rights and duties. In any provision of the Low-Level Radioactive Waste Disposal Act (Act 1988-12) prescribing a fine, imprisonment or penalty, or any combination of the foregoing, the term "person" shall include officers and directors of any corporation or other legal entity having officers and directors.

Recycle - The reuse of radioactive materials. It includes on-site, "in-process" recycling and both on-site and off-site beneficial reuse under controlled (i.e., licensed or permitted) conditions.

Regional facility - A facility which has been approved by the commission and licensed under Act 1988-12 for the disposal of low-level radioactive waste.

Toxicity - The physical and chemical form and radiological properties of a radionuclide, that makes it available to interact, directly or indirectly, with the human body.

Toxicity reduction - Waste avoidance, recycling or the treatment of waste to lessen its availability to interact, directly or indirectly, with the human body.

Waste - Low-level radioactive waste.

Waste stream - A type or category of low-level radioactive waste such as: dry active waste, ion exchange resins, etc. Waste stream types or categories shall be consistent with the waste stream code designations contained in the department's quarterly reporting system (see attachment A for specific waste stream codes) or designations specified on the regional facility manifest forms (to be developed).

2.0 General Provisions

2.1 It is the policy of the department to encourage all users of radioactive materials to implement programs that minimize the generation of LLRW. Radioactive materials users seeking to implement waste minimization programs and users with active waste minimization programs are encouraged to embrace or enhance programs that include the continuous cycle of planning, implementing, reviewing and improving the actions that a person takes to meet its environmental obligations. The Bureau of Radiation Protection proposes to work with radioactive material users as they design and implement their waste minimization programs.

This policy will be backed by two specific actions that will take effect when regional facility operations begin; 1) adoption of a regional facility disposal fee schedule that encourages reduction of the toxicity and volume of LLRW, and 2) requiring, as a condition of issuing a regional facility access permit, that a waste generator have a plan for reducing the toxicity and volume of LLRW requiring disposal.

2. Waste minimization plans shall cover a five-year time period and address activities that reflect current operating practices and project anticipated future operating practices. Waste minimization plans shall be prepared in a manner that affords generators maximum flexibility in accommodating practice changes that result in further toxicity or waste volume reductions without having to request permit amendments. In addition, generators may choose to discuss past conditions to document and illustrate voluntary waste minimization practices (i.e., up to the effective date of promulgation of the generator permitting regulations specified at Section 310 of Act 1988-12 at startup of regional facility operations). Finally, each generator shall assure that implementation actions included in individual waste minimization plans (i.e., a plan covering any

five-year period) will not adversely affect (i.e., increase the toxicity or volume of LLRW requiring disposal) future decontamination and decommissioning activities.

Plans shall address the minimization of both the toxicity and volume of wastes generated. In situations where toxicity and volume minimization are mutually exclusive, preference shall be given to toxicity minimization.

The most effective method for minimizing waste toxicity and volume is source reduction/waste avoidance. Consequently, source reduction/waste avoidance should take precedence over other waste minimization practices. The priority of methods to be considered when designing and implementing a waste minimization plan and program are presented in order of preference:

1. Source reduction/waste avoidance: includes any practice that reduces the amount of radioactive materials entering a waste stream. This practice is conducted prior to recycling, treatment or disposal. Examples of source reduction/waste avoidance include but are not limited to; procedure or process modifications, technology or equipment modifications, materials segregation and substitution, and product redesign.

2. Recycle: pertains to the recycle/reuse of radioactive materials. It includes on-site, "in-process" recycling and both on-site and off-site beneficial reuse under controlled (i.e., licensed or permitted) conditions.

3. Treatment: includes any physical alteration of a waste stream that results in either or both the reduction of toxicity and volume of waste requiring disposal. Examples of treatment include but are not limited to; chemical or mechanical methods to remove radioactive materials from an item, solidification or encapsulation to make the radioactive materials more resistant to leaching and transport, separation, compaction, and incineration.

All waste minimization methods shall minimize the generation of secondary waste streams (including the generation of mixed wastes) and be conducted in compliance with all regulatory requirements.

3.0 Waste Minimization Plan Requirements

1. Waste Minimization Plan

A person whose activity results in the production of LLRW requiring disposal and seeks to dispose of the waste at the regional facility, is required to obtain a regional facility access permit. Preparation and a commitment to implement a waste minimization plan are a condition for receiving a permit for access. The plan shall satisfy the requirements described in section 3.1.1.

A person that certifies it is a one-time generator can satisfy waste minimization plan requirements by preparing and submitting a waste minimization report with its permit application. The report shall satisfy the requirements described in section 3.1.2.

1. Content of a Waste Minimization Plan

A person seeking a regional facility access permit is required to prepare and implement a waste minimization plan consistent with and in proportion to the amount and toxicity of radioactive materials used by the generator (see one-time generator exception, section 3.1.2). The same types of information are requested from all persons. Waste minimization plans shall consist of:

1. A statement of management commitment and support.

2. A summary discussion of the activities that result in the generation of waste and a description of the methods (i.e., the procedures and operations used to minimize the toxicity and volume of LLRW including; source reduction, recycle, treatment, etc., as discussed under section 2.2 of this document) that will be implemented to minimize the amounts of waste generated. For example, a generator may describe waste minimization methods as, "filtering and dewatering of liquid wastes," and "radionuclide segregation for decay-in-storage".

3. Generator-specified waste minimization goals including numeric goals and/or process goals.

4. A description of the program that will be used to assess the effectiveness of the waste minimization plan.

2. Content of a Waste Minimization Report

It is recognized that some persons that seek a regional facility access permit will be one-time waste generators. It is the department's intent to minimize administrative burdens on such persons and to assure that the minimal amount of waste is generated. Waste minimization reports shall consist of:

1. A statement from the person that it is a one-time waste generator (e.g., a scrap metal recycler that unknowingly received a radioactive source, a school that discovered old radioactive items as a result of cleaning out science labs, etc.).

2. A description of the events and/or activities that caused the wastes to be generated and require disposal.

3. Descriptions of the processes that will be or were implemented to minimize the amounts of waste generated and requiring disposal.

2. Waste Minimization Plan and Waste Minimization Report Reviews

An initial waste minimization plan or report shall be included as part of the generator's application for a regional facility access permit. It will be reviewed during the permit application review process.

Administrative procedures such as: verification of receipt of a generator's permit application; revising the permit application; requirements for issuance of a permit; conditions of the permit; etc., will be prepared as part of the broader rulemaking package for permitting generators, brokers and carriers access to the regional LLRW disposal facility (i.e., regional facility access permit). The procedures will include a requirement that an approved waste minimization plan or report is a condition for issuance of the regional facility access permit.

1.

2. Waste Minimization Plan Review

The department will review waste minimization plans for completeness, and to ensure that the plans are prepared in accordance with the Act and regulations. Reviewers are advised to consider generators discussions of: historic and planned waste minimization efforts for its licensed activities; anticipated product, process or service changes that may affect waste generation activities; justifications involving ALARA considerations, and health and safety versus cost considerations; and compliance with other regulations and regulatory guides that affect waste minimization plan decisionmaking. Such information will assist the department in evaluating the generator's overall approach and commitment to implementing waste minimization activities.

Reviewers also are advised to compare a generator's waste minimization plan against waste minimization plans of similar generator types (e.g., government, utility, industrial, etc.) as a method for determining the reasonableness of the specific waste minimization goals proposed by a generator.

Generators' waste minimization plans will be reviewed for the following:

1. A signed statement of support from management, committing to implement its waste minimization plan. This statement should be reviewed for the inclusion of the following types of information: commitment to waste minimization and the establishment of specific minimization goals and a commitment to provide funding for the waste minimization program; provisions for employee training and involvement; and a commitment to conduct periodic assessments to assure plan compliance and identification of opportunities for continued improvement (i.e., further waste minimization). The statement shall be evaluated for signature by a duly designated officer of the organization.

2. A summary discussion of the activities that result in the generation of waste and a description of the processes that will be implemented to minimize the amounts of waste generated. This section should be reviewed for the inclusion of a summary of the activities that result in the generation of waste requiring disposal. Summaries should be organized by waste stream (e.g., as reported by the generator on its quarterly reports to the department or on the generator's waste manifest forms). Proprietary information need not be disclosed in waste minimization plans. However, generators shall allow department personnel access to additional detailed records during site visits and inspections.

   Reviewers are advised to compare the generator's summary discussions against selected quarterly reports and waste manifest forms to confirm all reported waste streams are addressed in the waste minimization plan.

3. Generator-specified waste minimization goals. This section should be reviewed for the inclusion of the following types of information; priorities, methods, schedules and specific goals for minimizing the waste streams identified and discussed in section 3.1.1.2. This information will be reviewed in conjunction with the evaluation conducted under section 3.2.1.2 to understand the schedule for implementation, the waste minimization processes to be implemented (e.g., source reduction, recycle, etc.), priorities for waste stream minimization, and to confirm the generator considered all waste streams.

4. Inclusion of a program to periodically assess conformance with, and effectiveness of, the waste minimization plan. This section should be reviewed for the following types of information: identification of position (s) responsible for conducting the assessments; duties, responsibilities and authority of the position (s) responsible for conducting the assessments; frequency of assessments as related to generator-specific radioactive material use practices; and provisions for continuous improvement.

2. Waste Minimization Report Review

The department will review waste minimization reports to confirm that the generator submitted a statement certifying that it is a one-time generator; the statement was signed by a duly designated officer of the organization; and to confirm that the generator will or has implemented methods to minimize the toxicity and volume of waste requiring disposal.

3. Waste Minimization Plan Approval

The inclusion of an acceptable waste minimization plan or waste minimization report will be a condition for issuing a regional facility access permit.

The department will commit to a specific duration of time for reviewing and acting (i.e., approval or disapproval) on waste minimization plans and reports. This commitment will be included as part of the broader rulemaking package for permitting generators, brokers, and carriers access to the regional LLRW disposal facility.

4. Waste Minimization Plan Changes

Generators are required to submit revised waste minimization plans:

1. In conjunction with a permit renewal (i.e., every five years) for continued access to the regional facility. At a minimum, the generator shall assess its radioactive material use activities relative to opportunities for improved waste minimization. The generator shall document the assessment. If its radioactive material use activities are unchanged, the generator shall indicate that waste minimization plan changes are not required. If the assessment indicates opportunity for improved waste minimization, a revised plan shall be submitted with the permit renewal application.

2. When periodic assessment of waste minimization activities indicate a trend significantly different than expected (e.g., goals are not being achieved or activities are not being implemented).

Revised waste minimization plans shall conform to the requirements of "Content of a Waste Minimization Plan" (3.1.1). Waste minimization plan revisions shall be highlighted and justified where necessary (e.g., a less aggressive waste minimization goal due to the potential for increased exposure to workers or the public).

4.0 Oversight and Enforcement

1. Oversight

The department will determine the adequacy of generators' waste minimization programs through conduct of oversight activities.

1) The department will monitor waste minimization progress through analysis of generators quarterly and annual waste generation reports and information contained on waste manifest forms received at the regional facility.

2) The department may conduct inspections at generator facilities. The purpose of the inspections is to confirm waste minimization plan implementation. This includes exploring options for working with the Appalachian Compact party states and the Appalachian States Low-Level Radioactive Waste Commission to implement an effective on-site inspection program.

2. Enforcement

Enforcement options will be included as a separate section in the broader rulemaking package for permitting generators, brokers and carriers access to the regional facility.

It is anticipated that negative inspection findings will be categorized as "Level III" violations which are defined as "an act or omission, contrary to applicable statutes, regulations, or department orders which include violations that are administrative or clerical in nature and do not result in radiation exposure, radioactive contamination of the environment, or pose a threat to public health and safety."

Initial actions of the department will be to work closely with a generator to assist it in complying with the Act and regulations. Upon exhausting other options, the department may, in situations where generators

continuously and/or purposefully neglect to implement their approved waste minimization plans, terminate the generator's regional facility access permit.

Attachment A

Waste Stream Codes for PA DEP LLRW Database

STREAMCODE	STREAMNAME
00	NONE
01	ANIMAL CARCASSES OR NON-INFECTIOUS BIOLOGICAL WASTE
02	DRY ACTIVE WASTE - COMPACTED BY COMPACTOR
03	DRY ACTIVE WASTE - NON-COMPACTED
04	DRY ACTIVE WASTE - SUPER COMPACTED BY COMPACTOR
05	FILTER MEDIA - DEWATERED
06	FILTER MEDIA - SOLIDIFIED
07	GASEOUS SOURCES
08	INCINERATOR ASH OR RESIDUALS
09	ION EXCHANGE RESINS - DEWATERED
10	ION EXCHANGE RESINS - SOLIDIFIED
11	IRRADIATED REACTOR OR POOL COMPONENTS
12	LIQUID AQUEOUS - ABSORBED
13	LIQUID AQUEOUS - SOLIDIFIED
14	LIQUID ORGANICS, INCLUDING CONTAMINATED OIL
15	LIQUID SCINTILLATION (FLUIDS OR VIALS)
17	RADIOACTIVE SEALED SOURCES, DEVICES, OR GAUGES
18	SOLIDIFIED EVAPORATOR BOTTOMS/CONCENTRATIONS/SUMP SLUDGE
19	VITRIFIED ASH OR RESINS
99	OTHER* CONTACT PA DEP BEFORE USING THIS CODE: 1-800-232-2786

DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF RADIATION PROTECTION
DIVISION OF RADIATION CONTROL

DOCUMENT NUMBER:	291-0400-001
TITLE:	Policy & Procedure Summary, Radiation Control Division
EFFECTIVE DATE:	Revised: September 20, 1996
AUTHORITY:	This policy is established under the authority of the Radiation Protection Act, act of July 10, 1984, P.L. 688, No 147 (35 P.S. §§ 7110.101-7110.703).
POLICY:	This is an assembly of policies that were intended to eliminate difficulties of interpretation that have arisen during inspections when field staff have tried to enforce the regulations.
PURPOSE:	These policy documents that are intended to help the Division of Radiation Control field staff apply the regulations uniformly throughout the state.
APPLICABILITY:	These policies are for all Division of Radiation Control field inspectors.
DISCLAIMER:	The policies and procedures outlined in this guidance are intended to supplement existing regulations.. Nothing in the policies or procedures shall affect regulatory requirements. The policies and procedures herein are not an adjudication or a regulation. There is no intent on the part of DEP to give the rules in these policies that weight or deference. This document establishes the framework within which DEP will exercise its administrative discretion in the future. DEP reserves the discretion to deviate from this policy statement if circumstances warrant.
PAGE LENGTH:	10
LOCATION:	Vol. 3, Tab 01

BUREAU OF RADIATION PROTECTION
DIVISION OF RADIATION CONTROL
INDEX OF
POLICY INSTRUCTIONS
TO STAFF

EXEMPTION FOR CYTOGEN REAGENT KIT
(Memo Dated April 28, 1993)
EXEMPTION FOR MEDICAL USE OF RADIOACTIVE MATERIAL
FDA-LICENSED DIAGNOSTIC IMAGING KIT
SATUMOMAB PENDETIDE TAGGED WITH INDIUM 111 CHLORIDE

BACKGROUND

On December 29, 1992, the Food and Drug Administration (FDA), U.S. Department of Health and Human Services, issued License No. 1164 to Cytogen Corporation (Princeton, NJ) to manufacture and ship for sale, barter, or exchange in interstate or foreign commerce a new diagnostic imaging agent, satumomab pendetide (OncoScint ® CR/OV, Product License Application No. 89-0601). OncoScint ® is licensed for use in patients with ovarian or colorectal cancer and is tagged with Indium 111 Chloride (INDICLOR ™, New Drug Application (NDA) No. 19-862) prior to injection.

At issue, is the regulatory status of an FDA Product License Application (PLA) under Pennsylvania's Medical Use of Radioactive Material Regulations set forth in 25 Pa. Code Chapter 224. Section 224.60 (2) of the regulations provides that a licensee may use for medical use only:

(2) Reagent kits that have been manufactured, labeled, packaged and distributed in accordance with an approval by the Department of Environmental Protection (Department) under Sec. 217.91, an agreement state or the NRC, under equivalent regulations for the preparation of radiopharmaceuticals for medical use.

FDA regulations set forth in 21 CFR Subchapter F, Part 600 pertaining to radioactive biological products are deemed to be equivalent to Department standards for the preparation of radiopharmaceuticals for medical use.

