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RCRA
40 CFR PART 264, SUBPART X
DRAFT
PERMIT WRITERS GUIDANCE

U.S. ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF SOLID W .STE
PERMITS AND STATE PROGRAMS DIVISION
AND
THE SUBPART X PERMIT WRITERS WORKGROUP

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1.0 INTRODUCTION

This manual provides permit writers from Environmental Protection Agency (EPA) Regional and state environmental protection offices with guidance on reviewing permit applications and establishing permit conditions for miscellaneous units under Subtitle C of the Resource Conservation and Recovery Act (RCRA). The manual gives permit writers guidance on minimum information requirements for permit applications for miscellaneous (Subpart X) units, criteria for evaluating submissions by permit applicants, guidance on issuing notices of deficiency (NOD) for Subpart X permit applications, and guidance on developing permit conditions based on information submitted by permit applicants. This manual also is intended to provide a background and explanation of the intent of the provisions for permitting Subpart X units that are set forth in Title 40 of the Code of Federal Regulations (CFR) Part 264 Subpart X and requirements for submission of information by Subpart X permit applicants, set forth in 40 CFR 270.23.

The manual consists of seven sections and eight appendices. This section is intended to orient the permit writer by presenting the statutory, regulatory, and policy history concerning permitting of Subpart X units. Section 2 is an overview of the permitting process in general, with emphasis on issues of particular importance with regard to Subpart X units. Section 3 contains information on reviewing permit applicants' descriptions of Subpart X units. Section 4 provides the permit writer with information on reviewing environmental assessments that are unique to the Subpart X permitting process, including minimum completeness requirements for permit applications, relevant evaluation criteria, and guidance on developing permit conditions based on information submitted in environmental assessments. Section 5 provides permit writers with guidance on reviewing information submitted by permit applicants on waste characterization and treatment effectiveness. Section 6 describes criteria for applying existing standards for conventional hazardous waste management units to Subpart X units. Finally, Section 7 provides information for evaluating provisions concerning closure and post-closure in Subpart X permit applications. Within the first seven sections of the document, the term "section" refers to any of the seven major components of the guidance manual excluding the appendices, and the term "subsection" refers to any subdivision of these major components.

The first seven sections of the guidance manual are organized to allow permit writers to first gain a basic understanding of the permitting process under Subpart X, and then to gradually progress to more difficult issues concerning the Subpart X permitting process. Sections 1 and 2

the guidance provide the permit writer with a general orientation to the major issues associated with Subpart X permitting; these sections will be of the most assistance to less experienced permit writers. Section 3 builds on the information presented in the first two sections by presenting information to aid the permit writer in evaluating a permit applicant's description of a Subpart X unit. Section 4 then provides the permit writer with information on the difficult task of evaluating environmental assessments required under Subpart X. Finally, Chapters 5, 6, and 7 provide the permit writer with information on evaluating submissions by permit applicants concerning treatment effectiveness, establishing permit conditions based on other Subparts of 40 CFR Part 264, and evaluating submissions by Subpart X permit applicants with respect to requirements for closure and post-closure, respectively.

The appendices to the guidance manual are intended to provide the permit writer with additional tools and examples that will increase understanding of the Subpart X permitting process. Appendix A is a bibliography of references to aid the permit writer in making some of the determinations discussed in the first seven sections of the manual. Appendix B is a sampling and analysis guidance that provides case studies that illustrate many of the problems associated with issuing a Subpart X permit. Appendix C consists of two case studies that involve the review of two permit applications for open burning and open detonation (OB/OD) units. Appendix D provides example reviews of air assessments for two OB/OD units. Appendix E is a guide for treatment and disposal methods that provide alternatives to open burning and open detonation of energetic (that is, propellant, explosive, and pyrotechnic) compounds. Appendix F includes the document, *Compendium of ORD and OSWER Documents Relevant to RCRA Corrective Action*, EPA, 1992, which may assist permit writers in reviewing environmental assessments submitted as part of Subpart X permit applications. Appendix G is a memorandum of understanding between the Occupational Safety and Health Administration (OSHA) and EPA regarding worker health and safety. Finally, Appendix H is a copy of the draft Chapter 11 to the SW-846 (*Test Methods for the Evaluation of Solid Waste, Physical/Chemical Methods*, EPA, 1986) which deals with quality assurance and quality control methods for saturated and unsaturated zone monitoring.

This guidance manual is part of an overall guide to the permitting of Subpart X units. The guide also contains two other documents. The first document is a permit writer's checklist designed to provide a quick reference to the minimum requirements for Subpart X permit applications. The second document is a model permit for a Subpart X unit that treats energetics; the model is designed to illustrate some permit conditions for a Subpart X unit.

The remainder of this section provides a history of the development of the Subpart X permitting program, including the development of the Subpart X regulations and a summary of policy decisions made to date with respect to permitting of Subpart X units.

1.1 REGULATORY BACKGROUND FOR THE PERMITTING OF SUBPART X UNITS

EPA originally developed regulations for permitting Subpart X units because of problems with RCRA Subtitle C regulations that made it difficult to permit certain types of hazardous waste management units. The problems were primarily that the regulations for permitting hazardous waste facilities specified permitting standards only for a finite group of hazardous waste management units and did not have the flexibility to allow permitting of certain types of units. Such facilities included those that (1) used certain innovative technologies and (2) had obtained interim status under the original regulations for interim status facilities as physical, chemical, or biological treatment units under the provisions of 40 CFR Part 265 Subpart Q, or as thermal treatment units under the provisions of 40 CFR Part 265 Subpart P.

To address this gap in the regulations for permitting hazardous waste facilities, EPA used its general rulemaking authority for treatment, storage, and disposal facilities, as defined in Section 3004(a) of RCRA, to propose regulations for the permitting of a new group of units referred to as miscellaneous units. The proposed regulations, published on November 7, 1986, proposed a series of approaches for permitting miscellaneous units, including design and operating standards, technical performance standards, containment standards, and facility-specific risk assessments. EPA requested comments on the applicability of these approaches to miscellaneous units.

After careful consideration of those approaches and review of public comments received on the proposed rule, EPA promulgated final permitting standards for miscellaneous units at 52 *FR* 46946 (December 7, 1986). The regulations, most of which were promulgated in 40 CFR Part 264 Subpart X, defined miscellaneous units as those that did not meet the definitions of other types of units, such as containers, tanks, surface impoundments, landfills, waste piles, land treatment units, and incinerators. The regulations incorporated an approach that consisted of a combination of the approaches described in the proposed rule. EPA felt the combination approach was necessary because flexibility was needed to develop permit conditions for a wide array of miscellaneous units, many of which employ new technologies and innovations and are

operated much differently from conventional hazardous waste management units. The major provisions of the Subpart X regulations published on December 7, 1986 were:

- Environmental performance standards (40 CFR 264.601) - These regulations require owners or operators of miscellaneous units to conduct environmental assessments to determine the impact the operation of their unit will have on the air, surface water, wetlands, surface soils, ground water, and the subsurface environment.

- Monitoring, analysis, inspection, response, reporting, and corrective action requirements (40 CFR 264.602) - These regulations require owners or operators of miscellaneous units to conduct monitoring and inspections necessary to comply with the general facility standards for conventional hazardous waste management units and the environmental performance standards described above and to take corrective measures, if necessary, to remedy problems detected as a result of such monitoring and inspections.

- Post-closure care requirements (40 CFR 264.603) - These regulations require owners and operators of miscellaneous units that are disposal units (or treatment or storage units that cannot be closed to meet the closure performance standard under RCRA Subtitle C) to comply with all relevant requirements for post-closure that apply to land disposal units under RCRA Subtitle C, including submission of a post-closure plan, and to comply with the requirements of the environmental performance standards during closure.

- Specific Part B information for miscellaneous units (40 CFR 270.23) - These regulations require owners or operators of miscellaneous units seeking a permit under RCRA Subtitle C to submit information, as part of a hazardous waste permit application, regarding the following: a detailed description of the miscellaneous unit; detailed hydrologic, geologic, and meteorologic assessments to demonstrate compliance with the environmental performance standards; information on potential pathways of exposure of human and environmental receptors to releases of hazardous waste or hazardous constituents from the miscellaneous unit; a demonstration of the treatment effectiveness of any miscellaneous unit that is a treatment unit; and any other information deemed by EPA necessary to determine compliance with the environmental performance standards.