Under Sec. 224.201 (a) of the regulations,

(a) "A licensee may use radioactive material in a diagnostic radiopharmaceutical or a generator or reagent kit for preparation and diagnostic use of a radiopharmaceutical containing radioactive material for which the FDA has accepted a "Notice of Claimed Investigational Exemption for a New Drug" or approved a "New Drug Application".

While Sec. 224.201 is silent as to the use of reagent kits for which the FDA has approved a PLA, the product license for OncoScint ® CR/OV is issued by the FDA in accordance with applicable provisions of Title III Part F of the Public Health Service Act of July 1, 1944 (58 Stat. 702) and regulations promulgated thereunder. These Federal standards adequately protect the pubic health and safety.

Section 224.9 of the Medical Use of Radioactive Material Regulations authorizes the Department to grant exemptions from its Radiological Health Regulations upon a determination that the exemption does not endanger life or property or the common defense and security and is otherwise in the public interest.

EXEMPTION

The Cytogen Corporation's diagnostic imaging kit OncoScint ® CR/OV (satumomab pendetide), PLA No. 89-0601 is hereby exempt from the requirements of 25 Pa. Code Sec. 224.201 (a) so long as the manufacturer complies with applicable provisions of Federal law.

INQUIRES

Inquiries regarding the exemption of the Cytogen Corporation's reagent kit, OncoScint ® CR/OV (satumomab pendetide) should be directed to Stuart R. Levin, Chief, Radioactive Material Licensing, Department of Environmental Protection, P.O. Box 8469, Harrisburg, PA 17105-8469. Mr. Levin's telephone number is (717)-787-3720.

NEW REGULATIONS
D.E.P. GUIDANCE
REGARDING
RADIOACTIVE CONTAMINATION SURVEYS
(Memo Dated OCTOBER 1, 1992)

This regulatory guidance is public information and should be distributed to any person who has questions.

Section 224.108 (e): "A licensee shall survey for removable contamination each day of use the areas where radiopharmaceuticals are routinely prepared for use or administered and each week where radioactive materials are stored."

GUIDANCE

PA licensee's will be considered in compliance with 224.108 (e) if they are (1), complying with 224.108 (a); and (2), if or when radiation levels exceed the licensee's trigger levels, wipes were taken to determine if the levels were due to contamination..

If the PA licensee has an NRC license, the same criteria as above will apply.

FIXED C-ARM FLUOROSCOPIC INSTALLATIONS
(Memo Dated FEBRUARY 28, 1991)

In determining compliance with Sections 221.33 (a) and (b) at fixed C-Arm fluoroscopic installations, entrance exposure rate measurements should be made as follows:

a. Since the SID (Source-to-Image receptor-Distance) in fixed C-Arm installations is variable, position the source housing and/or the imaging assembly so as to obtain the minimum SID.

b. Measure the exposure rate at 30 cm from the input surface of the imaging assembly under the conditions specified in Section 221.33 (c) (5).

INTERPRETATIONS OF CHAPTER 217, LICENSING
(Memo Dated JANUARY 30, 1990)

There has been a question about the interpretation of the above mentioned section as to whether or not calibration or reference sources which have decayed to less than their exempt quantity have to be listed in the quarterly inventory.

The answer is YES.

The Department requires all calibration or reference sources obtained under section 217.63 (d) (4) to be inventoried quarterly until their legal disposition. This means Cobalt-57 sources must be inventoried when they decay below 100 microcuries.

The NRC may interpret this requirement differently. Therefore, it is possible that a licensee may not be listing any sources below an exempt quantity (byproduct or NARM) on their inventory.

ENFORCEMENT

1. DO NOT CITE a licensee for failure to inventory calibration sources which have decayed to exempt quantities.

2. DO include a paragraph in the inspection letter advising the licensee to include those sources in their inventory and that compliance with section 217.63 (e) (4) (ii) will be checked during the next inspection.

NEW EMERGENCY ROOMS
(Memo Dated NOVEMBER 20, 1989)

The design of emergency rooms is changing as older rooms are being remodeled. The overhead stationary tube is more convenient than a portable and capable of better radiographs. One tube for several rooms is also cost effective. The design will increase the efficiency of the emergency room when x-rays are needed.

On the negative side, the convenience will probably lead to more x-rays being taken in the emergency room which is shielded for x-rays on only three sides. The side toward the hall cannot be shielded since no door will be put on this end. In addition, the opening into this room will be 6 to 8 feet wide, making the door impractical. This leaves only administrative controls to protect the people in the hallway.

The following guidelines are suggested for your review.

GUIDELINES FOR USING STATIONARY X-RAY UNITS IN NEW EMERGENCY ROOMS

1. The x-ray technologist must clear the hall in front of the room prior to making an exposure.

2. A portable lead shield shall be available and placed in the room which is being used for the x-ray exposure. It will be placed to eliminate, as much as possible, any scatter radiation into the hall.

3. Projections which require the tube to be pointed toward the open doorway are not permitted.

4. The x-ray tube shall not be operable from a control panel where the operator cannot view the patient and the control panel at the same time.

INDUSTRIAL RADIOGRAPHY REGULATIONS
(Memo Dated AUGUST 4, 1989)

The following interpretations of Chapter 225 apply to shielded room radiography employing only x-ray equipment.

1. Section 225.22 (a): Recommend that interlocks and other safety devices be tested periodically (similar to requirement in Section 225.21 (d) for cabinet systems). Interlocks that de-energize the x-ray unit in lieu providing an audible signal are acceptable.

2. Section 225.22 (b): Compliance with this section satisfies the training requirements; do not enforce Section 225.41.

3. Section 225.22 (c): Compliance with this section satisfies the personnel monitoring requirements; do not enforce Section 225.43

4. Section 225.31 (d): Do not enforce this section as the purpose of the survey meter is to comply with Section 225.22 (d). In lieu of calibration, however, there must be a way of determining that the meter is operable.

WRITTEN SAFETY PROCEDURES FOR X-RAY OPERATORS
(Memo Dated MAY 2, 1989)

Enclosed are common safety procedures which may be given to registrants during an inspection as an example of what is needed to comply with Section 221.11 (d) of the regulations. The registrant should be told that the procedures may be used as is or may be modified, if necessary, to meet their particular situation.

The item of non-compliance should be worded as follows:

"Written safety procedures were not available to the operators of the x-ray equipment, Chapter 221.11 (d). If the procedures given to you at the time of the inspection or a modified version of these procedures are made available in the future, no further action is required."

This requirement should be enforced only at facilities having operators in addition to the practitioner. If this is the only item of non-compliance, the compliance status field in LUMIS should be "2".

SAFETY PROCEDURES
X-RAY EQUIPMENT

1. Only qualified individuals, authorized by the registrant, may operate the x-ray equipment.

2. X-ray examinations must be prescribed by a licensed practitioner.

3. Technique factors must be posted and used for each projection to be performed.

4. No individual occupationally exposed to radiation may hold patients during exposures except in an emergency. If a patient must be held by an individual, that individual must be protected with adequate shielding devices (e.g., a lead apron and gloves) and be positioned so that no part of that individual's body, except for the hands and forearms, may be struck by any part of the useful beam.

5. Only individuals required for the radiographic procedures are to be in the radiographic room during exposures. All such individuals, except for the patient, are to use appropriate protective devices.

6. The useful beam must be confined to the area of clinical interest.

7. Ask female patients (of child-bearing age) about the possibility they may be pregnant. Do not assume they are not.

8. Questions concerning radiation protection should be directed to the registrant of the individual designated as the radiation safety officer for the facility. Inquiries may also be made to the Pennsylvania Bureau of of Radiation Protection. The telephone number is (717)-787-3720.

RECIPROCITY FOR RADIOACTIVE MATERIAL
(Memo Dated APRIL 12, 1988)

The use of byproduct, source, and special nuclear material in Pennsylvania is completely under the jurisdiction of the Nuclear Regulatory Commission (NRC) 215.1 (d).

Persons who conduct radioactive material operations in Pennsylvania on temporary jobs and who use only byproduct, source, and/or special nuclear material under an NRC or Agreement State License are exempt from 217.121. These licensees are not required to notify us, nor do they operate under our radiation regulations.

Persons in the above paragraph operate under the requirements of 10 CFR 150.20 (b) (1). This section also mentions use of NRC Form 241, "Report of Proposed Activities in Non-Agreement States."

Section 217.122 (reciprocity of licenses of NARM) does apply to persons operating in Pennsylvania on temporary jobs and holding an Agreement State of licensing state license. If these persons have both types of material, 217.122 still applies to the use of NARM.

SUMMARY

1. Out-of-state licensees using byproduct, source, and special nuclear material must comply with 10 CFR 170. They have no legal obligations to Pennsylvania.

2. Out-of-state licensees using NARM alone must comply with 217.122.

3. Out-of-state licensees using both NARM and "NRC" material must comply with 217.122 and 10 CFR 170.

Data Management /
eFACTS

What is eFACTS?

- eFACTS is the Environmental Facility Application Compliance Tracking System.
- eFACTS is a Data Integration and System Conversion Project.
- It contains **integrated:**
  - ⇒Client and Site records
  - ⇒Application processing
  - ⇒Program-specific facility details
  - ⇒Compliance (Inspections, Violations, Enforcements, and Penalties)
  - ⇒Licensing
  - ⇒Bonding and Forfeiture Tracking
  - ⇒Self Monitoring
  - ⇒Reporting Functionality

What is eFACTS? continues

eFACTS allows DEP to collectively focus on and carry out its mission: *"to protect Pennsylvania's air, land, and water from pollution and to provide for the health and safety of its citizens through a cleaner environment."* While historically the agency has had to deal with information in multiple, non-integrated databases and files, DEP now has the ability to access information from multiple programs about a regulated client or site.

To carry out its mission, DEP is responsible for a vast array of diverse programs. These programs include traditional environmental protection programs like air, water, and waste; resource management programs like wetland protection and water resource planning; and other programs as diverse as oil and gas drilling, radiation protection, surface mining, and deep mine safety. Few businesses in Pennsylvania fall outside the scope of DEP's regulatory oversight. Over 1,600 of the DEP regulated businesses must interact with more than one program. Because each program had it's own "stovepiped" data, the agency failed to capitalize on the information it collected. This meant a company might have been in non-compliance across multiple programs, without DEP realizing it. It also put the department at risk for oversights, such as a facility receiving an award from waste minimization from one program, while another program cited the same facility for air quality violations.

Why is the eFACTS needed?

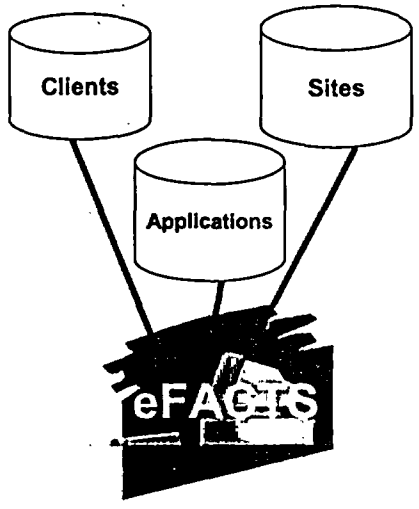
- To foster Cross-Program and Cross-Organizational communication
- To support New Initiatives, support decision making, and better manage DEP Resources
- To better understand facilities regulated by multiple programs
- To foster single authorizations issued by multiple organizations
- To regulate Compliance Issues

Who uses eFACTS?

- People like you, working with the following Bureaus use eFACTS:
  - Land Recycling and Waste Management
  - Mining and Reclamation
  - Oil and Gas Management
  - Radiation Protection
  - Water Quality Protection
  - Air Quality

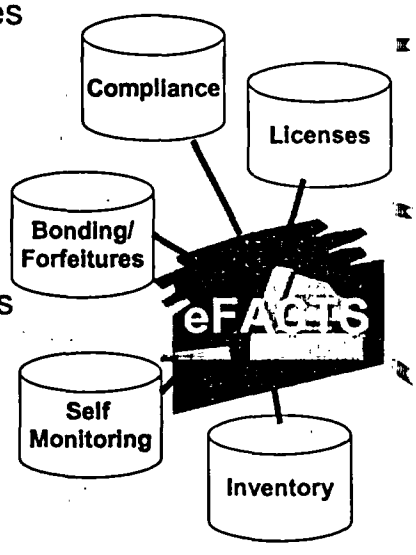
Phase 1

- Application Processing
- Client / Site Systems Conversions
- Data Standardization



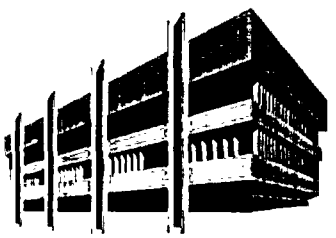
Phase 2

- Program Specific Inventories
  - **BMR**
  - **BWQP**
  - **BLRWM**
  - **BRP**
  - **BOGM**
- Inspections and Violations
- Enforcements and Penalties
- Bonding and Forfeitures
- Self-Monitoring
- Licensing



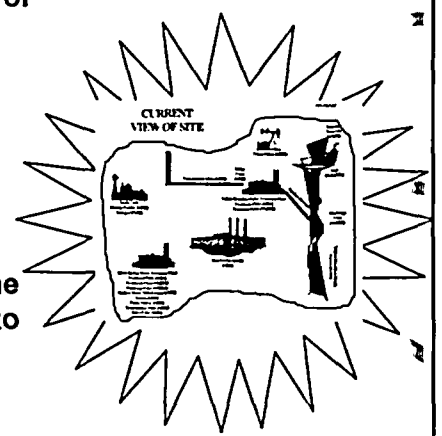
Client

- An applicant;
- An officer within the applicant's organization;
- Any other organization within the applicant's organizational hierarchy;
- An agent representing the applicant;
- An operator working for the applicant;
- A person or organization responsible for environmental damage.



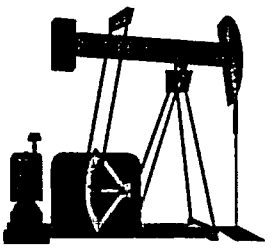
Site

- A site is a physical location(s) of importance to DEP.
- Site is defined by the client/applicant's purpose for doing business, not solely by geographic location.
- This holistic view of site promotes; understanding of the interrelationships of facilities to support pollution prevention; multi-media inspections; a department wide view of compliance; and public understanding and access to information.



Primary Facility

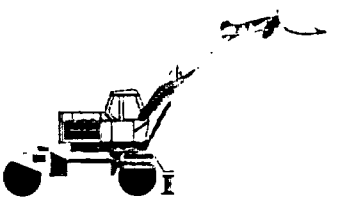
- A logical bridge between sites and sub facilities that allows DEP to provide a framework for a facility's or an activity's regulation.



- Examples:
  - Coal Mining Operation
  - Oil and Gas Location
  - Water Pollution Control Facility
  - Radiation Facility
  - Captive Hazardous Waste Operation

Sub Facility

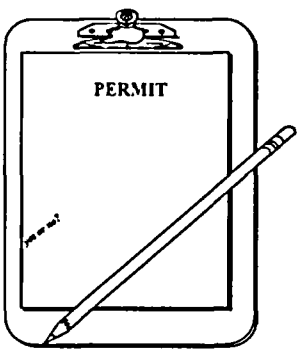
- A physical thing that DEP regulates



- Examples:
  - Surface Mine
  - Discharge point
  - X-ray machine
  - Treatment plant
  - Oil and gas well

Authorization

- Any DEP approval
- Examples:
  - Permits
  - Certificates
  - Licenses
  - Plans
  - Registrations

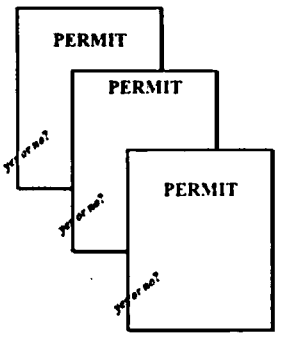


Master Authorization

- A DEP approval, which will be maintained by continuing renewals, amendments, certifications, reissues, and modifications.

Project

- A group of authorizations, potentially including multiple programs, coordinated to support an organization's process or purpose.

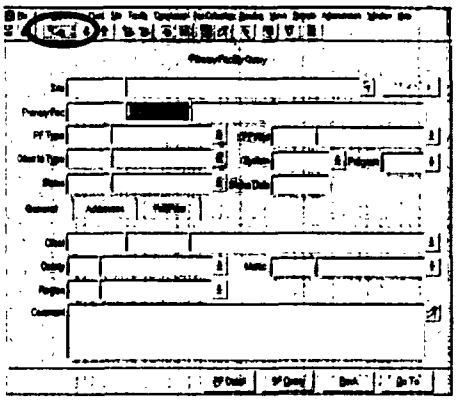


Tasks

- Assignments that must be completed prior to an authorization's approval.