EPA has made some changes in the definition of miscellaneous units since the original regulations for Subpart X units were published in 1987. For example, the final rule for boilers and industrial furnaces (BIF) at 56 *FR* 7134 (February 21, 1991) modified the definition of the term incinerator to include plasma arc furnaces and infrared furnaces, two types of units that previously were regarded by EPA as Subpart X units. The BIF rule also clarified that sludge dryers are miscellaneous units, provided they do not meet the requirements for the wastewater treatment unit exemption, as defined in 40 CFR 260.10. The BIF rule also clarified that carbon

regeneration units are miscellaneous units, whether or not they use controlled flame combustion. (Permit writers are cautioned that these provisions were issued under RCRA authority, which means that they do not take effect in an authorized state until that state adopts them.) In addition, a technical correction notice to the BIF rule at 57 *FR* 38558 (August 25, 1992) has clarified that all plasma arc and infrared units may not be easily regulated as incinerator (for example, the unit may not have an afterburner) and that such units can be permitted as Subpart X units on a case-by-case basis. Finally, the definition of Subpart X units probably will continue to change, as necessitated by experience in permitting miscellaneous units and the continued emergence of new, innovative technologies.

1.2 GENERAL POLICY GUIDANCE FOR PERMITTING OF SUBPART X UNITS

The minimum environmental requirements for Subpart X permit applications are not unit-specific, because they must apply to a wide range of units and because they must be flexible, particularly when units using emerging technologies are permitted. This lack of specificity has spawned a number of policy issues that are being addressed by a special EPA Subpart X permit writers workgroup. These issues include:

- Applicability of the Subpart X permitting standards
- General permitting concerns for Subpart X units
- Minimum requirements for Subpart X units
- Minimum requirements for air assessments
- Requirements for sampling, monitoring, and analysis for Subpart X units
- Risk assessments for Subpart X units
- Additional information requirements for Subpart X units performing treatment
- Requirements for closure and post-closure for Subpart X units
- OB/OD units on active impact ranges

The remainder of this section discusses the current status of and provides available guidance on the issues being addressed by the Subpart X workgroup.

1.2.1 Applicability of the Subpart X Permitting Standards

Permit writers may be confronted with the following issues regarding the applicability of the Subpart X permitting standards:

- How do the exemptions in 40 CFR Parts 264 and 270 apply to Subpart X units?
- What are the criteria for deciding whether to issue a permit under Subpart X or under another Subpart of Part 264?
- Can a unit receive permits under more than one subpart of 40 CFR Part 264?
- What are the criteria for deciding whether to issue an Research Development, and Demonstration (RD&D) permit or a Subpart X permit?
- What are the criteria for deciding whether to issue an emergency permit or a Subpart X permit?

Units that are exempt from regulation under 40 CFR Parts 264 and 270 are not subject to Subpart X permit requirements. For example, a carbon regeneration unit that meets the definition of a wastewater treatment unit is exempt from regulation under 40 CFR 270.1(c).

Whenever possible, when owners or operators submit applications for a Subpart X permit, the unit should be permitted as another type of hazardous waste management unit under other Subparts of Part 264. Permits should be issued under Subpart X only for units that do not meet the definitions of other types of units set forth in 40 CFR 260.10. For example, a unit that performs chemical treatment and that also meets the definition of a tank should be permitted as a tank, rather than as a miscellaneous unit.

Whatever decision is made regarding the permitting of a unit, whether under Subpart X or otherwise, only one permit should be issued to the unit. For example, an indoor storage unit that resembles a waste pile should be permitted either as a waste pile or as a miscellaneous unit, but not as both. In addition, shredders that manage hazardous wastes may be regulated as Subpart X units or as ancillary equipment to other units. To be regulated under Subpart X, a shredder must be used (1) to shred a container containing a hazardous waste and (2) to perform treatment on the waste. Standalone shredders that meet these criteria will be regulated as Subpart X units.

However, a shredder unit may be regulated[1] as ancillary equipment if it is directly associated with another unit, for example, a hazardous waste incinerator.

Although only one permit should be issued to a unit being considered for a Subpart X permit, the Agency may issue Subpart X permits that specify requirements drawn from other subparts. For example, for a unit that requires containment, a permit writer might decide to require an owner or operator to provide a double-liner and leachate collection system similar to that required for landfills under 40 CFR Part 264 Subpart N.

The Subpart X standards do not supersede or replace any requirements in any other Subparts of Part 264. For example, container storage areas at permitted facilities are required to have containment. An owner or operator cannot evade this requirement by seeking a permit under Subpart X.

Small-scale, experimental units may be permitted under the RD&D permitting procedures stated in 40 CFR 270.65. However, the RD&D permit does not apply to larger units, because the procedures for RD&D permitting are amenable only to trial units. Larger, nonexperimental treatment processes can be permitted as Subpart X units. Laboratories can be permitted under Subpart X even when a broad range of treatment activities are proposed. This circumstance remains the case until the Agency develops in Part 264 technology-specific standards for laboratories.

It is established in 40 CFR 270.1(c)(3) that actions taken to remove a threat of imminent discharge or to respond to a release of hazardous waste do not require a permit. For example, a local emergency coordinator may remove and treat an explosive device without getting a permit because such an action would be taken in response to a threat of discharge.

Should there be any question about the exempt or nonexempt status of an action to remove a threat of an imminent discharge or respond to a hazardous waste release[2], the RCRA emergency permit regulations at 40 CFR 270.61 can be applied to handling activities. As the rules provide,

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[1] Shredders that shred containers defined as empty under 40 CFR 261.7 are generally not regulated.

[2] See memorandum to the Bureau of Alcohol, Tobacco, and Firearms (BATF) on emergency treatment in the bibliography of references included as Appendix A to this guidance manual

an emergency RCRA permit can be issued by an EPA Regional office or by an authorized state (that is, if the state offers such a permit) by telephone or in writing. Such permits may be issued when the Region or state finds that an imminent and substantial endangerment to human health or the environment exists, according to the provisions of 40 CFR 270.61. The permit can cover treatment, storage, and disposal of hazardous waste. If necessary, transportation also can be authorized by a provisional identification number, obtainable by telephone. However, emergency permits should not be issued to facilities that perform routine or systematic treatment or handling of such hazardous waste.

1.2.2 General Permitting Concerns for Subpart X Units

This section provides permit writers with guidance on policy for the permitting of all Subpart X units and provides guidance on permit conditions that should be included in all permits issued under Subpart X authority.

1.2.2.1 Loss of Interim Status (LOIS) and Applicability of the November 8, 1992 Permitting Deadline to Subpart X Facilities

Facilities with Subpart X units are subject to the same permitting deadlines as conventional hazardous waste management units. These deadlines are found in Section 3005(c) of RCRA. Under these deadlines, an owner or operator must submit a complete Part B permit application covering all units identified on the facility's Part A permit application as of November 8, 1992, if the facility is to retain interim status after November 8, 1992. These deadlines also stipulate that permit writers by November 8, 1992 should have made a permit determination -- including permit issuance or permit denial -- on all units identified in Part B permit applications received by November 8, 1992. Permit writers should note that any permit determination made on a permit application may take the form of a partial permit, because the permit determination only has to cover units operating under interim status on November 8, 1984. For example, if a facility had obtained interim status for container storage in 1980, but also had a Subpart X unit that became eligible for interim status in 1990 (for example, as a result of the wastes being treated becoming subject to regulation as a result of the toxicity characteristic (TC) rule), the permit writer would have been required to make a permit determination only on the container storage area, and not the Subpart X unit, by November 8, 1992.

Permit writers should be aware that applicability of the permit determination deadlines in Section 3005(c) of RCRA is limited to applications that are complete as of November 8, 1988. For Subpart X units, a complete permit application includes all the general information requirements for permit applications in 40 CFR 270.14 and specific information requirements for Subpart X units in 40 CFR 270.23. If a facility had submitted a permit application for a Subpart X unit prior to November 8, 1988, but the application was incomplete, the permit writer may revoke the facility's interim status, or address deficiencies using NODs and continue to allow the facility to operate.

Permit writers also may allow facilities that have submitted permit applications late (that is, after November 8, 1988) to continue to operate after November 8, 1992, if it is felt that requiring the facility to close would pose a greater threat to human health or the environment than allowing the facility to continue to operate through the use of a compliance order under Section 3008(h) or 3008(a) of RCRA, or other comparable state enforcement authority. These facilities will have lost their interim status, but will be allowed to continue to operate as if they had interim status. An example of this situation would be a case where a facility conducts open detonation of energetic wastes that are unsafe to transport or to store for extended periods of time. Permit writers considering such an action should coordinate their efforts with Regional or state enforcement personnel.