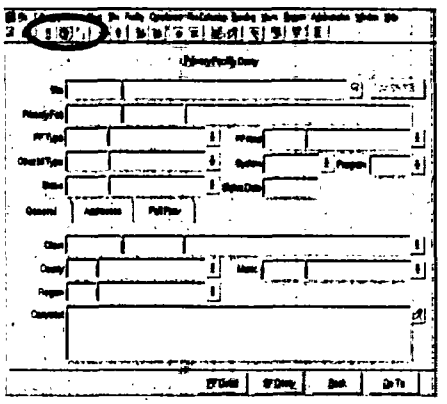
Entry Mode

- Indicates the capacity to record data in a eFACTS screen.
- By default, when a user accesses eFACTS he or she is in entry mode.



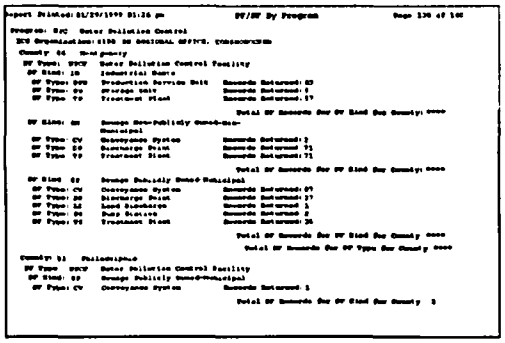
Query Mode

- Indicates the capacity to search the database for information using criteria identified on a eFACTS screen.
- When the system is in query mode you are unable to record data.



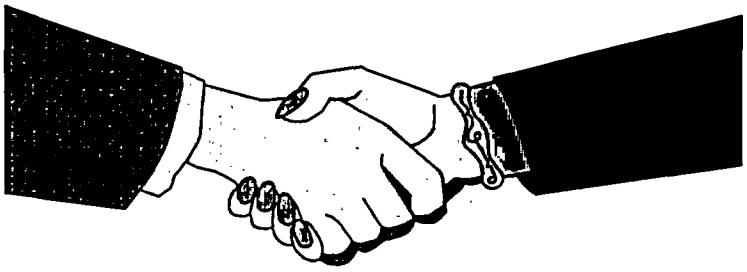
Reports

- Dedicated processes that answer user queries or supply data.
- eFACTS has multiple pre-defined reports available to supply information or statistics.
- Ad-hoc reporting is accomplished when a tool other than eFACTS accesses information contained in eFACTS.



Moneyback Guarantee

- A commitment from DEP to process client's applications in a specific time frame or refund the application fee.



Database

- A structure that is built to hold data that is valuable to an organization that can easily be accessed, managed, and updated.
- An organized collection of information.
- A simple database might be a single file containing many records, each of which contains the same set of fields where each field is a certain fixed width.

Relational Database

- A relational database allows the definition of data structures (how it looks), storage (how it's kept), and retrieval operations and integrity constraints (how and when it can be updated). In such a database the data and relations between them are organized in tables.
- A table is a collection of records and each record in a table contains the same fields. Certain fields may be designated as keys, which means that searches for specific values of that field will use indexing to speed them up.

Client Server

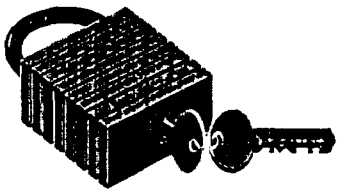
- A common form of distributed system in which software is split between server tasks and client tasks.
- A client (your PC) sends requests to a server, according to some protocol, asking for information or action, and the server responds.
- This is analogous to a customer (client) who sends an order (request) on an order form to a supplier (server) who dispatches the goods and an invoice (response). The order form and invoice are part of the "protocol" used to communicate in this case.

Oracle

- The database product used to create the Environmental Facility Application Compliance Tracking System (eFACTS).

Security

- Refers to techniques for ensuring that data stored in a database cannot be compromised.



Security Role

- Refers to the ability of a user to modify (insert, update, or delete) data in eFACTs.
- Examples:
  - Application Processors(APPL)
  - Query Only Rule (Query)
  - Client Verifiers (CLVER)
  - Site Verifiers (STVER)
  - Inspectors (INSP)
  - Enforcement (ENF)
  - Compliance (COMP)
  - Facility Updaters (FACUPD)
  - Data Administrators (DADMN)
  - Program Specific Data Administrators (PRGDA)
  - Certification, Licensing and Bonding Specialist (CLB)
  - Forfeiture Certification, Licensing and Bonding Specialist (FOFRCLB)

eF.A.C.T.S.

Environment, Facility, Application, Compliance Tracking System

Commonwealth of Pennsylvania
Department of Environmental Protection

General Overview User's Guide

Prepared by:	Applications Support Help Desk
Version:	1.8
Date:	April 7, 2006

Table of Contents

Purpose

Welcome to the pocket-sized guide for a general overview of Environment Facility Application Compliance Tracking System (eFACTS).

This guide provides instructions on the most commonly performed operations and common components contained in eFACTS.

To view the complete 'Basics' User Guides, reference the Basics Section of the Learn About eFACTS Page on the eFACTS Web Site.

Applications Support Help Desk Team

Help Desk Support Line:

Number: (717) 705-3768

Hours: Monday to Friday 8.00 am to 4:30 pm

Email: ep-efactshelpdeskteam@state.pa.us

Applications Support Help Desk Team:

The Applications Support Help Desk Team is composed of members from Veridyne, Inc. and the DEP. The support team includes help desk specialists, trainers, web masters, on-line help developers and testing engineers working together to provide complete end-user support for eFACTS and other applications.

Applications Support Help Desk Team's Services:

- Applications Training
  - Formalized Classroom Training
  - Small Group Training
  - One-on-One Training
- Participate in meetings to provide application guidance
- Telephone Support Help Desk
- Application Web Page Development and Maintenance
- Publish articles identifying solutions to common problems
- Application Testing
- Documentation Development
- Application On-Line Help Development and Maintenance

eFACTS Overview

eFACTS

Environmental Facility Application Compliance Tracking System

- This system allows DEP to collectively focus on and carry out its mission:

  to protect Pennsylvania's air, land, and water from pollution and to provide for the health and safety of its citizens through a cleaner environment.

- While historically the agency has had to deal with information in multiple, non-integrated databases and files, DEP now has the ability to access information from multiple programs about a regulated client or site.
- To carry out its mission, DEP is responsible for a vast array of diverse programs. These programs include traditional environmental protection programs like air, water, and waste; resource management programs like wetlands protection and water resource planning; and other programs as diverse as oil and gas drilling, radiation protection, a surface mining and deep mine safety.
- Few businesses in Pennsylvania fall outside the scope of DEP's regulatory oversight. Over 1,600 of the DEP regulated businesses must interact with more than one program. Because each program had it's own "stovepiped" data, the agency failed to capitalize on the information it collected. This meant a company might have been in non-compliance across multiple programs, without DEP realizing it. It also put the department at risk for oversights, such as a facility receiving an award for waste minimization from one program, while another program cited the same facility for air quality violations.
- eFACTS is a Data Integration and System Conversion Project containing integrated:
  - Client and Site records
  - Application processing functionality
  - Program-specific facility functionality
  - Compliance (Inspections and Enforcements)
  - Licensing
  - Bonding and Forfeiture Tracking
  - Self Monitoring

Why Is eFACTS needed?

- To foster Cross-Program and Cross-Organizational communication
- To support New Initiatives
- To better manage DEP Resources
- To better support decision making
- To better understand facilities regulated by multiple programs
- To foster single authorizations issued by multiple organizations
- To regulate Compliance Issues

Phase 1 APSCS (Released February 1997)

- Clients, Sites, Primary Facilities, and Sub Facilities
- Application Processing
- Client/Site Systems Conversions
- Data Standardization

Phase 2 (Released September 1999)

- An extension of Application Processing
- Department-wide Compliance System
- Program Specific Inventories
- Licensing
- Bonding and Forfeiture Tracking
- Self-Monitoring

Phase 3 (Released June 2002)

- Storage Tanks
- Land Recycling
- Fees

Phase 4 (Released ?)

- Abandoned Mines
- Deep Mine Safety

Definitions of Concepts

Client

Any regulated person, company, organization, or government agency.

A client can be any of the following variations:

- An applicant/permittee
- Any officer within the applicant's organizational hierarchy
- Any organization within the applicant's organizational hierarchy
- An agent representing an applicant
- An operator working for an applicant
- A contractor working for an applicant
- A person responsible for environmental damage

Site

A physical location(s) of importance to DEP. Site is not solely defined by geographical location (can span several municipalities and even counties in some cases) but rather by the client/applicant's purpose for doing business.

The Big Picture All DEP Programs involved at a physical location of importance to DEP is grouped under one 'entity', site. This holistic view of site will promote an understanding of the interrelationships of facilities to support pollution prevention; multi-media inspections; a department-wide view of compliance; and public understanding and access to information.

Primary Facility

A physical thing created to serve a particular function. It provides a physical framework to achieve the applicant's business goal. In other words, it is a way to group a specific DEP program's involvement at a site under one heading. For example: the Coal Mining Program groups all of their involvement (regulated entities) under the Primary Facility type of 'Coal Mining Operation'.

Examples:

- Water Pollution Control Facility
- Radiation Facility
- Oil and Gas Location
- Water Resource
- Air Emissions Plant
- Encroachment Location

Sub Facility

Program specific. A sub facility is what DEP regulates. For example: A deep mine is a sub facility of a Coal Mining Operation facility.

Examples:

Water Pollution Control Facility
- Treatment Plant
- Discharge Point

Radiation Facility
- X-ray Machine
- Radioactive Materials

Oil and Gas Location
- Well
- Pit

Water Resource
- Discharge
- Groundwater Withdrawal

Air Emissions Plant
- Incinerator
- Process

Encroachment Location
- Bridge
- Dock

Diagram of the Concept's Relationships (Example 1)

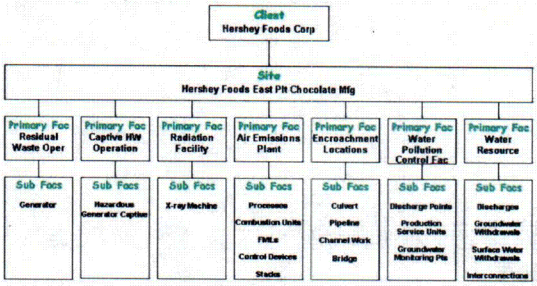
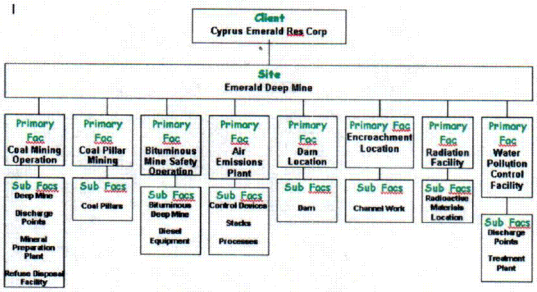


Diagram of the Concept's Relationships (Example 2)



Authorization

Any DEP approval given to a client, site or facility (i.e. permits, certifications, licenses, plans, and regulations, etc.). Also includes notifications to DEP.

Master Authorization

A DEP approval, which will be maintained by continuing renewals, amendments, certifications, reissues, and modifications.

Child Authorization

A renewal, amendment or modification made to a Master Authorization.

Database

A database is a structure that is built to hold data that is valuable to an organization that can easily be accessed, managed, and updated. It is an organized collection of information. A simple database might be a single file containing many records, each of which contains the same set of fields where each field is a certain fixed width.

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A relational database allows the definition of data structures (how it looks), storage (how it's kept), and retrieval operations and integrity constraints (how and when it can be updated). In such a database, the data and relations between them are organized in tables. A table is a collection of records, and each record in a table contains the same fields. Certain fields may be designated as keys, which means that searches for specific values of that field will use indexing to speed up searching.

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The database product used to create *e*FACTS.

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Refers to the ability of a user to modify (insert, update, or delete) data in *e*FACTS.

Reports

Dedicated processes that answer user queries or supply data. *e*FACTS has multiple pre-defined reports available to supply information or statistics. Ad-hoc reporting is accomplished when a tool other than *e*FACTS accesses information contained in *e*FACTS.

Accessing *e*FACTS

Obtaining eFACTS Security Role(s)

Security in *e*FACTS is based on an individual being assigned a specific security role(s). A security role determines a user's ability to insert, update, or delete information in *e*FACTS. Security is based on a user's specific region/district mining office/area and DEP program.

Part 1: Determining the Type of Security Role Needed:

Before beginning to work in *e*FACTS, a user must apply for an appropriate security role. If you want to learn more about the various security roles in *e*FACTS, access the file using the pathway indicated below or click on one of the links below.

- Security Role Descriptions (\\Epencofs04\PIE\eFACTS\Guidance\security_desc_efacts.doc)
- Security Specifications (\\Epencofs04\PIE\eFACTS_Documentation\Security\eFACTS Security Specification.doc)

Part 2: Completing and Submitting the Necessary Security Application:

After determining the role that you need in *e*FACTS, access the file using the pathway indicated below, or click on the instructions link below and then read the instructions for completing the security application. Once you have read the instructions, click on the DEP program (or access the file) for your appropriate security role, fill out the application, save the file to your hard drive, print a copy of the application, and send the application to the appropriate person in your region.

- **Security Application** (\\Epenscofs04\PIE\eFACTS\Forms\security_requests\efacts)

  Instructions (READ_ME_Security_Requests.doc)
  Air Quality (security_AQ.doc)
  Assistant Regional Director (security_ARD.doc)
  CLB – Certification, Licensing, and Bonding (security_CLB.doc)
  Mining and Reclamation (security_MING.doc)
  Abandoned Mines (security_MING_AMR.doc)
  Deep Mine Safety (security_MING_DMS.doc)
  Oil & Gas (security_OG.doc)
  Pollution Prevention Compliance Assistance (security_PPCA.doc)
  Radiation Protection (security_RP.doc)
  Waste Management (security_WASTE.doc)
  Water Quality (security_WATER.doc)

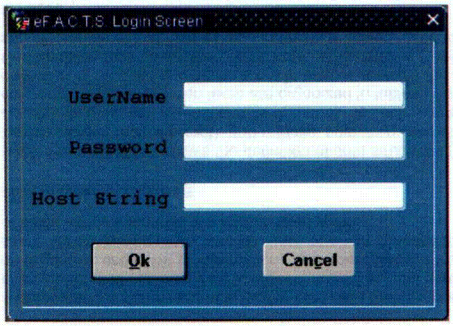
Logging On and Off eFACTS

To log onto the Environmental Facility Application Compliance Tracking System (eFACTS), the user **must** have an active security role in eFACTS.

Logging Onto eFACTS:

1. Click the 

browser icon on your desktop.
2. Click the **Oracle Applications** hyperlink on the **IntraDep Menu**.
3. Click the **eFACTS** hyperlink on the **Oracle Web Applications** page.



4. The eFACTS Login Screen Pop-Up Window will display. The cursor will be positioned in the *Password* field.
5. If your user name (i.e., your email name) is different from the default user name, click in the *User Name* field and enter your user name.

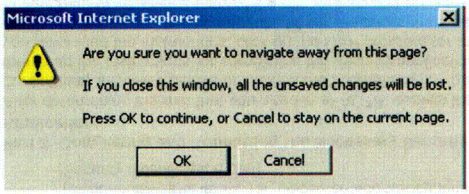
   Note: *The user name of the last user to sign into eFACTS on your PC will default.*
6. Click in the *Password* field. Enter your eFACTS password.
7. Verify that the Host String is EFACTS or PROD. If not press the [TAB] key once to move to the *Host String* field and update to EFACTS or PROD.

8. Click the OK button if you wish to log onto eFACTS or click the CANCEL button if you do not wish to log onto eFACTS.
9. If logging into eFACTS, the MAIN screen will appear indicating that login was successful.

Logging Off eFACTS

1. Click the  button or press the [F10] key to commit any modifications.
2. Click the  button on the toolbar to exit all open screens.

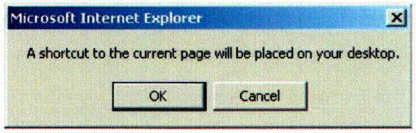
   Note: *If more than one screen is open, continue to click the EXIT button until the MAIN Screen displays.*
3. When the MAIN Screen displays, click the **File Menu** and **Exit** command. The screen will become blank.
4. Click the  in the upper right hand corner of the screen. A Logoff Pop-Up Window will display.