1.2.2.2 Treatment Versus Disposal for Miscellaneous Units

Miscellaneous units may be defined as either treatment or disposal units, depending upon the specifics of the operation. A Subpart X unit may be defined as a disposal unit if the unit meets one (or both) of the following criteria: (1) if its operation affects the soil or (2) if it is located on the ground. Units that do not meet one of these criteria are generally considered treatment units. Examples of potential Subpart X disposal units include underground mines or caves and geologic repositories. These types of units are subject to all relevant requirements for units defined as land disposal units under RCRA, including the land disposal restrictions, ground-water monitoring, and if wastes, contaminated structures, or contaminated environmental media are to be left in place at closure, post-closure requirements.

Permit writers should be aware that there are two exceptions to the general guidelines provided above with regard to the determination as to whether a Subpart X unit is a treatment or disposal unit. The first exception to the definition of disposal unit under Subpart X includes open

burning and open detonation units. Under RCRA, open burning and open detonation are defined as treatment activities; therefore, these units are considered treatment units. A second exception may be a Subpart X unit that incorporates engineering zones of control. Such a unit may be defined as a treatment unit if its operation does not affect the soil or ground water, even if the unit is located on the ground.

1.2.2.3 Storage Versus Incidental Handling at Subpart X Facilities

Generally, if wastes are placed directly into a Subpart X unit from an off-site source or a generator accumulation area on site, only a permit for treatment is required. However, in many cases, facilities may store wastes near a Subpart X unit for a period of time before treatment or disposal. In such cases, permit writers should require a permit for storage in such a unit if it is felt that the waste will be stored for a period of time longer than necessary for the incidental handling associated with treatment of the waste. Permit applicants must be required to describe storage practices when wastes are stored near the unit before treatment. The determination whether a storage permit is required should be based on site-specific factors.

1.2.2.4 Selection of Treatment Technologies

There is no direct authority under Subpart X (or elsewhere under RCRA) to require an owner or operator to use a specific technology. However, owners or operators of Subpart X units must be able to demonstrate that their unit is located, designed, operated, and maintained in a manner that is protective of human health and the environment. Therefore, the permit writer may encourage the use of alternative technologies by using the following tools:

- **Ability to specify design and operating conditions.** Subpart X allows permit writers to specify design and operating conditions that they consider appropriate for the technology and the specific site involved, even if such conditions are not proposed in the original permit application. If the applicant does not supply the necessary documentation for such conditions, or if the permit writer believes that the environmental performance standard for Subpart X units cannot be met by the technology proposed, then the permit can be denied. For example, permit writers may wish to require air pollution control devices similar to those required for an incinerator for a thermal desorption unit that has been determined to pose unacceptable risks from air emissions.

- **Ability to request additional information in notices of deficiency** (NOD). The permit writer can issue an NOD that, through the inclusion of specific,

targeted questions or comments, can compel the applicant to consider design or operation features that will ensure protection of human health and the environment. For example, permit writers may ask such questions as:

- How will emissions be monitored or indicated on a continuous basis to ensure at all times, that emissions are within the limits established by the permit?

- How will deposition of hazardous waste or hazardous constituents in soil be prevented?

These practices have been used successfully in Utah to require facility owners or operators to conduct a study of alternative technologies when the proposed treatment technology was deemed to be unprotective of human health and the environment.

If more environmentally sound technologies exist than the one proposed by the applicant, permit writers can suggest those technologies to the applicant. Often, the applicant is not aware that better alternatives are available. For example, improving the unit's ability to contain the material being treated reduces the complexity of the required environmental assessment. In cases in which the applicant cannot demonstrate compliance with the environmental performance standard required for Subpart X units, the use of a unit with more environmental controls may be the only way in which the applicant can obtain a permit.

1.2.2.5 Corrective Action

All treatment, storage, and disposal facilities (TSDF), including Subpart X units, are subject to RCRA corrective action requirements for releases of hazardous wastes and hazardous constituents from solid waste management units (SWMU) at the facility. Existing requirements specify that all past or potential releases from solid waste management units are to be evaluated through a RCRA facility assessment (RFA). If deemed necessary as indicated by the results of the RFA, owners or operators must conduct a RCRA facility investigation (RFI) to determine the nature and extent of contamination from SWMUs on site. Permit writers may use information from RFAs and RFIs when evaluating environmental assessments for Subpart X units submitted by permit applicants.

Permit writers also should consider proposed corrective action requirements when evaluating Subpart X permit applications. On July 27, 1990 (55 *FR* 30796), EPA proposed

procedures and technical requirements for implementing the corrective action provisions of Section 3004(u) of RCRA. The requirements, if they become final, will be codified as a new Subpart S of 40 CFR Part 264. The proposed Subpart S regulations include requirements for conducting RFIs, and evaluating, selecting, and conducting corrective measures at TSDFs. The proposed rule establishes health-based and environment-based action levels, above which corrective action must be implemented.

The aspects of the Subpart S process that are most useful for Subpart X permitting include the RFI and the action levels. The procedures specified in the proposed Subpart S requirements for conducting RFIs can be adopted for use in conducting environmental assessments under 40 CFR 264.601 to establish the existing quality of potentially affected environmental media. At sites at which the RFA, RFI, or a Subpart X environmental assessment reveal contamination, permit writers may wish to apply the action levels in the proposed Subpart S rule as part of any corrective action for releases from Subpart X units. Where no action level is offered, the applicant should propose a level in the permit application or the permit writer should set a level in the permit which is equal to background concentrations. Appendix A of the proposed Subpart S regulations gives examples of action level concentrations derived by EPA for several hazardous constituents listed in Appendix VIII of 40 CFR Part 261. Chapter 4 of this guide attempts to translate the RFA and RFI guidances for use in evaluating a Subpart X unit. In addition, Appendix F to this guidance manual provides a list of documents relevant to corrective action.

1.2.2.6 Waste Minimization

Provisions for waste minimization should be included in permit applications submitted by owners or operators of proposed Subpart X units, as required by Section 3005 of RCRA and by 40 CFR 264.73(b)(9). Permit applicants must certify that they have undertaken efforts to reduce the amount and toxicity of wastes treated, stored, or disposed of on site. Waste minimization provisions will be based on waste- and unit-specific considerations. The permit writer may wish to suggest that the applicant explore recycling or reuse options before treating or disposing of the waste by using a partially uncontrolled process (for example, an open burning or open detonation [OB/OD] unit). When the amount of waste to be treated or disposed of is reduced, the impact of releases on human health and the environment, and, hence, the burden on the permit applicant in completing environmental assessments, is reduced.

1.2.2.7 Worker Health and Safety

Permit writers must be aware of worker health and safety considerations when reviewing permit applications, but also should be aware that their authority is limited under RCRA in the area of worker protection. RCRA standards for protection of workers should be implemented primarily through the personnel training requirements of 40 CFR 264.16, the preparedness and prevention requirements of 40 CFR Part 264 Subpart C, and the contingency plan requirements of 40 CFR Part 264 Subpart D. In addition, the Occupational Safety and Health Administration (OSHA) has the responsibility for assuring worker health and safety at hazardous waste sites. Under the Occupational Safety and Health Act, all workers involved in hazardous waste operations at Subpart X facilities are required to undergo at least 40 hours of health and safety training (see 29 CFR 1910.120(e)). A memorandum of understanding (MOU) between EPA and OSHA details the responsibilities of both agencies at hazardous waste sites; permit writers can refer to this MOU when addressing worker health and safety issues at a Subpart X facility. (The MOU is included as Appendix G to this guidance manual.) Concerns for worker health and safety may be of particular interest at facilities that have OB/OD units because of the nature of operation of these units.

Although the authority of a permit writer to require health and safety provisions under RCRA is limited, permit writers can request information on potential health effects on on-site workers as part of the risk assessment for a Subpart X unit. Permit writers should be sure that such receptors are taken into account, especially at larger facilities where residents may be living on site.

Permit writers can coordinate their efforts with OSHA inspectors when reviewing permit applications. In cases in which the authority of permit writers under RCRA appears limited, the permit writer should refer health and safety concerns to an OSHA representative.

1.2.2.8 Quality Assurance and Quality Control (QA/QC)

Quality assurance and quality control procedures, as part of the waste analysis plan and of other monitoring and analysis procedures, are an essential element of any Subpart X permit application. Errors and inadequacies in data can result from many sources, including unanticipated matrix effects, equipment malfunctions, and operator error. Permit applicants should specify the precision and accuracy of analytical results and the detection limits of

analytical methods, to enable the permit writer to determine the quality of the data submitted. Permit applications should specify procedures for verifying results of sampling and analysis for all environmental media, including air, ground water, surface water, and soil. Owners or operators should follow the procedures stated in Chapter 1 of SW-846 (*Test Methods for the Evaluation of Solid Waste, Physical/Chemical Methods, 2nd edition*, U.S. EPA, 1986) that require a quality assurance project plan (QAPjP) for testing of solid or hazardous wastes. A draft Chapter 11 of SW-846 specifies additional QA/QC procedures for saturated and unsaturated zone monitoring. (This document is included as Appendix H to this guidance manual.) Permit writers should consider incorporating these provisions in a permit issued to a Subpart X unit. If adequate QA/QC cannot be established, the permit application should justify the use of any best engineering judgments made.

1.2.3 Minimum Requirements for Subpart X Units

This section provides information to permit writers on minimum requirements for Subpart X units, with regard to the types of wastes allowed in OB/OD Subpart X units and to the types of protective controls required for all Subpart X units.

1.2.3.1 Definition of the Term "Potential to Detonate"

Under RCRA Subtitle C, there is a general ban on the open burning or open detonation of hazardous wastes (see 40 CFR 265.382). The only exceptions to this prohibition are (1) waste explosives that have the potential to detonate and (2) bulk military propellants that cannot be disposed of through other means of treatment. The definition of the term "potential to detonate" has been the subject of several policy memoranda, dating back to 1987. These memoranda are provided in the bibliography of references provided as Appendix A to this guidance manual.

In some cases, safety considerations may define the waste as one with the potential to detonate. For example, certain wastes may not be amenable to off-site treatment or incineration because it is not safe to transport them. In addition, certain wastes may become increasingly unstable over time. Such wastes cannot be stored safely and must be treated by the safest available method, which in many cases is open burning or open detonation.

Not all reactive wastes have the potential to detonate; in fact, only a fraction of such wastes exhibit this property. For example, waste solvents with a small amount of explosives fines, flares, dyes, and ball ammunition cannot be open burned or open detonated because these wastes do not have the potential to detonate. Permit applications should explain the potential to detonate of each waste or wastestream that will be treated in an OB/OD unit. This explanation should include information on concentration of explosive or propellant constituents in the waste. It also should specify waste quantities, method of treatment, and treatment effectiveness. For energetics that are determined not to have the potential to detonate, permit writers may refer to Appendix E to this guidance manual, which lists potential alternatives to OB/OD for a variety of energetic wastestreams.

1.2.3.2 Containment

For all Subpart X units that pose a threat of release of hazardous waste or hazardous constituents, containment should be required, to the extent practicable. As a rule, the greater the extent of containment for a Subpart X unit, the less detailed an environmental assessment will be required for that unit -- a point that should be emphasized to permit applicants. For example, it should be required that OB activities be conducted in burn pans or burn pads, rather than on the ground. Containment requirements stated in other Subparts of Part 264 may be incorporated into Subpart X permits; for example, permit writers can specify liner systems for units that resemble land disposal units, wind-dispersal controls for units that resemble waste piles, or secondary containment for units that resemble tanks. Permit writers make every effort to use applicable authorities to ensure that such containment is constructed before wastes are treated or disposed of in a Subpart X unit.

1.2.4 Minimum Requirements for Air Assessments

Owners or operators conducting air assessments should use air monitoring or air modeling, or a combination of the two approaches, to assess the potential effects of releases of hazardous waste consitutents to the air pathway. When it is feasible, air monitoring generally is considered preferable to modeling, because the results obtained represent measured, rather than estimated, concentrations of hazardous waste constituents being released from a unit. However, at many sites, monitoring may not be possible because of difficulties in sampling a particular emission from a Subpart X unit. Any emission modeling should use verifiable, reasonable, worst-case emissions factors. In addition, modeling results must be interpreted by experts. The choice of a

model is also an important factor in determining whether emissions from a Subpart X unit are being characterized correctly. Regional and state permit writers should seek help from people who have expertise in air modeling; usually, permit writers will find such experts on the staffs of the air divisions of EPA Regional and state environmental protection offices.

Air monitoring should be conducted and data provided for all types of meteorological conditions that may occur during operation of the unit to be permitted (for example, during both turbulent and calm wind conditions). Levels of hazardous waste constituents obtained from monitoring activities should be compared with health-based levels tracked in the Integrated Risk Information System (IRIS), with values from Health Effects Assessment Summary Tables (HEAST), and with any other data source the Agency uses to establish risk factors. The applicant also can propose, and justify, a safe level of emissions, if no other health-based level exist.

EPA Region VIII currently is implementing a Regional policy that initially requires emissions from OB/OD units to be characterized for all constituents listed in Appendix VIII of Part 261. Under the Region's policy, the permit applicant may propose to eliminate characterization of some of the constituents through test results or knowledge of the waste (for example, based on stoichiometric considerations). The permit applicant also may be required to monitor for hazardous waste constituents not found in Appendix VIII.

1.2.5 Requirements for Sampling, Monitoring, and Analysis for Subpart X Units

This section provides general guidance for permit writers on minimum requirements for sampling, monitoring, and analysis of wastes and environmental media that permit applicants must conduct for their Subpart X units.

1.2.5.1 Detection Limits and Availability of Test Methods

Permit writers should require permit applicants to use the detection limits and associated analytical detection limits specified in SW-846 whenever possible. However, many wastes treated in Subpart X units have constituents for which (1) there are no EPA-approved test methods to detect them or (2) their detection limits are above health-based standards. In cases in which EPA test methods are not available, alternative methods can be used. For example, the American Society of Testing and Materials (ASTM) and the United States Army Toxic and Hazardous Materials Agency (USATHAMA) have developed methods for detecting explosive constituents in

ground water for which no test methods are specified in SW-846. Additional test methods that are potentially applicable to energetic wastes being treated by Subpart X permit applicants are discussed in a sampling and analysis guidance included as Appendix B to this guidance manual. A set of indicator parameters often used by facilities that handle explosive compounds is the Cold Regions Explosive List. For constituents that have detection limits above health-based standards, the permit application should use the detection limit specified in SW-846 as a substitute for a health-based standard, unless the owner or operator can justify use of an alternative concentration. (Permit writers should note that in a situation where the detection limits in SW-846 are used as substitutes for a health-based standards in a permit, the permit writer can include reopener clauses in the permit that will require these permit limits to be changed if the detection limits in SW-846 are modified.)

1.2.5.2 Ground-Water Monitoring

Ground-water monitoring is not required explicitly in 40 CFR Part 264 Subpart X for miscellaneous units. However, the owner or operator of any Subpart X unit that has the potential to affect the ground water will be required to install a ground-water monitoring system that complies with the requirements of 40 CFR Part 264 Subpart F. Such units include disposal units and any treatment units that do not have engineering controls to prevent migration of hazardous waste or hazardous constituents to soils or to the subsurface. Owners or operators of such units must provide adequate justification through an environmental assessment, if they believe that their unit(s) should not be required to have a ground-water monitoring system. A unit that is contained within a building is an example of a unit that may be eligible for an exemption from ground-water monitoring requirements. If it is determined that ground-water monitoring is necessary, owners or operators should be required to install a ground-water monitoring system before the permit is issued. Additional guidance on evaluating proposals for ground-water monitoring is available in a number of documents, including the *RCRA Ground-Water Monitoring Technical Enforcement Guidance Document*[3] and *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities - Interim Final Guidance*.[4] Permit writers also may wish to take a course

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[3] Available from the National Technical Information Service (NTIS), NTIS #PB87-107 751/AS.

[4] Available from NTIS, NTIS #PB89-151-047. In addition, the EPA Office of Solid Waste offers a supplemental training course, "Statistical Training Course for Ground-Water Monitoring Data Analysis," June 1991, available through the RCRA Hotline at 1-800-424-9346.

like Site Characterization for Subsurface Remediation,[5] which deals with several aspects of ground-water and unsaturated zone monitoring. A bibliography is available that summarizes current literature on assessing and remediating subsurface contamination. The summary is listed in the bibliography of references provided as Appendix A to this guidance manual.

When establishing permit conditions for ground-water monitoring parameters, permit writers should start with a broad list of parameters (for example, constituents listed in Appendix IX of Part 264) and require permit applicants to justify any reduction in the number of parameters to be analyzed. Under the authority of 40 CFR 270.14(c), owners and operators can be required to monitor for parameters other than Appendix IX constituents. An example is monitoring for constituents found in explosives that are not listed in Appendix IX, but that may migrate from open burning or detonation units.

The point of compliance for ground-water monitoring is defined in 40 CFR 264.93 as an imaginary line circumscribing the downgradient edge of the unit. In some cases, an alternative point of compliance (POC) for ground-water monitoring may be warranted for Subpart X units. An alternative POC may be appropriate when (1) physical obstacles prevent its establishment at the edge of the unit or (2) there is risk of damage to monitoring equipment. For example, many OB/OD units are located within the boundaries of an active impact range. In such cases, the POC should be located where ground-water monitoring wells will not be damaged by ongoing range activities or by shock waves or heat from OB or OD treatment.