5. Click OK on the Pop-Up Window. eFACTS will close, and your PC's Desktop will display.

Adding an eFACTS Web Forms Shortcut to Your Desktop

1. Access the **Oracle Web Applications** page.
2. Right click on an area of the page that does not contain text.
3. Select Create Shortcut. A Microsoft Internet Explorer Pop-Up Window displays.

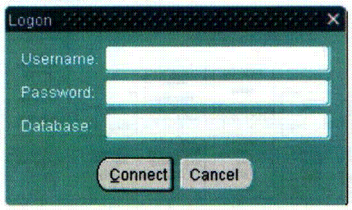


4. Click the OK button. An  Main Menu icon will be added to your desktop.
5. If you wish to rename the icon, click once on the icon, pause, and then click once on the text "Main Menu."
6. Type the new name.

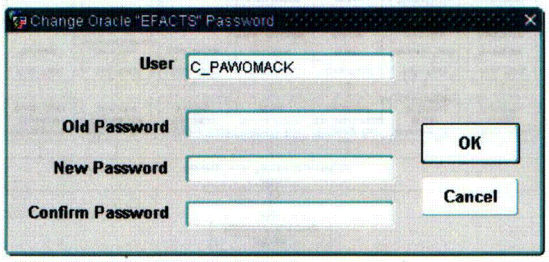
Changing your eFACTS Password

1. Click the 

browser icon on your desktop.
2. Click the **Oracle Applications** hyperlink on the **IntraDep Menu**
3. Click on the Change Oracle Password command on the **Oracle Web Applications** page. The Logon Pop-up Window will display.



4. Enter your user name in the *Username* field. Press the [TAB] key.
5. Enter your current password in the *Password* field. Press the [TAB] key.
6. Enter EFACTS in the *Database* field.
7. Click the CONNECT button.
8. The Change Oracle eFACTS Password Pop-Up Window will display.



9. Enter your old password in the *Old Password* field. Press the [TAB] key.
10. Enter your new password in the *New Password* field. Press the [TAB] key.
11. Enter your new password a second time in the *Confirm Password* field to confirm the change.
12. Click the OK button to change the password.

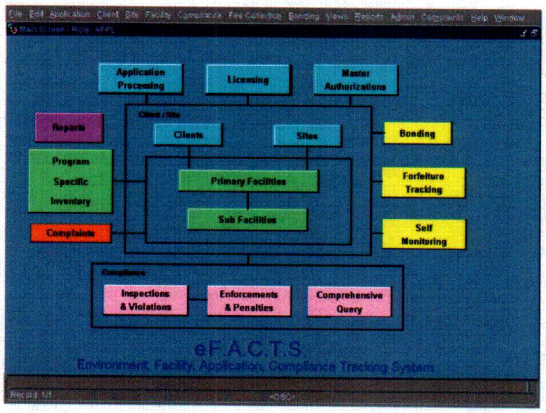
Main Screen (Opening Screen)

The MAIN Screen is the opening screen for the Environmental Facility Application Compliance Tracking System (*e*FACTS). The MAIN Screen automatically displays when the user logs onto *e*FACTS.

The MAIN Screen contains four components:

- *e*FACTS Menu Bar
- Title bar
- Navigational buttons
- System name

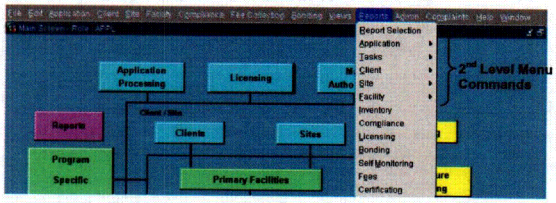
The title bar is displayed on all screens and indicates the name of the active screen, the current security role, and the minimize/maximize/close buttons. The menu bar is displayed directly above the title bar for all screens. The *e*FACTS Menu Bar contains the various menu, command, and sub command options that are used to access the various screens and reports. The navigation buttons display below the title bar and are used to directly access the key screens in *e*FACTS.



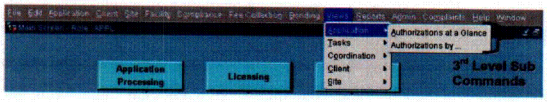
Menu Bar

The *e*FACTS Menu Bar displays on all screens contained within *e*FACTS. The menu bar is located directly above the tool bar at the top of each screen. The *e*FACTS Menu Bar contains the various menus, menu commands, and menu sub commands used to access the various screens and reports contained within *e*FACTS. The *e*FACTS Menu Bar has three levels of options: menu, command, and sub command options. The menu options (i.e., the first level) are always visible on the screen. The menu options do not directly access a screen or report, but clicking the menu option will display the Menu Drop Down List containing a list of commands.

The second level is the command options. The command options are contained on the Menu Drop Down List that display directly below the selected menu option. Clicking a command option will perform an operation (i.e., save, print, etc.), or access a screen or report unless the '►' symbol displays to the right of the command. The left and right arrow indicates that there is a menu of sub commands available.



The third level is the sub command options. The sub commands are displayed on the Menu Command Drop Down List. The sub commands are available if the highlighted command contains the '►' indicator. Clicking the sub command will directly access the associated screen or report.



Toolbar

Min/Max/Close Buttons

Every window in *e*FACTS contains a horizontal toolbar positioned in the top left of the window, under the menu bar. The *e*FACTS toolbar displays in two forms: the Entry "Normal" form and the Query form.

Entry "Normal" Mode

The default (Entry Mode) *e*FACTS toolbar is shown below:

The toolbar button descriptions proceed in the order of the toolbar buttons, left to right:

Save (F10)

Commits (saves) to the database any inserts, updates, or deletes made to the record(s) on the current, active screen. For example: If a user inserts facility details for a particular sub facility, the information is not "permanently" added to the database record until the modifications are committed to the database by clicking the SAVE button.

Print

Performs a screen print of the current screen. In other words, by clicking the PRINT button, the system prints an exact "picture" of the current screen. When the user clicks the PRINT button, a series of pop-up windows from the program manager will display allowing the user to select a printer, paper format, print orientation, and number of copies.

Enter Query (F7)

Changes the screen from entry "normal" mode to query mode. Before a user can search for information in *e*FACTS, they **must** click the ENTER QUERY button to place the system into query mode. This button will be displayed when the current, active screen is in entry "normal" mode. When the user clicks on the ENTER QUERY button, the system will "replace" the ENTER QUERY button with the three query mode buttons: EXECUTE QUERY, CANCEL QUERY AND COUNT QUERY. If there are any unsaved updates, the system will display the "Do you want to save the changes?" message before placing the system into query mode, thus providing the user the opportunity to save before continuing. For more information on the three query mode buttons, reference the query mode section following the Entry 'Normal' Mode toolbar button descriptions.

Next Record

Displays and navigates the cursor to the next record of the **current block**. This button is available, by default, when the user opens a screen and has security access to insert a new record. In addition, when a query is executed and more than one record is retrieved, the NEXT RECORD button is available.

When the user clicks the NEXT RECORD button, the next record will display on the current block until the user reaches the last record. This button is disabled (i.e., grayed out) if there is no next record.

Previous Record

Displays and navigates the cursor to the previous record of the **current block**. For example: If multiple records are retrieved as the user is "scrolling" through the list of records, the PREVIOUS RECORD button allows the user to go back to the previous record in the list. This button is disabled (i.e., grayed out) if there is no previous record.

Next Block

Navigates the cursor to the next sequential block. The user can proceed from block to block in the established sequence. This button is available, by default, when the screen is first opened, unless the current active screen contains only one block.

When the user clicks the NEXT BLOCK button, the cursor will navigate to the next block (i.e., group of fields offset by a line, box, or some other visual attribute) on the current active screen. If the screen contains a sequence of tabs, the NEXT RECORD button will move recursively through the blocks on the current active tab but will not proceed to the various tabs.

Previous Block

Navigates the cursor to the previous sequential block. The user can go back to the previous block in the established sequence. This button is available, by default, when the screen is first open, unless the current active screen contains only one block.

When the user clicks the PREVIOUS BLOCK button, the cursor will navigate to the previous block (i.e., group of fields offset by a line, box, or some other visual attribute) on the current active screen. If the screen contains a sequence of tabs, the PREVIOUS RECORD button will move recursively through the blocks on the current active tab but will not proceed to the various tabs.

Create Record (F6)

Creates a new blank record. After viewing, inserting, or updating a record, this button for a single block record clears the current screen or for a multi-record block, opens a new blank record below the current record ready for the next record to be added. This button is available, by default, when the screen is first opened and the user has security access to insert a new record on this screen. This button is disabled (i.e., grayed out) if the user does not have insert permission on the current screen.

When the user clicks the CREATE RECORD button, the system opens; and the cursor is placed in a new blank record.

Delete Record (Shift+F6)

Deletes the current record. This button is available, by default, when the screen is first opened and the user has security access to delete a record on this screen. This button is disabled (i.e., grayed out) if the user does not have delete permission on the current block.

The record is not permanently deleted from the database until the deletion is committed to the database, by clicking the SAVE button.

Duplicate Record (F4)

Duplicates the previous record into the current, empty record. This button allows the user to enter multiple similar records by inserting a duplicate copy of the current record and then changing the duplicate record by updating the information in the fields that are unique to the new record. This button is available, by default, when the screen is first opened and the user has security access to insert a new record on the current active screen.

When the user clicks the DUPLICATE RECORD button, the system duplicates the previous record into the current, empty record.

Edit Item

Calls the default editor. The default editor for eFACTS is MS Notepad or the Editor. For all free form text fields (i.e., comments, directions, descriptions, etc.) the EDIT button opens Windows Notepad or the Editor. The notepad provides the user with the capability to view, insert, and update the entire contents of the field without scrolling across the field. All updates to the contents of the Notepad will be reflected in the field.

Clear Record

Clears (does not delete) the current record. This button "removes" the current record from the screen without changing the record and displays the next record in the list.

Clear Form

Clears the current screen. This button removes **all** records from the current screen without updating the record. If there are any unsaved changes, the "Do you want to save the changes?" message will display, thus providing the user with the capability to save the changes before the form is cleared.

This button is available, by default, except on pop-up windows. When the user clicks the CLEAR FORM button, the screen will display in the same form as when the screen was first opened. All tabs and buttons will return to the same state as when the screen was first opened.

Help

Displays the context level help for eFACTS. The HELP button activates the cursor into "help" mode portrayed by the question mark attached to the cursor. In "help" mode the user can click on any part of the screen, and information will display concerning the selected screen, block, tab, button, or field. For example: If the user needs clarification on a particular field, the user can click the HELP button, move the cursor with the question mark attached, and then click on the field in question. A help pop-up window will display a detailed description of the field.

Caution: *The eFACTS Help File must be installed in order to use the HELP button.*

GIS

Opens *eMapPA* and displays the GIS MAP SELECTION Screen. The GIS MAP SELECTION Screen displays the client, site, primary facility, and sub facility queried on the eFACTS screen (if any).

Correct Address

For the highlighted address on the original screen, this button displays the Correct Address Pop-Up Window. The Correct Address Pop-Up Window displays the address that has been corrected by Correct Address and allows the user to accept or reject the address.

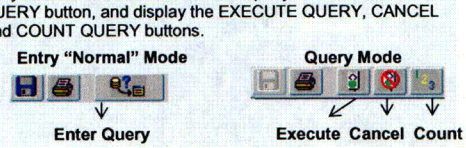
Exit

Exits the current screen. If updates have not been saved, the system will display the "Do you want to save the changes?" message providing the user the opportunity to save any changes that have been made before exiting the screen.

The "Do you want to save the changes?" Pop-Up Window provides three options in the form of buttons. The YES button is used when the user wishes to save the changes before exiting. The NO button is used when the user wishes to exit the screen without saving the changes. The CANCEL button is used when the user wishes to return to the screen without saving the changes or exiting.

Query Mode

When a form is in entry mode, the system will display the ENTER QUERY button and will 'hide' the EXECUTE QUERY, CANCEL and COUNT QUERY buttons. When the user clicks on the ENTER QUERY button, the system will move the screen into query mode, 'hide' the ENTER QUERY button, and display the EXECUTE QUERY, CANCEL QUERY and COUNT QUERY buttons.



Execute Query (F8)

Performs the user's query. The system will retrieve all records that match the user-defined query criteria. Some screens have a restriction on the number of records that may be queried. If the user executes a query which will retrieve more records than the number allowed, the Forms Pop-Up Window will display the message "This query matches (number) records. Enter more restrictive query criteria to select lesser number of records and query again." The user must further define the query before continuing.

Cancel Query

Cancels the current query by placing the system into entry mode.

Note: *The CANCEL QUERY button does* ***not*** *stop a query that is currently executing (i.e., a running query).*

Count Query (Shift+F2)

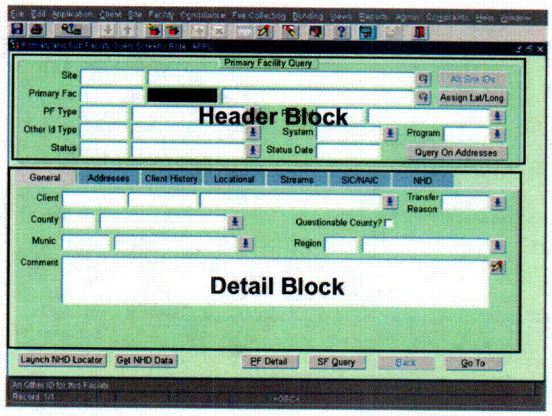
Displays the number of records that match the established query criteria to assist the user in determining whether to execute the query or further qualify the query to reduce the number of records retrieved. The query count displays on the hint line at the bottom left corner of the screen.

Standard Screen Components

Header and Detail Blocks

A **header block** is where information for a screen can be queried. This block will "drive" what information will display on the detail areas of a screen.

A **detail block** will display information in relation to the header block. If query mode is available for a detail block, any queries will be in reference to the queried header record.



Tabs

For the screens that use file tabs, the screen structure involves a header block and attached file tabs. The file tabs are used to display additional information related to the record in the header block. File Tabs can be queried and updated within the context of the header block, except for certain screens where various tabs can be queried to retrieve header information (i.e., most General TABs).

To activate a file tab, click on the file tab name. The header block will remain unchanged, but the activated tab will replace the current tab displayed. The label of the current, active tab will always be displayed in bold type. The labels of the other file tabs will be grayed out if the tab is not relevant for the record in the header block. When retrieving a screen using the GO TO button, the file tabs' accessibility and activation will change depending on the situation and the information retrieved from the "originating" screen.

Before a user activates a file tab, the user must query or insert at least one header record.

Tab labels will display in three different formats that indicate the tab's status.

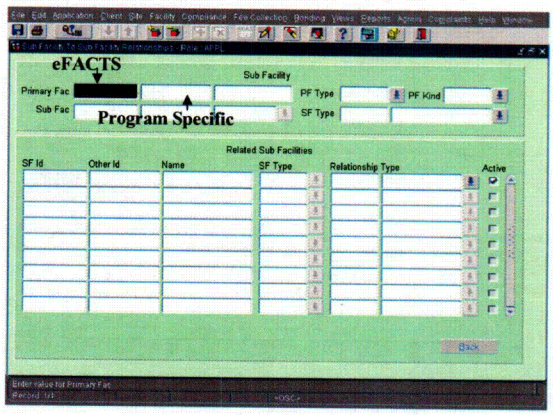
General Light Gray: Indicates the current active tab displayed on the screen.

Rel Clients Dark Gray: Contains available information and can be activated by clicking on the file tab label.

Payments Grayed out: The file tab is inactive and cannot be accessed for the queried record.

Fields

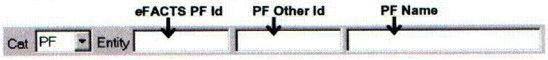
A field is a portion of a record. A field contains information. Various types of fields are available in *e*FACTS. Due to limitations of space on a screen, we were unable to add field labels for each field. To assist the user in easily identifying the unlabeled fields', standard formatting have been applied.



Common field formatting has been applied in the form of four different structures.

The **first structure** involves the three fields following the primary facility, sub facility, client, or entity field labels.