In some cases, ground-water modeling also may be acceptable, particularly as a supplement to ground-water monitoring. Modeling also may be used independently of monitoring, although the burden of proof that any model proposed is adequate rests with the permit applicant. Several models are available, including models developed by EPA and by industry. The utility of models often may be limited because they generally must be run by an expert hydrologist, and they are not as reliable as actual ground-water monitoring. For example, the actual structure of the subsurface may be different from the conditions the models are based upon.

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[5] Available from the Office of Research and Development (ORD) Publications Office, Center for Environmental Research Information, 26 West Martin Luther King Drive, Cincinnati, OH 45268-1072, (513) 569-7562, #CERI-89-224.

1.2.5.3 Soil Sampling

Soil sampling should be specified as a permit condition under Subpart X, unless an applicant can demonstrate that such sampling is not necessary. Soil sampling is required for units that may affect the soil through (1) direct contact of wastes or degradation products with the soil or (2) deposition in the soil of particulates from air releases from the unit. Soil sampling generally will not be required for indoor units or for certain units that do not incorporate the soil as part of the unit's zone of engineering control. Several guidances[6] are available on conducting soil sampling; they include:

- RFA and RFI guidances
- Closure guidances for various types of hazardous waste management units
- U.S EPA Environmental Monitoring Systems Laboratory (EMSL) soil guide
- Land treatment guidances
- Superfund guidances

1.2.5.4 Unsaturated Zone Monitoring

Like soil sampling, monitoring of the unsaturated zone should be required of Subpart X permit applicants, unless the owner or operator can demonstrate through the environmental assessment that it is not necessary to do so. Results of this monitoring should be used to characterize horizontal and vertical migration of contaminants in the unsaturated zone. Soil borings and piezometers should be used to measure the thickness of the unsaturated, saturated, and capillary fringe zones. Perched water tables may occur in these zones; such water tables should be monitored on at least a seasonal basis. The Office of Solid Waste at EPA Headquarters is working on a modification of the 40 CFR Part 264 Subpart F requirements that will mandate the monitoring of the unsaturated zone for landfills, surface impoundments, and waste piles. (Monitoring of the unsaturated zone already is required for land treatment units.) Unsaturated zone monitoring should be conducted in a manner that ensures the integrity of monitoring equipment; for example, piezometers should be placed so that they are not damaged by waste

[6] A list of RCRA and Superfund guidances is presented in Subsection 4.4.3.3 of this guidance manual.

treatment or disposal activities in the Subpart X unit (see discussion in Subsection 1.2.5.2 on ground-water monitoring).

1.2.6 Risk Assessments for Subpart X Units

This section provides permit writers with an overview of the types of issues involved in the review of risk assessments conducted by permit applicants.

1.2.6.1 Minimum Content Requirements for Risk Assessments

Risk assessments must be conducted by permit applicants to validate information submitted in support of the environmental assessments required under 40 CFR 264.601. Permit writers should expect to see varying levels of detail in the risk assessments submitted in permit applications. The detail included in risk assessments will vary, depending upon the type of environmental assessment conducted (for example, whether a preliminary or a detailed assessment is performed; see Section 4 for more discussion of the types of assessments). However, risk assessments conducted for Subpart X units should present the same (or a greater) level of detail as do risk assessments required under other sections of RCRA or other statutes, including risk assessments conducted as part of the RFA/RFI process or preliminary assessments and site inspections (PA/SI) conducted under CERCLA. Risk assessments must focus on risks posed throughout the life of the unit, not just those present at the time the permit is issued.

1.2.6.2 Determination of Background Concentrations

A permit applicant must be able to determine background concentrations of hazardous waste or hazardous constituents in environmental media around a Subpart X unit. Background concentrations should be representative of natural levels of hazardous waste constituents and should not be affected by past activities at the facility. (An exception to this requirement may be a Subpart X unit (for example, an OB/OD unit) located on an active impact range.) When establishing background concentrations for ground water, permit applicants should follow the requirements of 40 CFR Part 264 Subpart F.

1.2.6.3 Minimum Requirements for Risk Assessments for Releases to Air

When conducting a risk assessment for air releases, permit applicants should select a point of compliance that takes into account on-site exposure (for example, worker exposure) as well as off-site exposure. The nearest human receptor should be identified as the maximum exposed individual (MEI). The MEI is defined as the closest resident to the site or, alternatively, if people reside on site, the closest person to the unit. (This issue is of particular importance for large, federally-owned facilities.) Assessments of exposure by the air pathway should include not only human health but also environmental concerns (for example, effects on biota). Guidance on environmental effects is available in *Eco Update: Ecological Assessment of Superfund Sites: An Overview.*[7]

1.2.7 Additional Requirements for Subpart X Units Performing Treatment

Permit applicants that submit a permit application for a Subpart X unit that conducts treatment must furnish a report on the effeetiveness of such treatment. This report should include information on the concentrations of hazardous waste constituents in the waste before and after treatment.

At the time of publication of this manual, there is no universal definition of what constitutes effective treatment. Consequently, permit writers cannot deny a permit or issue a NOD based solely on the effectiveness of treatment. However, permit writers can issue a NOD or permit denial for a Subpart X unit if the unit does not comply with the environmental performance standards under Subpart X, which require the permit applicant to demonstrate that operation of the unit will not have an adverse effect on human health or the environment.

1.2.8 Requirements for Closure and Post-Closure for Subpart X Units

For the most part, Subpart X units are subject to the same requirements for closure and post-closure as conventional hazardous waste management units. An owner or operator of a Subpart X unit should be required to comply with the requirements of 40 CFR Part 264 Subpart G,

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[7] Available from NTIS, NTIS #PB92-963 335.

include removal of all contaminated equipment (for example, burn pans for OB units), debris, and soil.

when closing such a unit. Permit applicants should propose procedures for closure of a Subpart X unit as part of a closure plan.

For Subpart X units that are disposal units, permit writers should require permit applicants to submit a post-closure plan. This plan should include all information necessary to comply with applicable post-closure requirements in 40 CFR Part 264 Subpart G. Owners or operators can be relieved of initiating post-closure activities only if the Subpart X unit in question can be clean-closed; that is, if all contaminated environmental media and other, contaminated materials associated with the unit can be removed or decontaminated at closure. Permit writers should also require Subpart X permit applicants to submit a contingent post-closure plan for treatment units if there is a possibility the unit cannot be clean-closed.

1.2.9 OB/OD Units on Active Impact Ranges

Since the beginning of the Subpart X program, OB/OD units located within the boundaries of impact ranges have presented problems that stem from a number of technical, regulatory, and policy issues that historically have proven difficult to solve. OB/OD units on active impact ranges can present complications in corrective action or closure because it is often difficult to determine whether the source of contamination is the OB/OD unit or the active impact range. Typically, there are also problems with the installation of monitoring equipment for these units, particularly ground-water wells and unsaturated zone monitoring devices, because they may be damaged by ongoing range activities.

Existing OB/OD units located within active impact ranges may be permitted in certain cases, but new OB/OD units should not be sited within the boundaries of an active impact range. The decision whether to allow such existing OB/OD units to continue to operate should be based on several factors, including precipitation and runoff at the site, hydrogeologic and geologic variables, intensity of training activities, and location of the OB/OD activities. Permit writers should decide whether it will be feasible to monitor the unit for releases of hazardous waste constituents as part of the environmental assessment; if monitoring is not feasible, the unit should be relocated.

Closure of OB/OD units on active impact ranges should include all practicable closure activities. Most of such closures will be minimal, with the majority of the cleanup conducted at the time the range is closed. Closure activities for OB/OD units on active impact ranges should

2.0 OVERVIEW OF THE SUBPART X PERMIT APPLICATION PROCESS

As in the case of any other hazardous waste management unit, the goal of the Subpart X permitting process is to develop permit conditions for the unit. This goal is accomplished by requiring the permit applicant to submit information that describes the unit, the wastes it manages, and the environmental conditions (for example, geologic and meteorologic) at the facility. As part of this information collection process, permit writers must require applicants to submit certain minimum information that documents that the operation of the unit will not adversely affect three different environmental media (that is, air; surface water, wetlands, and surface soils; and ground water and subsurface environment).