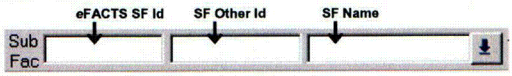
Primary Facilities (PF)



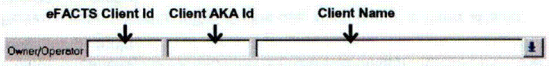
Primary Facility (Program-Specific) Other Ids:

OG – API Well Number (Permit Number)
Mining – Permit Number
RPX – Registration Number
RPNARM – License Number
WPC –NPDES Id
AQ – AIMS Firm Code
WM – Permit Number
LR – LRP Id
STSTA – Facility Id
WRWOB –WOBS File Id
SDW –Public Water Supply Id
WRDS –DAMINV Dam Id

Sub Facilities (SF)



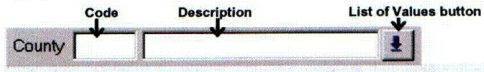
Client



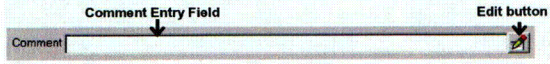
Client (Program-Specific) AKA Ids:

OG – Oil and Gas Operator (OGO) Number
WM – Permit Number
Mining – Permit Number or License Number
WPC – Establishment Id
WRWOB –Water Obstructions Id
SDW –Public Water Supply Id
WRDS – Permit Number
RPX – Registration Number
RPNARM – License Number
AQ – AIMS Firm Code/Tax Id
STSTA – STDS Number or Tank Owner Id

The **second structure** involves fields where there is an available list of codes.

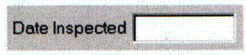


The **third structure** involves free form text fields like comments.



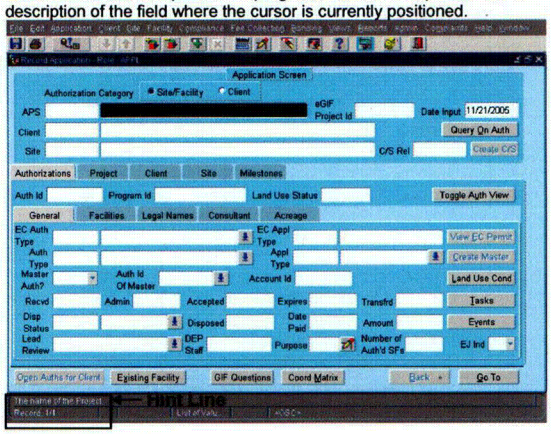
The **fourth structure** involves date fields.

The date can be entered in the format MM/DD/YY or MM/DD/YYYY. In addition to slashes separating the month, days, and year, you can also use a dash, period, or space.



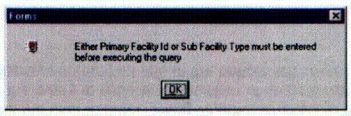
Hint Line

Every window in *e*FACTS (except the MAIN Screen) contains a horizontal bar at the bottom of the screen. The Hint Line is located in the bottom, left corner of the screen. The Hint Line displays information about the screen, an operation in progress, result of an operation, or a description of the field where the cursor is currently positioned.



Pop-Up Messages

Pop-up messages are alerts or warnings produced by the system to identify required or more restrictive information to facilitate system performance. A pop-up message will identify to the user information for the currently active screen. A user should acknowledge the pop-up message by clicking the OK button and enter the identified information to continue with their workflow. The following is an example of a pop-up message in *e*FACTS:

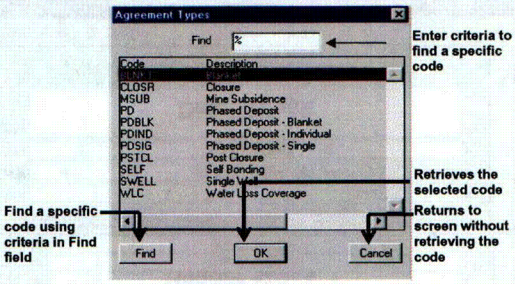


List of Values

The button displays a list of codes that are available for the field to the left of the button. If the system is in entry mode, the list of values will include only the active codes available for the field. But, if the system is in query mode, the list of values will display all codes that are available for the field regardless of status. The list of values in query mode displays all active and inactive codes so that the user can query historical records that contain a code no longer in use (inactive).

Using the LIST OF VALUES button:

1. Click the LIST OF VALUES button to the right of the field. The List of Values Pop-Up Window will display.



2. Click on the code you wish to select.

   If the list of values contains numerous code values, the list can be restricted by clicking in the *Find* field (top); entering the wildcard (%), part of a code or description, and the wildcard (%); and then clicking the FIND button (bottom of window). Only the codes that match the query criteria selected will display.

3. Click the OK button to select the highlighted code or click the CANCEL button to return to the field without retrieving a code value.

Choice Drop Down List

The button displays the limited number of options available for the field. This button is to the right of the field and provides a drop down list of a few possible selections.

To select a code value using the CHOICE button:

1. Click the CHOICE button to the right of the field. The Choice Drop Down List will display below the field.

2. Click on the code value you wish to select. The selected code value will display in the field.

Function Keys

If you prefer to use keystrokes instead of the mouse, below are listed the associated keystrokes for eFACTS. The keystrokes are assigned commonly used functions. You may also find this information listed under the **Help Menu** and **Keys** command.

Function (A-Z)	Keys
Accept/Save	F10
Application Menu	Ctrl + ,
Cancel	ESC
Clear Block	Shift + F5
Clear Form	Shift + F7
Clear Item	Ctrl + U
Clear Record	Shift + F4
Copy	Ctrl+C
Count Query Hits	Shift + F2
Cut	Ctrl+X
Debug Mode	Ctrl + ?
Delete Backward	Backspace
Delete Record	Shift + F6
Down	Ctrl + I
Down	Down Arrow
Duplicate Item	F3
Duplicate Record	F4
Edit	Ctrl + E
Enter Query	F7
Execute Query	F8
Exit	Ctrl + Q
Help	F1
Insert Record	F6
Left	Left Arrow
List of Values	F9
Main Menu	Ctrl + .
Next Block	Ctrl + Page Down
Next Item	Tab
Next Primary Key	Shift + F3

Function (A-Z)	Keys
Next Record	Shift + Down
Next Set of Records	Ctrl + >
Paste	Ctrl+V
Previous Block	Ctrl + Page Up
Previous Item	Shift + Tab
Previous Menu	Ctrl + Enter
Previous Record	Shift + Up
Print	Shift + F8
Redefine Username/Password	Ctrl + N
Return	Enter
Right	Right Arrow
Scroll Down	Page Down
Scroll Up	Page Up
Show Keys	Ctrl + F1
Toggle Query Mode	F5
Up	Up Arrow
Up	Ctrl + P

Using the Go To and Back Buttons to Navigate the System

Button Descriptions

The [Go To] button is used to navigate to other related screens within eFACTS. The button provides the user the capability to proceed through their workflow without being required to open the next screen via the menu bar and query the record. The GO TO button provides the user the capability of completing a task with a particular record, saving the updates, and then proceeding to the new screen where the record from the previous screen will "automatically" display; saving the user the additional steps of querying the record.

The [Back] button displays the previous screen used by the user.

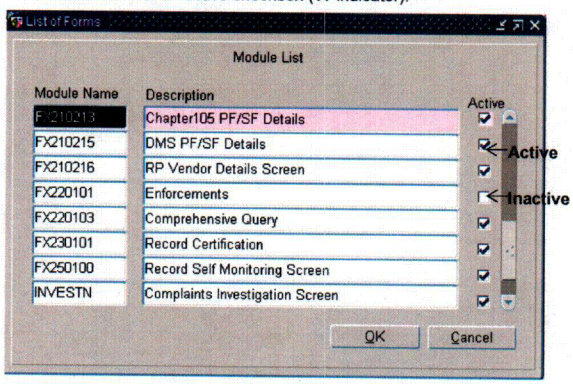
How to use the GO TO and BACK buttons:

1. Open the main screen for your current workflow.
2. Query the record you wish to view or update.
3. Click on the GO TO button at the bottom right corner of the screen. The Module List Pop-up Window will display.

   Warning: *All changes must be saved before clicking the GO TO button.*

   Once a screen has been opened, the GO TO button can only be used twice. For example: If the user queries a record on the RECORD/VERIFY SITE Screen, clicks the GO TO button to proceed to the PRIMARY FACILITY TO CLIENT RELATIONSHIP Screen, and then clicks the GO TO button to proceed to the RECORD/VERIFY CLIENT Screen; the user will not be able to access the GO TO button a third time.

4. Highlight the screen that you want to open. You may only access the screens with an active checkbox ('X' indicator).



5. Click the OK button to open the highlighted screen.
6. The selected screen will display and the details associated with the record from the previous screen will display.

   The displayed information and positioning of the tabs on the new screen is dependent on where the cursor is located in the "originating" screen and the type of record.
7. The user can only use the GO TO button one more time before they are forced to go back at least one screen.

   For example: If the user queries a record on the RECORD/VERIFY SITE Screen, clicks the GO TO button to proceed to the PRIMARY FACILITY TO CLIENT RELATIONSHIP Screen, and then clicks the GO TO button to proceed to the RECORD/VERIFY CLIENT Screen; the user will not be able to access the GO TO button a third time. The user is already two screens "deep." The user must click the BACK button to proceed back at least one screen and then select another screen using the GO TO button.
8. Click the BACK Button to return to the previous screen. If you use the GO TO button to get to a screen, you **must** use the BACK button to return.

Basic Query Rules

A query is a question you ask the system. You ask the question in order to retrieve specific information from the eFACTS database. There are many reasons you may wish to retrieve information from the system. For example: You may wish to view a record, change a record, add information to a record, etc.

Queries (i.e., questions) can be entered in three ways:

- You can ask the system to return a record for single criteria (i.e., eFACTS assigned Ids, program specific Ids, etc.).
- You can ask the system to return a record for multiple criteria (a combination of fields). For example: If you wish to know what primary facility records are in the eFACTS database, you can ask to see only those primary facilities that are located in Chester County.
- You can ask the system to return a record for a pattern search (using the wildcard '%').

For example: If you want to find a primary facility record, you could execute a query on the primary facility Id and the record would display. If you don't know the primary facility Id, you could still find the record (or similar records) by executing a query using information that you do know, such as primary facility type, related site Id, related client Id, the county where the primary facility is located, the primary facility kind, etc.

It is important to realize that the accuracy and amount of information you supply in a query will affect the number and accuracy of the results to your query. For example: If you execute a query to find a site using the county as the only query criteria, you should expect to receive many sites as a response. However, if you supply the county and municipality, you should expect to see significantly fewer results.

Hints and Tips:

How do I determine the queryable fields? Place the system into query mode. If you can click in a field, it is queryable.

Where should my cursor be positioned before going into query mode? Make sure you can see the field that you want to use as query criteria and click in at least one of the fields. If you follow this rule, your cursor will always be in the right location before querying.

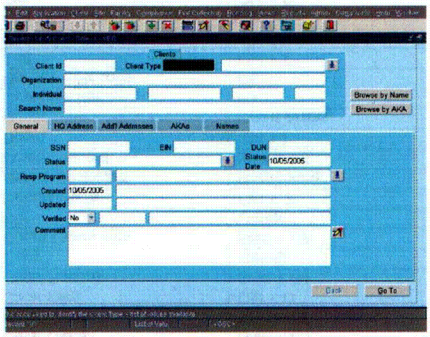
What if I do not know the entire contents of the field? Use the wildcard '%' in the front, middle, or at the end of the information. For Example: If I am searching for a client whose name begins with Brown but I do not know the entire name, I would enter '%Brown%' as the query criteria.

How do I determine the number of records that will be retrieved? Before executing the query, click the COUNT QUERY button or press the [Shift]+[F2] key and view the query count on the hint line (bottom of the screen).

Querying Client Information

There are four recommended queries when attempting to locate an existing client. This section identifies the procedure for locating a client using the name, address, contact, EIN, SSN, AKA Id, and query name.

In addition, this section identifies the information available for a client including the information displayed on the screen and information that can be accessed via the GO TO button.



Querying a Client using the Standard Name

1. Open the RECORD/VERIFY CLIENTS Screen by clicking the CLIENTS button on the MAIN Screen.
2. Click the button on the toolbar or press the [F7] key to enter query mode.
3. Click in the *Search Name* field.
4. Enter the client's organization or individual name (last first middle suffix).

   Hint: *If you do not know the entire name, use the wildcard in front, in the middle, or at the end of one or two key words in the client name - %one key word%second key word% without spaces.*

   For example: % AMANDAS %GOUR% can be used to find AMANDAS GOURMET COFFEE CO.

   Remember *to use the DEP Data Standards and Naming Conventions.*

5. Click the button on the toolbar or press the [F8] key to execute the query.

   Caution: *If you are using the wildcard '%' for a pattern search, you may want to click the button on the toolbar to determine the number of results that will be retrieved. To lessen the number of results, revise your pattern search by adding more characters.*
6. The client record will display on the RECORD/VERIFY CLIENTS Screen.
7. Look at the hint line and determine if more than one record was retrieved (bottom left corner of the screen).

   Hint: *Record 1/1 – one record retrieved.*

   Record 1/? – multiple records retrieved.
8. If multiple records are retrieved, use the button on the toolbar or press the [↓] key to locate the correct record.

Querying a Client using the Address or Contact

1. Open the RECORD/VERIFY CLIENTS Screen by clicking the CLIENTS button on the MAIN Screen.
2. Click on the HQ Address TAB.
3. Click the button on the toolbar or press the [F7] key to enter query mode.
4. Click in the field that you want to use as query criteria:

   The queryable fields are:

   Address Line 1
   Address Line 2
   City
   State (use the LOV button)
   Zip Code (May enter additional four digits – 17055-6551)
   Country
   Contact Last Name
   Contact First Name
   Contact Middle Name
   Contact Name Suffix
   Contact Title
   Phone (enter 10 digits no dashes – the system defaults dashes)
   Extension
   Fax (enter 10 digits no dashes – the system defaults dashes)
   E-mail

   Hint: *If you do not know the entire address, use the wildcard in front, in the middle, or at the end of one or two key words in the street address.*

   For Example: Enter '%Market' without spaces in Address Line 1 and then enter 'Harrisburg' in the City field to find all clients located on market street in a Harrisburg.
5. Enter the query criteria.
6. Repeat Steps 4 and 5 until you have entered query criteria in every applicable field.
7. Click the button on the toolbar or press the [F8] key to execute the query.

   Caution: *If are using the wildcard '%' for a pattern search, you may want to click the button on the toolbar to determine the number of results that will be retrieved. To lessen the number of results, revise your pattern search by adding more characters.*

8. The client record will display on the RECORD/VERIFY CLIENTS Screen.
9. Look at the hint line and determine if more than one record was retrieved (bottom left corner of the screen).

   Hint: *Record 1/1 – one record retrieved.*

   Record 1/? – multiple records retrieved.
10. If multiple records are retrieved, use the button on the toolbar or press the [↓] key to locate the correct record.

Querying a Client using the EIN/SSN

1. Open the RECORD/VERIFY CLIENTS Screen by clicking the CLIENTS button on the MAIN Screen.
2. Click on the General TAB if not displayed.
3. Click the button on the toolbar or press the [F7] key to enter query mode.
4. Click in the *EIN* field for non-individual clients or the *SSN* field for individual clients.
5. Enter the federal tax Id (EIN) or social security number (SSN) assigned to the client.
6. Click the button on the toolbar or press the [F8] key to execute the query.
7. The client record(s) will display on the RECORD/VERIFY CLIENTS Screen.
8. Look at the hint line and determine if more than one record was retrieved (bottom left corner of the screen).

   Hint: *Record 1/1 – one record retrieved.*

   Record 1/? – multiple records retrieved.
9. If multiple records are retrieved, use the button on the toolbar or press the [↓] key to locate the correct record.

Querying a Client using the AKA Id or Query Names

1. Open the RECORD/VERIFY CLIENTS Screen by clicking the CLIENTS button on the MAIN Screen.
2. To query on an AKA Id (program-specific Ids assigned to a client), click the BROWSE BY AKA button (right top corner of screen).

   To query on a query name (previous names for a client, etc.), click the BROWSE BY NAME button (right top corner of the screen).
3. Click the button on the toolbar or press the [F7] key to enter query mode.
4. Click in the *AKA* or *NAME* field.
5. Enter the program-specific number (AKA) assigned to the client. If searching by name, enter the client query name.

   OG – Oil and Gas Operator (OGO) Number
   WM – Permit Number
   Mining – Permit Number or License Number
   WPC – Establishment Id
   WRWOB –Water Obstructions Id
   SDW –Public Water Supply Id
   WRDS – Permit Number
   RPX – Registration Number
   RPNARM – License Number
   STSTA – STDS Number or Tank Owner Id
   AQ – Tax Id-Plant Code
6. Click the button on the toolbar or press the [F8] key to execute the query.
7. Verify that the highlighted client is the correct client.
8. Click the OK button.
9. The client record will display on the RECORD/VERIFY CLIENTS Screen.
10. Look at the hint line and determine if more than one record was retrieved (bottom left corner of the screen).

    Hint: *Record 1/1 – one record retrieved.*

    Record 1/? – multiple records retrieved.
11. If multiple records are retrieved, use the button on the toolbar or press the [↓] key to locate the correct record.

Information Contained in the Client Record

Client Header Block - Displays the main identification information for the client including the unique, system-generated Id (client Id), the type of client, and the DEP standardized and abbreviated name of the client (organization or individual).

The Client Type determines the available information. There are three client types: Individual, Non-Government, and Government.

General TAB - Displays general information regarding the client including EIN/SSN numbers, Dun and Bradstreet Id, status, program responsible for verifying the record, who created and last updated the record, the client verifier that verified the accuracy of the record, and any additional comments.

HQ Address TAB - Displays the address and primary contact for the client's headquarters including address, undeliverable indicator, contact name, title, phone number and extension, fax number, and email.

Add'l Addresses TAB - Displays any addresses in addition to the client's headquarters address by which the client is known.

AKAs TAB - Displays the program-specific Ids assigned to the client. When clients were converted into eFACTS from the DEP legacy systems, the Ids from the previous systems were identified as AKA Ids. In addition, a program can assign unique AKA Ids to a client instead of using the system-generated number.

Names TAB – Displays the legal (official registered names) by which the client is known and any names that will assist in querying (previous names, abbreviated names, commonly used name, etc.).

Additional Information Available by using the Go To Button

Client/Client Relationship – Displays a list of clients that are related to the client, their relationship, and begin date and end date of the relationship.

View Authorization Information – Displays a list of client category authorizations linked to the client.

Tank SF Details – Displays details on specific Storage Tank primary facility as well as the related sub facility data for a client.

RP Vendor Details Screen – Displays detail records for a BRP Vendor Client.

Master Authorization Inventory – Displays any client category master authorizations linked to the client.

DMS Equipment Details – Displays the Deep Mine Safety equipment details for the client's master authorization(s).

Inspections – Displays the inspections and violations logged for the client.

Enforcements – Displays the enforcements and penalties taken against a client.

Record Licenses – Displays the Mining and Waste Management Licenses for the client.

Record Certification – Displays certification details for the client.

Record Bonds – Displays the Oil and Gas or Waste Management Bonds for the client.

Record Forfeitures – Displays the forfeiture cases for Oil and Gas or Waste Management Bonds for the client.

Maintain Training Courses – Displays the ST training details for the client.

Record Fee Payments – Displays the screen used to record the receipt of payments for the client's account.

Record Invoices – Displays the fee invoices for the client's account(s).

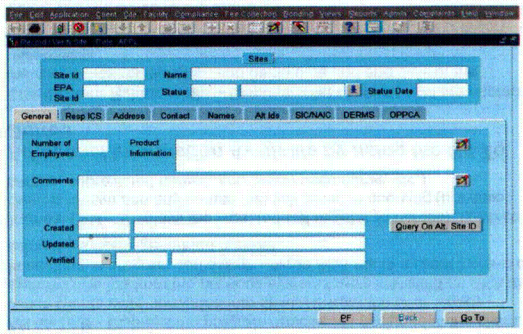
Record Fee Transactions – Displays the fee transactions for the client's account(s).

Comprehensive Fee Details– Display the account, transaction, invoice, and payment details for the client's account(s).

Querying Site Information

There are two primary queries when locating an existing site. This section identifies the procedure for locating a site using the name and the location address.

In addition, this section identifies the information available for a site including the information displayed on the screen and information that can be accessed via the GO TO button.



Querying a Site Using the Name

1. Open the RECORD/VERIFY SITES Screen by clicking the SITES button on the MAIN Screen.
2. Click the button on the toolbar or press the [F7] key to enter query mode.
3. Enter the Site's Standard Name in the *Name* field.

   Hint: *Use the '%' wildcard if you do not know the entire name. For Example: You can enter %PERRY YACHT CLUB% to find 'COMMODORE PERRY YACHT CLUB MARINA' if you do not know the entire name.*

   Remember *that when working with records that contain regulated site data, specific naming conventions must be applied to the site 'standard' name as well as data standards. See* ***Appendix A*** *for the Site Naming Standards.*

Caution: *If are using the wildcard '%' for a pattern search, you may want to click the button on the toolbar to determine the number of results that will be retrieved. To lessen the number of results, revise your pattern search by adding more characters.*

4. Click the button on the toolbar or press the [F8] key to execute the query.
5. The site record will display on the RECORD/VERIFY SITES Screen.
6. Look at the hint line and determine if more than one record was retrieved (bottom left corner of the screen).

   Hint: *Record 1/1 – one record retrieved.*
   Record 1/? – multiple records retrieved.

7. If multiple records are retrieved, use the button on the toolbar or press the [↓] key to locate the correct record.

Querying a Site using Location Address

1. Open the RECORD/VERIFY SITES Screen by clicking the SITES button on the MAIN Screen.
2. Click on the Address TAB.
3. Click the button on the toolbar or press the [F7] key to enter query mode.
4. Click in the field that you want to use as query criteria:

   The queryable fields are:
   Address Line 1
   Address Line 2
   City
   State (use the LOV button)
   ZIP Code (may enter additional four digits—17055-6551)

5. Enter the query criteria.
6. Click the button on the toolbar or press the [F8] key to execute the query.
7. The site record will display on the RECORD/VERIFY SITES Screen.
8. Look at the hint line and determine if more than one record was retrieved (bottom left corner of the screen).

   Hint: *Record 1/1 – one record retrieved.*
   Record 1/? – multiple records retrieved.

9. If multiple records are retrieved, use the button on the toolbar or press the [↓] key to locate the correct record.

Information Contained in the Site Record

Site Header Block – Displays the main identification information for the site including system-generated Id, name, EPA site Id, and status.

General TAB – Displays general details about the site including number of employees, product information, additional comments, who created the site, who last updated the site, and the site verifier who verified the accuracy of the site record.

Resp ICS TAB – Displays the location information for the site including the primary county in which the site is located, the priority program and responsible ICS for the site, and the additional counties and municipalities in which the site is located.

Address TAB – Displays the location address and directions for the site.

Contact TAB – Displays the primary contact for the site including name, title, firm, address, phone number and extension, fax number, and email address.

Names TAB – Displays the query names for a site (previous name, commonly used name, etc.).

Alt Ids TAB – For the Oil and Gas Program and Mining Program only, displays the program-specific Ids assigned to the site as an alternate Id to the system-generated number.

SIC/NAIC TAB – Displays the **S**tandard **I**ndustrial **C**lassification (SIC) Codes and **N**orth **A**merican **I**ndustrial **C**lassification (NAIC) Codes that describe the industrial, agricultural, etc. activity(ies) occurring at the site.

DERMS TAB – Displays the DERM file folder numbers (from the Electronic File Management Systems) for the site.

OPPCA TAB – Displays OPPCA's contact at the site.

Query on Alt Site ID BUTTON – Allows user to query on an alternate site id.

Additional Information Available by using the Go To Button

Complaints Maintenance – Displays complaint information for complaints made against a client or site.

Client/Site Relationship – Displays the clients currently related to the site and the clients related to the site in the past including the beginning and end date of the relationship, the type of the relationship, and the client Id and name.

Authorizations by... – Displays a list of authorizations linked to the site.

AML Facility Details – Displays an inventory of abandoned mine Problem Areas and their corresponding Features.

DMS PF/SF Details – Displays detail records for DMS Primary Facilities (PF) and Sub Facilities (SF).

RP Vendor Details Screen - Displays detail records for a BRP Vendor Client.

Master Authorization Inventory – Displays the master authorizations linked to the site.

Transfer Owner – Displays updated detailed information concerning the ownership of a Primary Facility.

Transfer Primary Facilities – Displays detail records for facilities transferred from an existing eFACTS Site record to another eFACTS Site record.

Merge Facilities – Displays detail record of a Primary Facility (PF) or Sub Facility (SF) that has been merged into another.

AML Project – Displays Bureaus of Abandoned Mine Reclamation (BAMR) and Mining and Reclamation (BMR) records that pertain to the tracking of mine reclamation work efforts.

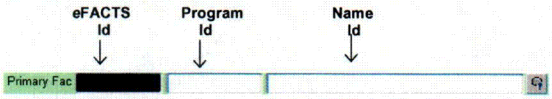
Inspections – Displays the inspections and violations logged for the site.

Record Fee Payments – Displays the screen used to record the receipt of payments for the client's account.

Comprehensive Fee Details– Displays the account, transaction, invoice, and payment details for the client's account(s).

Query Primary and Sub Facility Information

For a primary facility and sub facility, there will be one field label followed by three fields. The three fields contain a standard format.



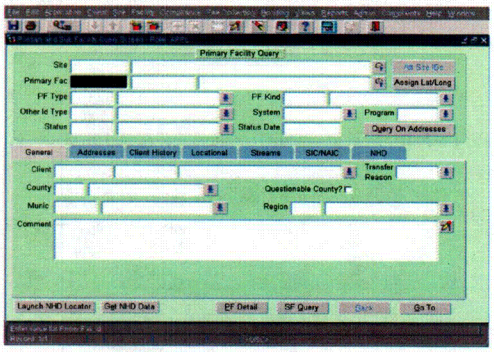
The Program Id is referenced using several different terms including other Id, AKA Id, and program-specific Id.

There are various options for querying an existing primary facility. This section identifies the procedures for querying a primary facility using various fields and querying a primary facility and sub facility using sub facility details.

In addition, this section identifies the information available for a primary facility and sub facility including the information displayed on the screen and information that can be accessed via the GO TO button.

Querying using Primary Facility Information

1. Open the PF/SF QUERY Screen by clicking the PRIMARY FACILITIES button on the MAIN Screen.



2. Click the button on the toolbar or press the [F7] key to enter query mode.

3. Click in the fields that you want to use as query criteria:

   The following fields are queryable:
   - *Site Name*
   - *Primary Facility Id*
   - *Primary Fac Other Id*
     - OG – API Well Number (Permit Number)
     - Mining – Permit Number
     - RPX – Registration Number
     - RPNARM – License Number
     - WPC – NPDES Id
     - AQ –Tax Id-Plant Code
     - WM – Permit Number
     - WRWOB –WOBS File Id
     - LR – LRP Id
     - STSTS – Facility Id
     - SDW –Public Water Supply Id
     - WRDS –DAMINV Dam Id
   - *PF Type* (use the List of Values)
   - *PF Kind* (use the List of Values)
   - *Other Id Type* (use the List of Values)
   - *Other Id System* (use the List of Values)
   - *Program* (use the List of Values)
   - *Status Code* (use the List of Values)
   - *Status Date*
   - *Client Id*
   - *Client AKA Id*
     - OG – Oil and Gas Operator (OGO) Number
     - WM – Permit Number
     - Mining – Permit Number or License Number
     - WPC – Establishment Id
     - WRWOB –Water Obstructions Id
     - SDW –Public Water Supply Id
     - STSTA – STDS Number or Tanks Owner Id
     - WRDS – Permit Number
     - RPX – Registration Number
     - RPNARM – License Number
     - AQ – Tax Id-Plant Code
   - *County* (use the List of Values)
   - *Municipality* (use the List of Values)
   - *Region* (use the List of Values)
4. Enter the query criteria.
5. Repeat Steps 3 and 4 until you have entered all desired query criteria.
6. To query on the primary facility address in addition to the other query criteria, click the Query On Addresses button.

7. Click in the fields that you want to use as query criteria:

   The following fields are queryable:
   - *Address Line 1*
   - *Address Line 2*
   - *City*
   - *State*
   - *Zip*
   - *Address Type*
   - *Undeliverable*

8. Enter the query criteria.
9. Repeat Steps 7 and 8 until you have entered all desired query criteria.
10. Click the button on the toolbar or press the [F8] key to execute the query.

Caution: If are using the wildcard '%' for a pattern search, you may want to click the button on the toolbar to determine the number of results that will be retrieved. To lessen the number of results, revise your pattern search by adding more characters.

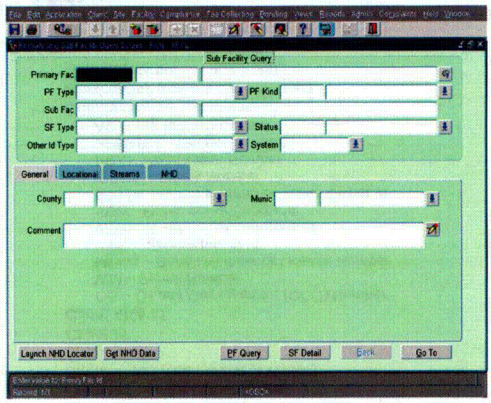
11. The primary facility record will display on the PF/SF QUERY Screen. Look at the hint line and determine if more than one record was retrieved (bottom left corner of the screen).

    Hint: *Record 1/1 – one record retrieved.*
    Record 1/? – multiple records retrieved.

12. If multiple records are retrieved, use the button on the toolbar or press the [↓] key to locate the correct record.
13. To view the associated sub facilities, click the SF QUERY button at the bottom of the screen.
14. To view or maintain the site record, complete the following steps:
    a. Click the GO TO button at the bottom of the screen (right corner).
    b. The Module List of Values will display. Highlight the RECORD SITE Screen option. Click the OK button (bottom of pop-up window).
    c. The PRIMARY FACILITY DETAILS Screen will display. Click the SITE button (bottom of the screen).
    d. The RECORD/VERIFY SITES Screen will display. The system will 'automatically' query the site.

Querying using Sub Facility Information

1. Open the PF/SF QUERY Screen by clicking the PRIMARY FACILITIES button on the MAIN Screen.
2. Click the SF QUERY button (bottom right corner of the screen).



3. To **query on a combination of the <u>Header Block</u> and the General TAB,** click the General TAB.

   To **query on a combination of the <u>Header Block</u> and the Locational TAB,** click the Locational TAB.

   Note: *Make sure you can see the field that you want to use as query criteria and click in one of the fields before going into query mode.*

4. Click the button on the toolbar or press the [F7] key to enter query mode.
5. Click in the fields to be used as query criteria:

   The following fields are queryable:

   <u>Header Block</u>
   - *Primary Facility Id*
   - *Primary Fac Other Id*
     - OG – API Well Number (Permit Number)
     - Mining – Permit Number
     - RPX – Registration Number
     - RPNARM – License Number

     - WPC – NPDES Id
     - AQ – Tax Id-Plant Code
     - WM – Permit Number
     - WRWOB –WOBS File Id
     - SDW –Public Water Supply Id
     - WRDS –DAMINV Dam Id
   - *PF Type* (use the List of Values)
   - *PF Kind* (use the List of Values)
   - *Sub Facility Id*
   - *Sub Facility Other Id*
   - *Sub Facility Type* (use the List of Values)
   - *Status Code* (use the List of Values)
   - *Other Id Type* (use the List of Values)
   - *Other Id System* (use the List of Values)

   General TAB (if selected in Step 4)
   - *County* (use the List of Values)
   - *Municipality* (use the List of Values)

   Locational TAB (if selected in Step 4)
   - *USGS* (use the List of Values)
   - *Map Section*
   - *Latitude*
   - *Longitude*
   - *South Offset (OG only)*
   - *West Offset (OG only)*
   - *Horizontal Accuracy*
   - *Horizontal Accuracy UM*
   - *Hor Ref Datum*
   - *Hor Coll Method*
   - *Reference Point*
   - *Altitude*
   - *Altitude UM*
   - *Altitude Datum*
   - *Ver Loc Datum*
   - *Geometric Type*
   - *Collection Date*
   - *Source Map Scale Number*
   - *Source Map Scale UM*
   - *To*
   - *To UM*

6. Enter the query criteria.
7. Repeat Steps 5 and 6 until you have entered all desired query criteria.
8. Click the button on the toolbar or press the [F8] key to execute the query.

9. The sub facility record will display on the SF QUERY Screen. Look at the hint line and determine if more than one record was retrieved (bottom left corner of the screen).

   Hint: *Record 1/1 – one record retrieved.*
   Record 1/? – multiple records retrieved.