Permit writers should require Subpart X permit applicants to include all the general information required for all other hazardous waste management units. That is, permit applicants must fulfill all the information requirements listed in 40 CFR 270.13 (contents of Part A permit applications) and 270.14 (contents of Part B permit applications: general requirements). Therefore, significant portions of Subpart X permit applications will be identical to applications for other hazardous waste management units. In addition, Subpart X permit applications must fulfill the information requirements in 40 CFR 270.23. These requirements include:

- A detailed description of the unit (270.23(a))
- Site assessments (270.23(b)) and information on pathways of exposure (270.23(c))
- A demonstration of treatment effectiveness (270.23(d))
- Any other information deemed necessary by the permit writer (270.23(e))

The detailed description of the unit should be reviewed for completeness in the same manner as any other description of a hazardous waste management unit is reviewed. Next, the permit writer should begin the technical review by determining whether the unit has any design or functional features that are similar or even identical to other hazardous waste management units that are regulated in 40 CFR Part 264 Subparts I through O. When conducting these reviews, the permit writer should carefully read the definitions in 40 CFR 260.10 of each type of hazardous waste management unit. If the permit writer finds features in a Subpart X unit that are functionally or structurally equivalent to those of other types of units, the permit writer should evaluate such features by applying the appropriate requirements specified in 40 CFR Part 264

Subparts I through O and the EPA permit review checklists pursuant to those requirements. A finding by the permit writer that a Subpart X unit (or portions of such a unit) is identical to another type of unit diminishes the need for the applicant to conduct the assessments required under 40 CFR 270.23(b) and (c) if the applicant complies with all the requirements for the other type of unit. In these cases, the permit writer can incorporate applicable provisions in 40 CFR Part 264 Subparts I through O as permit conditions for the Subpart X unit in question.

Permit applications that describe units (or portions of units) that are not similar in design or function to other types of hazardous waste management units should be reviewed to identify particular locations on the unit from which hazardous waste constituents may be released to the environment. For each of these locations, the permit writer should always (1) require permit applicants either to provide secondary containment or pollution control devices (whenever such devices appear to be applicable) to control the release, or (2) to provide specific justification for not using such devices. Examples of valid justifications by permit applicants may be interference with the units' treatment effectiveness or severe technical problems in installing the device. Section 3 of this manual provides further guidance for evaluating unit descriptions in Subpart X permit applications.

Site assessments (required by 40 CFR 270.23(b)) and information on pathways or exposure (required by 40 CFR 270.23(c)) must be provided in Subpart X permit applications to demonstrate compliance with the performance standards in 40 CFR 264.601. The standards require the "prevention of any releases that may have adverse effects on human health or the environment due to migration of waste constituents in":

- The ground water or subsurface environment (40 CFR 264.601(a)),
- Surface water, wetlands, or on the soil surface (40 CFR 264.601(b)),
- The air (40 CFR 264.601(c)).

The permit application must include a complete description of the units' actual and potential effects on each of the above-mentioned media. The descriptions will vary in length and complexity, depending on whether the applicant is providing a preliminary assessment or a detailed assessment, both of which are referred to in 40 CFR 270.23(b). If the applicant provides a successful preliminary assessment for a given media, no other assessment is required for that media. Similarly, much of the rigor normally required in a detailed assessment for a particular

media may be avoided by applicants that conduct screening assessments, which are discussed in this guidance but are not specifically cited in the Subpart X regulations.

In a preliminary assessment, the permit applicant must show that there are no expected releases to the environment above acceptable levels and that any potential releases above such levels will be controlled by secondary containment, pollution control devices, or other means of controlling releases. These assessments are relatively simple because they focus only on the types and amounts of wastes to be managed in the unit and on the design, construction, and operation of the Subpart X unit.

In a screening assessment, the applicant must provide worst-case assumptions on the concentrations of hazardous constituents that may be released from the unit, enter the affected media, and come into contact with receptors. These assessments are more complex than preliminary assessments because the applicant must provide convincing evidence that assumptions used concerning release rates, release amounts, and transport levels and concerning receptor exposure levels are worst-case, and that such levels still will allow the permit applicant to meet the performance standards stated in 40 CFR 264.601. The most effective screening assessments are those in which the performance standards are met even when the "worst-case" assumptions are unrealistically conservative.

A detailed assessment usually will be provided by applicants that cannot demonstrate successfully that their unit meets the performance standard under worst-case assumptions. These detailed assessments are more complex than screening assessments because they require the permit applicant to refine worst-case assumptions about the release and fate and transport of hazardous constituents by using more data from actual field measurements or more sophisticated modeling and monitoring techniques. The objective of the detailed assessment is the same as that of the preliminary assessments and screening assessments: to demonstrate that expected releases do not violate the performance standard established in 40 CFR 264.601. Therefore, the most effective detailed assessments will use assumptions that are worst-case within the environmental setting of the proposed Subpart X unit. Section 4 of this manual provides further guidance on evaluating assessments and information on pathways and exposure in Subpart X permit applications.

Subpart X permit applications for units that conduct treatment must include detailed information regarding treatment effectiveness (see 40 CFR 270.23(d)). The information normally should include waste-specific measurements of concentrations of hazardous constituents before

and after treatment. In addition, the information must demonstrate that hazardous constituents are not merely being shifted from one medium to another by the Subpart X treatment process. Section 5 of this manual provides further guidance on evaluating a permit applicant's reports on treatment effectiveness.

The information requirements of 40 CFR 270.23(e) allow the permit writer to request any additional information necessary to comply with the environmental assessment requirements of 40 CFR 264.601. Because the environmental assessment is the primary means of ensuring that miscellaneous units are designed, constructed, and operated to protect human health and the environment, a permit writer should use this authority to require the applicant to submit additional information if he or she is not satisfied with the information submitted for a preliminary or a detailed assessment.

The ultimate goal of collecting the information required under 40 CFR 270.23 from permit applicants is to establish permit conditions, or prepare a permit denial. When developing permit conditions, permit writers should attempt to use concepts from existing regulations and guidances for other types of hazardous waste management units. Permit writers should use those concepts because the regulations and guidances currently in use already have been reviewed, both by EPA and by the public, and have been determined to result in policies that are protective of human health and the environment. The use of such existing information will serve two purposes: (1) to save the permit writer time and effort and (2) to reduce the chances that the permit writer's decisions regarding permit conditions will be challenged.

When developing permit conditions, permit writers should keep in mind the two basic goals of establishing permit conditions:

- Protectiveness of human health and the environment
- Enforceability

To develop permit conditions that are protective of human health and the environment, permit writers likely will want to consult experts in the evaluation of the three environmental media and consult existing guidance manuals on those subjects. To evaluate the enforceability of potential permit conditions, permit writers should coordinate their efforts with EPA Regional or state enforcement personnel, including Regional or state counsel.

3.0 THE DESCRIPTION OF THE SUBPART X UNIT

The description of the Subpart X unit must be presented in sufficient detail to allow the permit writer to determine the integrity of the unit, its method of operation and associated waste management processes, and its degree of similarity to other hazardous waste management units. The unit description also must provide sufficient detail for the permit writer to combine it with descriptions of the wastes managed in the unit (required under 40 CFR 270.14(b)(2) and (3)) and assess the amounts and types of hazardous waste constituents that are likely to be released from the unit. The application must include:

- Physical characteristics, materials of construction, and dimensions of the unit (40 CFR 270.23(a)(1))
- Detailed plans and engineering reports describing how the unit will be located, designed, constructed, operated, maintained, monitored, inspected, and closed to comply with the requirements of 40 CFR 264.601 and 264.602 (40 CFR 270.23(a)(2))
- For disposal units, a detailed description of the plans to comply with the post-closure requirements of 40 CFR 264.603 (40 CFR 270.23(a)(3)).

Permit applicants may describe the physical characteristics, materials of construction, and dimensions of the unit, using specifications and engineering diagrams. The design should be certified by a registered professional engineer. It is important that these diagrams and specifications include all details of any containment systems, pollution control devices, and process measurement and process control systems. The permit writer must use this information to decide whether the unit is similar to other hazardous waste management units. Table 3-1 is a guide for permit writers to use in determining which existing RCRA requirements may be applicable to all or parts of a Subpart X unit. Additional guidance on the application to Subpart X units of existing technical standards for conventional hazardous waste management units is provided in Section 6 of this manual. Whenever a given set of regulations appear to apply, the permit writer may use the corresponding permit review checklists and issue notices of deficiency (NOD), when appropriate. The applicant's response to the NODs must either (1) revise the application to achieve consistency with the requirements for another type of unit or (2) provide an adequate justification why the requirements for another type of unit should not apply to the unit in question.