10. If multiple records are retrieved, use the button on the toolbar or press the [↓] key to locate the correct record.
11. To view the associated primary facility, click the PF QUERY button at the bottom of the screen.
12. To view or maintain the site record, complete the following steps:
    a. Click the GO TO button at the bottom of the screen (right corner).
    b. The Module List of Values will display. Highlight the RECORD SITE Screen option. Click the OK button (bottom of pop-up window).
    c. The SUB FACILITY DETAILS Screen will display. Click the SITE button (bottom of the screen).
    d. The RECORD/VERIFY SITES Screen will display. The system will 'automatically' query the site.

Information Contained in the Primary and Sub Facility Records

Primary Facility Record

<u>PF Header Block</u> - Displays main identification information for the primary facility including the Id and name of the site where the primary facility is located, the system-generated and program-specific Ids assigned to the PF, the name of the facility, type of facility, the primary facility kind, and the status of the facility.

General TAB – Displays general information for the primary facility including the client that owns/operates the facility, the county and municipality where the facility is located, the region/district office responsible for regulating the facility, and any additional comments.

Addresses TAB – Displays the various addresses associated with the primary facility (i.e., location address, mailing address, etc.).

Client History TAB – Displays the current client associated with the primary facility and the clients that owned/operated the primary facility in the past including the client identification information and the begin date and end date of the relationship.

Locational TAB – Displays location details for the primary facility including USGS, map section, latitude and longitude, and various other location details (i.e., horizontal accuracy, horizontal reference datum, etc.).

Streams TAB – Displays the streams that the primary facility has the potential to impact environmentally including stream code and name, river mile index, sub basin, watershed, and stream-side.

SIC/NAIC TAB – Displays the **S**tandard **I**ndustrial **C**lassification (SIC) Codes and **N**orth **A**merican **I**ndustrial **C**lassification (NAIC) Codes that describe the industrial, agricultural, etc. activity(ies) occurring at the site.

NHD TAB – Displays the **N**ational **H**ydrography **D**ataset. USGS/EPA created set of digital spatial data that contains information about naturally occurring and constructed bodies of water, natural and artificial paths through which water flows, and related hydrographic entities. Features are combined to form reaches, which provide the framework for linking (or geocoding) water-related data to the NHD surface water drainage network.

Sub Facility Record

SF Header Block - Displays main identification information for the sub facility including details for the primary facility associated with the sub facility (i.e., Id, other Id, name, type, and kind), the system-generated and program-specific Ids assigned to the sub facility, the name of the sub facility, type of sub facility, and the status of the sub facility.

General TAB – Displays general information for the sub facility including the county and municipality where the sub facility is located and any additional comments.

Locational TAB – Displays location details for the sub facility including USGS, map section, latitude and longitude, and various other location details (i.e., horizontal accuracy, horizontal reference datum, etc.).

Streams TAB – Displays the streams that the sub facility has the potential to impact environmentally including stream code and name, river mile index, sub basin, watershed, and stream-side.

NHD TAB – Displays the **N**ational **H**ydrography **D**ataset. USGS/EPA created set of digital spatial data that contains information about naturally occurring and constructed bodies of water, natural and artificial paths through which water flows, and related hydrographic entities. Features are combined to form reaches, which provide the framework for linking (or geocoding) water-related data to the NHD surface water drainage network.

Additional Information Available by using the PF/SF Details Button

BMR Facility Details Screen – Displays the screen containing Bureau of Mining and Reclamation program-specific details for a Coal Mining Operation (CMO) or Industrial Mineral Mining Operation (IMMO) Primary Facility. The BMR FACILITY DETAILS Screen contains:

- General information including acreage details, operational characteristics, various indicators (blast insurance, water loss, etc.), various Ids/numbers (NPDES Id, MSHA Id, etc.), and bond details (current bond amount and final release date).
- Surface Mine sub facility details including the sub facility identification information (Id, other Id, and name of the surface mine), various measurements (ultimate pit floor elevation, ground water elevation, etc.), the minerals mined, and the coal seams mined.
- Deep Mine sub facility details including the sub facility identification information (Id, other Id, and the name of the deep mine), various measurements (permitted underground acres and subsidence control plan acres), the minerals mined, and the coal seams mined.

BOGM Facility Details Screen - Displays the screen containing Bureau of Oil and Gas program-specific details for an Oil and Gas Location (OGL) or Coal Pillar Oil and Gas (CPLOG) Primary Facility. The BOGM FACILITY DETAILS Screen contains:

- Well details including sub facility identification information (Id, API Well number, and name), general information (well number, well status, etc.), well dates for various operations, and well details (surface elevation, UIC Id, etc.).
- Coal Pillar details including sub facility identification information (Id, other Id, and name), date permitted, date revised, coal seam, elevation information, and pillar support information.
- Operator History details including the current client and any previous clients that own(ed)/operate(ed) the primary facility including the client identification information and the begin date and end date of the relationship.

BRP Facility Details Screen – Displays a screen containing Bureau of Radiation Protection program-specific details for a Radiation Facility (RF) Primary Facility. The BRP FACILITY DETAILS Screen contains:

- General information including mailing address, county, area, date issued, RAM category, and RSO.

- X-ray details including sub facility identification information (Id, registration number, and name), compliance status, MQSA details, and tube details.
- RAM details including sub facility identification information (Id, certification number, and name), compliance status, Chapter 224 details, and isotope details.
- Fee details including sub facility identification information (Id, registration/certification number, and name), current account details (balance due, annual fee, etc.), fee invoice details (date invoiced, amount due, transmittal, etc.), and payment details.

BWQP Facility Details Screen – Displays a screen containing Bureau of Water Quality Protection program-specific details for a Water Pollution Control Facility (WPCF) Primary Facility. The BWQP FACILITY DETAILS Screen contains:

- General information including year the last Waste Load Report was received, major/minor indicator, operation certification type required, certified operators, and NAIC codes.
- Program-specific sub facility details for the Conveyance, Discharge Point, Groundwater Monitoring Point, Land Discharge, Pump Station, Storage Unit/Impoundment, and Treatment Plant type sub facilities.

HW Facility Details Screen - Displays a screen containing Hazardous Waste program-specific details for a Captive Hazardous Waste Operation (CAHWO) or a Commercial Hazardous Waste Operation (COHWO) Primary Facility. The BWM HAZARDOUS WASTE FACILITY DETAILS Screen contains program-specific details for BIF, Disposal, Generator, Incinerator, Recycling, Storage, or Treatment Sub Facilities:

- General information including sub facility identification information (Id, other Id, and name), closure and final closure dates, notifications (EPA and PBR), and general sub facility details based on type.
- Process code details.
- Waste details including type of waste, associated measurement, and process codes

RW/MW Facility Details Screen - Displays a screen containing Non-Hazardous Waste program-specific details for a Municipal Waste Operation (MWO) or a Residual Waste Operation (RWO) Primary Facility. The BWM MW/RW FACILITY DETAILS Screen contains:

- Program-specific details for MW type sub facilities (composting, land application, landfill, processing, resource recovery, and transfer) including sub facility identification information (Id, other Id,

and name), volume details, closure and final closure dates, attributes, and various type-specific details.

- Program-specific details for RW type sub facilities (compost, generator, impoundment, incinerator, land application, landfill, processing, and transfer) including sub facility identification information (Id, other Id, and name), volume details, closure and final closure dates, attributes, and various type-specific details.

AML Facility Details Screen - Displays a screen containing Abandoned Mine Land program-specific details. The AML FACILITY DETAILS Screen contains:

- Abandoned Mine Land primary facility (problem area) details and the related sub facility (feature) data. This screen provides functionality to maintain details for the primary facility (ownership data, minerals mined, reason for update, etc.) and related SF facility details (mining details, feature description, keywords, etc.).

DMS Facility Details Screen - Displays a screen containing Deep Mine Safety (DMS) program-specific details for a DMS Bituminous (DMSOB), Anthracite (DMSOA), and Industrial (DMSOI) Primary Facility. The DMS FACILITY DETAILS Screen contains:

- Program-specific details for DMS type sub facilities (deep mine, prep plant, bank, etc.) including sub facility identification information (Id, other Id, and name) and various type-specific details.

Chapter 105 Facility Details Screen - Displays a screen containing Encroachment Location program-specific details for an ENCL Primary Facility. The CHAPTER 105 FACILITY DETAILS Screen contains:

- Program-specific details for ENCL type sub facilities (bridge, culvert, stream restoration, etc.) including sub facility identification information (Id, other Id, and name) and various type-specific details.

Additional Information Available by using Go To Button

Complaints Maintenance – Displays complaint information for complaints made against a client or site.

Record Client – Displays the client associated with the Primary Facility.

Record Site – Displays the site where the Primary Facility and Sub Facility are located.

View Authorization Information – When accessed for a primary facility (PF QUERY Screen), displays a list of authorizations linked to any sub facility associated with the primary facility. When accessed for a sub facility (SF QUERY Screen), displays a list of authorizations linked to the specific sub facility.

Monitoring Point Information – When accessed for a primary facility (PF QUERY Screen), displays a list of monitoring points linked to the primary facility. When accessed for a sub facility (SF QUERY Screen), displays a list of monitoring points linked to the sub facility.

Land Recycling Activities –Used to create, query, and update remedial activity records for a given Primary Facility (PF) under each functional area (Act2, HSCA, Other and Tanks) of the Land Recycling Program (LRP).

Tank Closure – Used to query, create, and update tank closure records for a given Primary Facility (PF). This screen is used to close tanks involved in a cleanup action.

RP Vendor Details Screen – For Radiation Protection, used to create and update one or more detail records for a BRP Vendor Client. Displays information associated with the SF, inspections, fees, hours etc.

SF/SF Relationship – When accessed for a sub facility (SF QUERY Screen), displays a list of sub facilities (usually from other primary facilities) related to the sub facility. This option is inactive when on the PF QUERY Screen.

PF/Client Relationship - When accessed for a primary facility (PF QUERY Screen), displays the additional clients linked to a primary facility (other than the client directly identified on the primary facility record).

Master Authorization Inventory – When accessed for a primary facility (PF QUERY Screen), displays all master authorizations for any associated sub facility. When accessed for a sub facility (SF QUERY Screen), displays the master authorization(s) linked to the specific sub facility.

Transfer Owner – Used to change ownership of a Primary Facility (PF). When the owner of multiple primary facilities changes (a client sells multiple primary facilities it owns to a new client), this screen can be used to change the owner for multiple facilities in one operation. This

screen cannot be used to transfer facilities for Oil and Gas Operators. Oil and Gas Operators must be transferred on the BOGM OPERATOR TRANSFER Screen.

Transfer Primary Facilities – Used to transfer one or more primary facility record(s) and associated sub facilities from an existing site to another site record. The unique PF Id will remain unchanged and all existing data, including Sub Facilities, Compliance, Bonding, Fee Collections, etc. associated with the primary facility will remain intact. The Site Id for the primary facility will be updated with the new Site Id.

Merge Facilities – Used to merge one Primary Facility or Sub Facility into another. In order to merge primary facilities, the primary facilities must belong to the same site and be of the same PF Type. In order to merge sub facilities, both facilities must belong to the same primary facility and be of the same SF Type.

AML Projects – Used to track the Bureau of Abandoned Mine Reclamation (BAMR) mine reclamation work efforts. These efforts, called projects, are aimed at reclaiming environmental and safety concerns that are a result of current or abandoned mining efforts. This screen will be used to create, update, and delete project details.

Active BMR PF Link to AML- Used to maintain links between active Mining Primary Facilities and their Authorizations with the facility that it might impact. This will identify AML locations that may be impacted by mining activities, which will determine if existing or proposed AML projects should be delayed or terminated. Allowable AML Primary Facilities will be Forfeited Mining Primary Facilities and Abandoned Mine Land Locations.

Inspections – When accessed for a primary facility (PF QUERY Screen), displays the inspections conducted at any sub facility associated with the primary facility. When accessed for a sub facility (SF QUERY Screen), displays the inspections linked to the specific sub facility.

Enforcements – Displays the enforcements taken against the client identified for the primary facility.

Record Bonds – When accessed for a primary facility (PF QUERY Screen), displays the bonds for a mining primary facility (CMO or IMMO). When accessed for a sub facility (SF QUERY Screen), displays the bond for a waste management sub facility (CAHWO, COHWO, MWO, or RWO).

Record Forfeitures – When accessed for a primary facility (PF QUERY Screen), displays the forfeiture case details for any bond forfeited by a mining primary facility (CMO or IMMO). When accessed for a sub facility (SF QUERY Screen), displays the forfeiture case details for any bond forfeited by a waste management sub facility (CAHWO, COHWO, MWO, or RWO).

Record Self Monitoring Screen – When accessed for a primary facility (PF QUERY Screen), displays self monitoring reports scheduled, reports due, reports received, and a summary of each type for the primary facility. When accessed for a sub facility (SF QUERY Screen), displays self monitoring reports scheduled, reports due, reports received, and a summary of each type for the sub facility.

Comprehensive Fee Details – Used to query, view, and update the various permitting and facility fee details in one screen. This screen allows the user to retrieve fee details using specified criteria for an Account, Transaction, Invoice or a Payment record.

AIMS Airs Data – For AQ only, displays the AIRS Data for an AQ Air Emission Plant (AEP) primary facility.

AIMS Fuel Material Locations - For AQ only, displays the AQ-specific, sub facility details for an AQ fuel material location sub facility.

AIMS Emission Inventory Data - For AQ only, displays the emission inventory details for an AQ Air Emission Plant (AEP) primary facility.

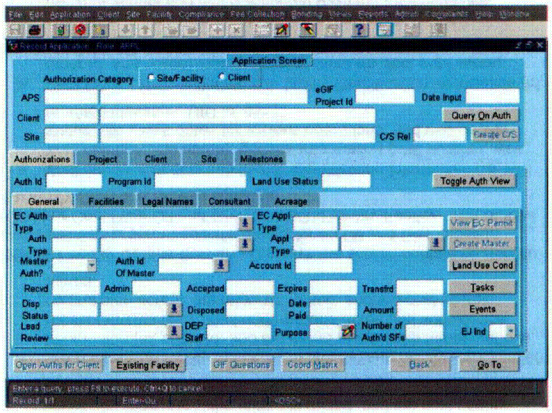
AIMS Primary Facility Update - For AQ only, displays the screen used to update AQ-specific details for an AQ Air Emission Plant (AEP) primary facility.

AIMS Sources - For AQ only, displays the screen used to insert and update AQ-specific details for all AQ sub facilities (processes, incinerators, combustion units, fuel material location, control device, and stacks).

Querying Authorization Information

There are three primary queries when locating an existing application/project/authorization. This section identifies the procedure for locating an application by querying on the APS Id, Client, Site Id, program Id, or Authorization Id.

In addition, this section identifies the information available for an application/project/authorization including the information displayed on the screen and information that can be accessed via the GO TO button.



Using the Program-Specific Id

1. Access the RECORD APPLICATION Screen by clicking the APPLICATION PROCESSING button on the MAIN Screen.
2. Click the Query On Auth button located on the top right corner of the Projects TAB.
3. The Query on Auth Pop-Up Window will display. Click in the *Program Id* field.
4. Enter the program specific Id (permit number, registration number, license number, etc. – the number that your program assigns to an authorization).

5. Click the button on the toolbar or press the [F8] key to execute the query.
6. The pending application record(s) will display and then the issued authorizations. If more than one application is retrieved, use the button on the toolbar or press the [↓] key to move through the records.

Using the APS Id, Client Id or Site Id

1. Access the RECORD APPLICATION Screen by clicking the APPLICATION PROCESSING button on the MAIN Screen.
2. Click the button on the toolbar or press the [F7] key to enter query mode.
3. Click in the *APS Id* (first field), *Client Id* (first field after the field label 'Client'), or *Site Id* field (first field after the field label 'Site') depending on the Id that you wish to use as query criteria.
4. Enter the eFACTS-assigned Id for the APS, Client, or Site.
5. Click the button on the toolbar or press the [F8] key to execute the query.
6. The pending application record(s) will display and then the issued authorizations.
7. If more than one application is retrieved, use the button on the toolbar or press the [↓] key to move through the records.

Using the Authorization Id

1. Access the RECORD APPLICATION Screen by clicking the APPLICATION PROCESSING button on the MAIN Screen.
2. Click the Query On Auth button located on the top right corner of the Projects TAB.
3. The Query on Auth Pop-Up Window will display. Enter the system-generated Id assigned to an authorization (auth Id).
4. Click the button on the toolbar or press the [F8] key to execute the query.
5. The application record will display.

Information Contained in the Application Records

Header Block – Displays main identification information for the application including the APS Id and name, the date the application was entered into eFACTS, the Id and name of the client requesting the authorization, the Id and name of the site where the activities are being authorized, and the relationship between the client and the site.

Authorizations TAB – Displays the authorizations for the application/project. Displays the main identification information for the authorization including system-generated and program specific Id of the authorization, as well as contains five sub tabs displaying various details for the authorization.

General TAB – Displays the general information for the authorization including the authorization type, application type, various dates (received date, etc.), and the status of the authorization.

Facilities TAB – Displays a list of sub facilities linked to the authorization including system-generated and program-specific Id, name, and latitude/longitude of sub facility.

Legal Names TAB – Displays the official, legal name for the client requesting the authorization instead of the standard client name with DEP data standards and naming conventions applied.

Consultant TAB – Displays the consultant for the authorization including name, title, firm, address, phone number, etc.

Acreage TAB – Displays the type and amount of acreage associated with the Mining permit.

Projects TAB – Displays the address and contact for the project/application.

Client TAB – Displays basic information for the client requesting the authorization.

Site TAB – Displays basic information for the site that is being authorized.

Milestones TAB – Displays the milestones for the project as identified by the client.

GIF QUESTIONS button – Displays coordination questions and land use questions for the application/project.

COORDINATION MATRIX button – Displays ICS codes flagged for potential coordination and their response.

TASKS button – Displays the money back guarantee, standard tasks, and sub task details for the authorization.

EVENTS button – Displays the events (public notification and comment periods) identified for the authorization.

Additional Information Available by using Go To Button

Client/Site Relationship – Displays the clients currently related or previously related to the site including the client identification information (Id and name), begin and end date of the relationship, and the type of relationship.

Maintain/Generate Letters – Displays a list of letters that can be generated for the authorization. The letter template (standard, DEP approved letter) will display in Microsoft Word, and the details from the application/authorization will 'automatically' populate.

Tank SF Details Screen – Displays the Storage Tanks (ST) facility details for a STL sub facility linked to a Tank authorization.

DMS PF/SF Details – For Deep Mine Safety, used to query, create and update one or more detail records for DMS Primary Facilities (PF) and Sub Facilities (SF). User can record detailed information about a mine, DEP inspectors, DEP supervisors, mine employees, addresses for a mine and equipment used at a mine.

RP Vendor Details Screen – For Radiation Protection, used to create and update one or more detail records for a BRP Vendor Client. Displays information associated with the SF, inspections, fees, hours etc.

Master Authorization Inventory – Displays the master authorization details for the authorization.

Transfer BOGM Operator – For Oil and Gas only, displays the BOGM TRANSFER OPERATOR Screen for the Oil and Gas transfer authorization so that a transfer of Oil and Gas Location (OGL) facility from one client to a new client can be processed.

Transfer Owner – Allows the transfer of a primary facilities ownership from one client to a new client (except for OG).

Active BMR PF Link to AML- Used to maintain links between active Mining Primary Facilities and their Authorizations with the facility that it might impact. This will identify AML locations that may be impacted by mining activities, which will determine if existing or proposed AML projects should be delayed or terminated. Allowable AML Primary Facilities will be Forfeited Mining Primary Facilities and Abandoned Mine Land Locations.

Special Waste Approval – For WM only, displays the generating sub facility or client as well as the types and amounts of waste that the receiving sub facility is being authorized to receive.

DMS Equipment Details – Displays information about the equipment used in DMS mining facilities, including the type of equipment, the manufacturer or other applicant and specific details about the equipment as submitted with the approval request. Allows DMS to review the authorizations, which approve the use of the equipment in Pennsylvania mines, and display a list of the mines where the approved equipment is currently in use.

Record Licenses – For WM and Mining only, displays the license details for the authorization (license) including general information, mining-specific license details, insurance details, and waste management-specific license details.

Record Certification– Displays the certifications for the client authorization identified as a certification.

Record Bonds – For WM, Oil and Gas, and Mining only, displays the bond agreements for the client (WM and OG), primary facility (Mining), or sub facility (WM) associated with the authorization.

Record Fee Payments – Displays the screen used to record payments received for the authorizations associated fee transaction.

Record Fee Transactions – Displays the screen used to record transactions for the authorization's account.

Comprehensive Fee Displays – Displays the account, transaction, invoice, or payment details for the authorization's account.

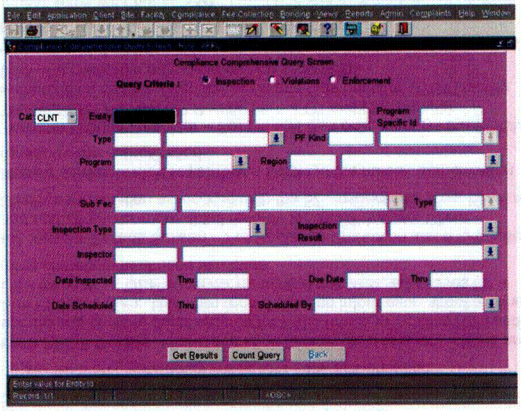
AIMS Permits – For AQ only, displays the screen used to view AQ-specific permit details including applicable requirements, sub facility groups, permit map, etc.

Querying Compliance Information

There are three primary queries when locating compliance information. This section identifies the procedure for locating inspections, violations, and enforcements.

In addition, this section identifies the information available for inspections, violations, enforcements, and penalties including the information displayed on the screens and information that can be accessed via the GO TO button.

1. Open the COMPLIANCE COMPREHENSIVE QUERY Screen by clicking the COMPREHENSIVE QUERY button on the MAIN Screen.



2. Click the appropriate radio button (Inspection, Violations, or Enforcement) that corresponds to the type of records to be retrieved.
3. If you wish to enter query criteria in the first three lines of the screen, use the button to select the appropriate category.
4. Click in the field that you wish to use as query criteria.

Query Fields for Inspections, Violations, and Enforcements:

- *Entity Id*
- *Entity AKA/Other Id*
- *Program Specific Id PF Kind Code*
- *Entity Type*

- *Program Code*
- *Region Code*

Query Fields for Inspections Only:

- *Sub Fac Id*
- *Sub Fac Other Id*
- *Sub Fac Type*
- *Date Inspected (Range) Begin Date*
- *Date Inspected (Range) Thru Date*
- *Due Date (Range) Begin Date*
- *Due Date (Range) Thru Date*
- *Inspection Type*
- *Inspection Result Code*
- *Date Scheduled (Range) Begin Date*
- *Date Scheduled (Range) Thru Date*
- *Inspector Id*
- *Scheduled By*

Query Fields for Violations Only:

- *Viol Type*
- *Resolution Reason Code*
- *Violation Date (Range) Begin Date*
- *Violation Date (Range) Thru Date*
- *Scheduled Response Date (Range) Begin Date*
- *Scheduled Response Date (Range) Thru Date*
- *Resolution Date (Range) Begin Date*
- *Resolution Date (Range) Thru Date*

Queryable Fields for Enforcements Only:

- *Enf Type*
- *Progress Date*
- *Enf Appeal Status Ind*
- *Enf Appeal Status*
- *Tracking #*
- *Enf Date Final (Range) Begin Date*
- *Enf Date Final (Range) Thru Date*
- *Date Initiated (Range) Begin Date*
- *Date Initiated (Range) Thru Date*
- *Pen Appeal Status*
- *Citation Number*
- *Pen Date Final (Range) Begin Date*
- *Pen Date Final (Range) Thru Date*
- *Pen Final Status*

5. Enter the query criteria in the selected field.
6. Repeat Steps 4 and 5 until you have established query criteria in all fields for which you wish to specify criteria.
7. To **count the number of records** that match the criteria, click the Count Query button. The query count will display on the hint line.

8. To **retrieve and view the inspections, violations, or enforcements** that match the query criteria, click the Get Results button.
9. The Retrieved Block will display the inspections, violations, or enforcements matching the query criteria.
10. Locate and highlight the record that you want to view or update.
11. Click the Go To button at the bottom of the screen.
12. The Module List of Values Pop-Up Window will display. Highlight the screen on which you want to view details.
13. Click the OK button. Review or maintain the displayed details.
14. Click the Back button to return to the RETRIEVED Screen.
15. Repeat Steps 10 through 14 to view the details for another inspection, violation or enforcement record.
16. Click the Criteria button to return to establish different query criteria.

Information Contained in the Retrieved Records

Inspections – Displays a list of inspections matching the query criteria including system-generated and program-specific Id assigned to the inspection, the type of inspection, the date the inspection was conducted, the result of the inspection, the inspected entity's (PF, Client, or Site) identification information (Id, other Id, and name), and buttons to access a list of inspectors and/or a list of inspected sub facilities.

Violations – Displays a list of violations matching the query criteria including the system-generated and program-specific Id assigned to the violation, the date the violation was identified, the type of violation, indicator identifying if the violation resulted in an enforcement, additional comments, and the sub facility in violation (Id, other Id, and name).

Enforcements– Displays a list of enforcements matching the query criteria including the system-generated and program-specific Id assigned to the enforcement, enforcement type, tracking number, date executed, the client against which the enforcement was taken (Id, AKA Id, and name), date referred, final status, citation number, and penalty details (final status and date, amount due, and amount collected).

Additional Information Available by using Go To Button

Inspections – For a queried inspection, displays the entire inspection record. For a queried violation, displays the entire inspection record for the inspection during which the violation was identified. The inspection record includes the following details:

- Main identification information including the system-generated and program-specific Id, the inspection type, date inspected, and the inspected entity (primary/sub facility, site, or client) details.
- General information including owner/operator of inspected entity, inspector, inspection result, complaint Id, date due or scheduled, inspection result, agency, program and ICS who conducted the inspection, and the county and municipality where the inspected primary facility is located.
- A list of inspected sub facilities.
- A list of violations identified during the inspection including system-generated and program-specific Id, violation type, date of scheduled response, additional comments, resolution date and reason, and sub facility where the violation occurred.
- A list of compliance assistance provided to the inspected entity during the inspection.
- A list of coverage area codes applying to the WM inspection.
- Administrative information including additional comments, who created the enforcement in eFACTS, and who last updated the record.

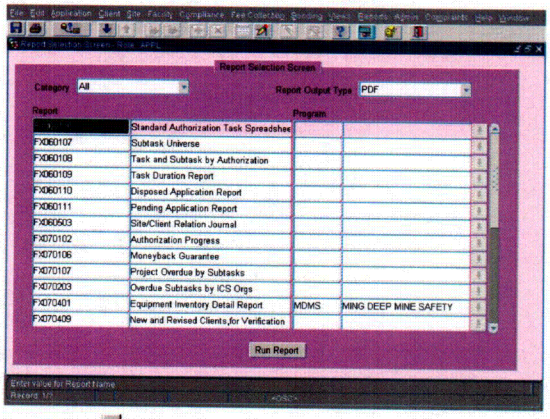
Enforcements – For a queried violation, displays the entire enforcement record that was the result of the queried violation. For a queried enforcement, displays the entire enforcement record. The enforcement record includes the following details:

- Main identification information including the system-generated and program-specific Id, the enforcement type, date executed, and the client against which the enforcement was taken (Id, AKA Id, and name).
- General information including DEP employee assigned the enforcement, date referred, responsible program and ICS, the appeal status of the enforcement and penalty, and the final status of the enforcement and penalty.
- A list of violations including system-generated and program-specific Id, violation type, date of scheduled response, additional comments, resolution date and reason, and sub facility where the violation occurred.

- A list of milestones including the due dates assigned to the client and date that the client completed the milestone.
- A list of related enforcements.
- A list of additional clients included in the enforcement.
- A list of actions taken by DEP to assess the penalty.
- A list of payments scheduled or received regarding the penalty.
- Administrative information including additional comments, who created the enforcement, who last updated the enforcement, and a list of modifications to the enforcement.

How to Run a Report

1. Access the *e*FACTS MAIN Screen.
2. Click on the REPORTS button.
3. The REPORT SELECTION Screen will display.



4. Click the button to the right of the *Category* field.
5. Highlight the appropriate category.
6. Click on the highlighted category. The report category will display in the *Category* field and the associated reports will display in order by report number.
7. Click the button to the right of the *Report Output Type* field.
8. Highlight PDF or HTML as the report output type.
9. Click on the highlighted report output type. The report output type will display in the *Report Output Type* field and the report will display/ print in the selected format.
10. Highlight the appropriate report.
11. Click the RUN REPORT button. The RUNTIME PARAMETER Screen will display. The cursor will be positioned in the first parameter field.

12. Select the appropriate criteria by using the button to the right of the parameter fields or by entering the appropriate code. Press the [TAB] key.
13. If you do not wish to use a parameter to restrict the report output, verify that the field contains the wildcard '%'.

    Note: *If the parameter field is a date range, enter the begin date in the first field, [TAB], and the end date for the range in the second field.*

    Caution: *The dates must be in the format MM/DD/YYYY.*
14. Repeat Steps 12 and 13 until all report criteria has been selected.
15. Click the Submit Query button.
16. The REPORT OUTPUT Screen will display the report details. The total pages of the report will display at the bottom of the screen.
17. Use the button on the toolbar or the scrollbar to move to the next page of the report.
    - *You may have to use the horizontal and vertical scrollbars to view the entire page of the report.*
    - *To move throughout the report, click the button to move to the previous page, click the button to move to the first page, or click the button to move to the last page of the report.*
    - *The report summary is located at the end of the report.*
18. To print the report click the button on the toolbar and verify that the page setup is set to appropriate orientation and the margins are accurate and then click the button to print the report.
19. After you have reviewed all necessary report details, click the button on the toolbar to close the report previewer.

*e*FACTS Internal Web Site

The internal *e*FACTS Web Site is maintained by the Applications Support Help Desk Team with the sole purpose to provide information regarding *e*FACTS. The web site contains everything from manuals on how to enter a record into *e*FACTS to program-specific guidance.

To access this world of *e*FACTS information, complete the following steps:

1. Access DEP IntraDep.
2. Click on the Data Access Tools Option.
3. Click on the *e*FACTS hyperlink.
4. The *e*FACTS Main Menu will display.

   The following menu options are available:

   Introduction: Provides introductory information about *e*FACTS such as an overview presentation, *e*FACTS movie, and a glossary.

   Getting Started: Provides instructions for a first-time *e*FACTS user on how to get started such as system requirements, installation instructions, security, and logging on and off the system.

   Learn About eFACTS: Provides beginning and veteran employees with information about *e*FACTS such as the basics, brief descriptions of reports and screens, and detailed user guides for each screen and report.

   Enhancement Requests: Provides information about the board that controls the changes made to *e*FACTS as well as provides a form for submitting enhancement requests.

   Help Contacts: Provides information about the *e*FACTS User Support Team including the Help Desk.

   Historical Information: Provides historical information about *e*FACTS.

   Training: Provides a training calendar, course catalog, and a link for requesting training.

   PA Bulletin: Provides general information, department-wide guidance, and program-specific guidance regarding the Pennsylvania Bulletin.

   Guidance: Provides department-wide and program-specific guidance to be followed while working in *e*FACTS.

   Client Verifier Contacts: Provides a listing by program of all DEP Client Verifiers, their location and telephone number.

Policy and Procedure: Provides DEP Policies and procedures to be followed while working in eFACTS.

What's New In eFACTS: Provides details about each release of a new version of eFACTS screens or reports.

EPA and Other States: Provides information about EPA and other state initiatives (one stop reporting, etc.).

FAQs: Provides answers for frequently asked questions about eFACTS.

Submit A Remedy Ticket: Used by the Applications Support Help Desk and the Hewlett Packard eFACTS Design, Development and Maintenance Team to submit remedy tickets to the various groups within DEP.

Data Quality: Provides links to pages containing information regarding data quality as it relates to eFACTS.

FAQ's Web Forms: Provides answers to the most frequently asked questions regarding eFACTS webforms.

5. Select the appropriate menu option.

eFACTS Public Web Site

The public web site provides basic eFACTS Informaton to the public regarding clients, sites, facilities, permits, and compliance (inspections, violations, enforcements, and penalties).

To access the eFACTS Information displayed for the public, complete the following steps:

1. Find the Client Id or Site Id using eFACTS (for faster searching).
2. Open DEP's IntraDep.
3. Access DEP's public website by clicking on the www.dep.state.pa.us menu option. Select Permits, Licensing & Certification from the navigation bar beneath the Quick Access heading.
4. Click the eFACTS hyperlink at the beginning of the first paragraph. The eFACTS page will display.
5. Select a search option or hyperlink: Authorization Search, Client Search, Facility Search, Inspection Search, Name Search, Pollution Prevention, Sites Search or Search by Municipality.
6. Enter the search criteria.
7. Click the SEARCH button.
8. To view the permits, inspections, or detail information, click the appropriate hyperlink.