Table 3-1

Guide for Applying the Design and Operating Requirements for Various Existing RCRA Units to Subpart X Units

Unit Description	Potentially Applicable RCRA Design and Operating Requirements
A portable device in which a material is stored, transported, treated, disposed of, or otherwise handled	Container requirements in 40 CFR Part 264 Subpart I and 40 CFR 270.15.
A stationary device, designed to contain an accumulation of hazardous waste that is primarily constructed on nonearthen materials that provide structural support	Tank requirements in 40 CFR Part 264 Subpart J and 40 CFR 270.15
A facility or part of a facility where wastes are placed in or on the land	Land disposal unit requirements in 40 CFR Part 264 Subparts K through N and 40 CFR 270.14(c), 270.17, 270.18, 270.20, and 270.21
Any enclosed device that uses controlled-flame combustion	Incinerator requirements in 40 CFR Part 264 Subpart O and 40 CFR 270.19 and boiler and industrial furnace requirements in 40 CFR Part 266 Subpart G and 270.22
Units that have process vents associated with distillation, fractionation, thin film-evaporation, solvent extraction, or air or steam stripping operations	Process vent requirements in 40 CFR Part 264 Subpart AA and 40 CFR 270.24
Units that contain or come into contact with hazardous wastes that have organic concentrations of at least 10 percent by weight	Air emission standards for equipment leaks in 40 CFR Part 264 Subpart BB and 40 CFR 270.25

After the permit writer has reviewed the application for all potentially applicable regulations for other hazardous waste management units, the permit writer should review any features of the unit that are not similar to those of any other types of hazardous waste management units. The review should focus on potential and expected releases at each stage of the processes to be conducted in the Subpart X unit and should incorporate information from the waste descriptions required under 40 CFR 270.14(b)(2) and (3). The permit applicant must provide estimates of the types and concentrations of hazardous waste constituents associated with each potential release. The estimates may be determined by using results of scientific studies in the literature, actual monitoring data, mathematical models, or a combination of these sources of information. Regardless of which source is used, however, the permit applicant must provide a detailed description of the operating variables of the unit. Such variables may include, but are not limited to:

- Waste feed rates
- Physical characteristics of the waste
- Chemical characteristics of the waste
- Retention times
- Process temperatures and pressures
- Reagent feed rates and concentrations
- Specifications for any pollution control devices
- Air or fluid velocities
- Description of wastes exiting the unit, including effluents, emissions, and solid wastes

The permit writer must review the information listed above and determine whether the applicant has:

- Identified all hazardous waste constituents that are likely to be released from the unit
- Provided convincing scientific evidence concerning the expected maximum concentrations of constituents likely to be released from the unit

- Identified and thoroughly discussed the effects of all operating variables of the unit on the concentrations of hazardous waste constituents likely to be released from the unit

The permit writer will make such determinations after:

- Reviewing descriptions of all wastes proposed for treatment or disposal to ensure that they are representative of the expected physical properties and concentrations of hazardous waste constituent in feeds containing more than one wastestream (for example, when wastes are blended before introduction into the unit)

- Examining process descriptions to ensure that they are representative of the predicted fate of the hazardous waste constituents that enter the unit, including the formation of new constituents that were not present in the waste feed

- Reviewing descriptions of process variables to ensure that all such variables are accounted for and controlled, to be consistent with the release levels of hazardous waste constituents projected for the unit

The waste feed descriptions are required of Subpart X permit applicants under 40 CFR 270.14(b)(2) and (3). The permit writer can evaluate these descriptions in the same manner in which such descriptions for any other permit applications are evaluated. That is, Subpart X permit applicants must provide information concerning the physical and chemical characteristics of the waste managed in the unit. The provisions for obtaining this information must be detailed in a waste analysis plan that must be submitted as part of the permit application. Guidance for permit writers in evaluating waste analysis plans is provided in the document, *Waste Analysis Plans, A Guidance Manual* (EPA, 1984).

The process descriptions may be lengthy or brief, depending on the complexity of the process and the ability of the applicant to monitor the types and levels of hazardous waste constituents being released from the unit. If the applicant demonstrates that all possible releases can be measured and the process can be shut down immediately if the release exceeds allowable levels, the applicant may not be required to provide extensive descriptions of the chemistry of the process. Applicants that cannot adequately monitor releases must provide detailed descriptions of processes and process variables. Such descriptions could include:

- Chemical equations or mass balances showing the results of chemical and physical reactions expected under the given operating conditions in the

- Results of measurements taken during bench- or pilot-scale tests, combined with calculations that estimate the increases or decreases in release rates for a given volume of waste to be expected from the operation of a full-scale unit under conditions identical to those of the bench- or pilot-scale test.

The permit writer may require the assistance of outside experts to help determine the scientific validity of the descriptions listed above. Such experts cannot make the decision whether to permit the unit; however, they can identify weaknesses in the descriptions and formulate requests for additional information from the applicant. The permit writer may identify appropriate outside experts by reviewing scientific literature related to the proposed treatment technology (for example, carbon regeneration and thermal desorption) or to the modeling or monitoring techniques proposed and contacting the authors of the appropriate literature.

After the permit writer is satisfied that the applicant has thoroughly described the expected releases and the operating conditions associated with those releases, the permit writer must ensure that the applicant has described all methods and equipment for managing the process in a manner that ensures adequate control of the unit's operations. Such controls may include, but are not limited to:

- Waste feed controls
- Process control monitoring equipment, such as pressure gauges, temperature gauges, pH probes, conductivity bridges, and flow meters
- Process control recording devices, such as strip chart recorders
- Process control safety equipment, such as alarm systems and automatic shutoff valves
- Types and frequency of inspections
- Maintenance and calibration procedures and relevant schedules for each component of the unit
- Types, methods, and frequencies of sampling
- Waste acceptance parameters
- Types and frequency of training for unit operators

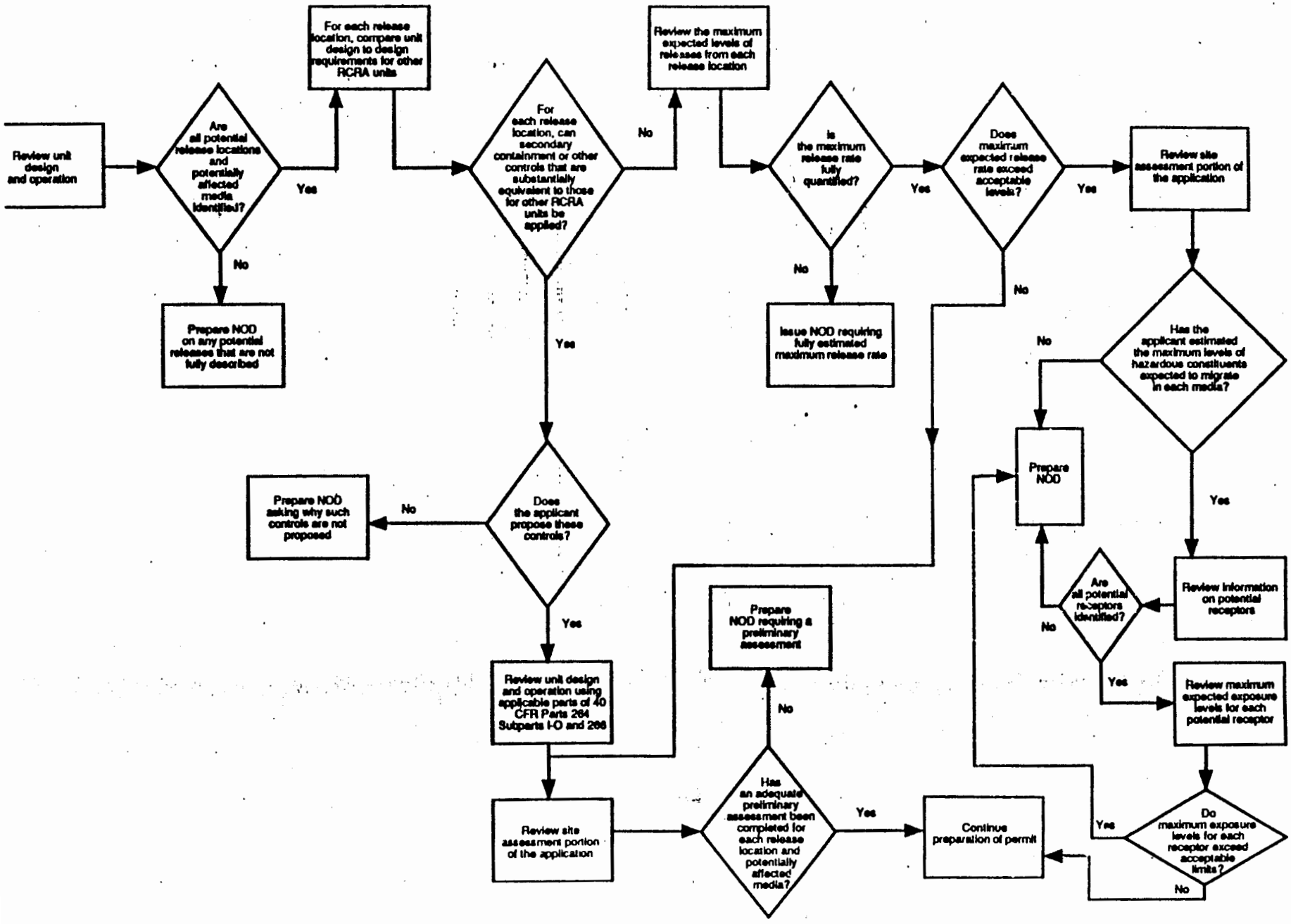
The permit applicant must demonstrate how the levels selected for each of the above controls ensure compliance with the environmental performance standards stated in 40 CFR

264.601, which requires Subpart X permit applicants to prevent releases that may have adverse effects on human health and the environment. There are three ways in which a permit applicant can demonstrate the absence of adverse effects caused by releases from a unit: (1) no releases will occur from the unit, (2) all releases will be below agreed-upon health-based and environmental levels (such levels are discussed in Section 4 of this manual), or (3) all releases will be reduced below health-based and environmental levels before they reach any potential receptors. The first two demonstrations can be accomplished by the submittal of information described in this section. The third demonstration requires that the information described in this section be combined with information described in Section 4. The permit writer should issue NODs for incomplete or missing information needed to achieve the demonstrations described above.

The permit writer also should issue NODs when the applicant has failed to adequately support estimates of the types and amounts of hazardous waste constituents that could be released from the unit. Finally, NODs should be issued when both of the following conditions are met: (1) an expected or potential release may exceed health-based and environmental levels (see Section 4 of this manual) at the point of release from the unit and (2) there is commercially available equipment or procedures that can reduce or eliminate the release.

Finally, the unit description in the permit application should specify provisions for closure of the unit. For disposal units, the application should include provisions for post-closure care. The applicant is required to submit a contingent post-closure plan for treatment units that incorporate the soil as a part of the zone of engineering control or for those units from which it may be deemed impossible to remove all contaminated residues and soils at closure (for example, an OB/OD unit where "pop-out," a condition in which materials are discharged from the unit as a result of the OB/OD operation, is a significant problem). Section 7 of this manual provides more information on requirements for closure of Subpart X units.

Figure 4-1: Overview of the Process for Review of the Site Assessment and Exposure Pathways



4.0 SITE ASSESSMENTS AND EXPOSURE PATHWAYS

Under 40 CFR 270.23(b), Subpart X permit applicants are required to submit the results of hydrologic, geologic, and meteorologic site assessments. The assessments must "... address and ensure compliance of the unit with each factor in the environmental performance standards of 40 CFR 264.601." Subpart X permit applicants also are required, under 40 CFR 270.23(c), to submit "information on the potential of exposure of human or environmental receptors to hazardous waste or hazardous constituents and on the potential magnitude and nature of such exposures." Table 4-1 presents, by media, the factors that must be addressed to demonstrate compliance with 40 CFR 264.601. Examination of the figure reveals that some of the factors for each media are directed to defining the sources of releases, while others define the potential movement of hazardous constituents in the environment and the effects of such releases on potential human and environmental receptors. In the case of an environmental assessment for a Subpart X unit, the sources of releases is the unit itself. Identification of potential releases from Subpart X units is discussed in Section 3 of this manual, which describes methods for reviewing the design and operation of Subpart X units to ensure that (1) all locations of potential releases are identified and (2) all potential releases at each location are either quantified or provided with secondary containment or other controls that are comparable to those provided for other types of hazardous waste management units. Therefore, the permit writer always must complete the Subpart X unit review described in Section 3 of this manual before beginning the review of the site assessment, because the results of the Subpart X unit review will determine the required level of detail that must be provided by permit applicants in the site assessment portion of the permit application.

Figure 4-1 presents an overview of the process of reviewing information submitted by permit applicants concerning the site assessment and exposure pathways. The figure shows that there are fewer requirements for site assessments and analyses of pathways when (1) the proposed Subpart X unit is substantially equivalent to another type of RCRA unit or (2) the maximum rate of release from the unit does not exceed acceptable levels. When either of these two conditions is met, the permit writer may choose to accept a "preliminary assessment," which is allowed under the regulations in 40 CFR 270.23(b). Permit applicants that can conduct a successful preliminary assessment are not required to submit the detailed information on pathways required under 40 CFR 270.23(c). A preliminary assessment is acceptable only when a permit applicant can demonstrate that releases from the unit are minimal, even when the most conservative assumptions possible are used, through the use of engineering judgment, information on waste feed contents, or as a result of other circumstances.

Table 4-1

Factors, by Media, That Must be Addressed in the Environmental Performance Standards of 40 CFR 264.601

Factor Number	Ground Water and Subsurface Environment	Surface Water, Wetlands, and Surface Soils	Air
1	The volume and physical and chemical characteristics of the waste in the unit, including its potential for migration through soil, liners, or other containing structures	The volume and physical and chemical characteristics of the waste in the unit	The volume and physical and chemical characteristics of the waste in the unit, including its potential for the emission and dispersal of gases, aerosols and particulates
2	The hydrologic and geologic characteristics of the unit and the surrounding area	The effectiveness and reliability of containing, confining, and collecting systems and structures in preventing migration	The effectiveness and reliability of systems and structures to reduce or prevent emissions of hazardous constituents to the air
3	The existing quality of ground water, including other sources of contamination and their cumulative impact on the ground water	The hydrologic characteristics of the unit and the surrounding area, including the topography of the land around the unit	The operating characteristics of the unit
4	The quantity and direction of ground-water flow	The patterns of precipitation in the region	The atmospheric, meteorologic, and topographic characteristics of the unit and the surrounding area
5	The proximity to and withdrawal rates of current and potential ground-water users	The quantity, quality, and direction of ground-water flow	The existing quality of the air, including other sources of contamination and their cumulative impact on the air
6	The patterns of land use in the region	The proximity of the unit to surface waters	The potential for health risks caused by human exposure to waste constituents
7	The potential for deposition or migration of waste constituents into subsurface physical structures, and into the root zone of food-chain crops and other vegetation	The current and potential uses of nearby surface waters and any water quality standards established for those surface waters	The potential for damage to domestic animals, wildlife, crops, vegetation, and physical structures caused by exposure to waste constituents
8	The potential for health risks caused by human exposure to waste constituents	The existing quality of surface waters and surface soils, including other sources of contamination and their cumulative impact on surface waters and surface soils	
9	The potential for damage to domestic animals, wildlife, crops, vegetation, and physical structures caused by exposure to waste constituents	The patterns of land use in the region	
10		The potential for health risks caused by human exposure to waste constituents	
11		The potential for damage to domestic animals, wildlife, crops, vegetation, and physical structures caused by exposure to waste constituents	

Permit applicants that can not meet the conditions for preliminary assessments described above must provide a detailed assessment, which is identified in 40 CFR 270.23(b). In addition, such applicants must submit the detailed information on exposure pathways and receptors specified in 40 CFR 270.23(c). Applicants that are required to submit detailed assessments may be able to limit their data-gathering burden by making the worst-case assumptions discussed in this guide as screening assessments, a special type of detailed assessment. Subsections 4.1, 4.2, 4.3, and 4.4 provide descriptions of the types of information and levels of detail that permit applicants must provide for preliminary and detailed assessments.

The objective of data collection for a Subpart X permit application is to demonstrate that releases from the unit in question do not pose unacceptable risks to human health or to the environment. Applicants must make such a demonstration by conducting human health and ecological risk assessments. For example, if a unit is in an area with a high population density, and a permit applicant proposes a Subpart X unit that will use thermal treatment of wastes containing volatile organic compounds (VOC), the permit writer should require the applicant to demonstrate that emissions of VOC do not pose an unacceptable risk to nearby residents. Procedures for permit writers to evaluate risk assessments conducted by permit applicants are contained in Subsection 4.5 of this manual.

4.1 GENERAL INFORMATION ON ENVIRONMENTAL ASSESSMENTS

This subsection provides general information on the two basic types of environmental assessments: preliminary assessments and detailed assessments. Subsection 4.2.1 also discusses screening assessments, a special type of detailed assessment.

4.1.1 Preliminary Assessments

Permit applicants may avoid conducting detailed assessments for one or more media if they can demonstrate through a preliminary assessment that releases to such media will not adversely affect human health and the environment. Preliminary assessments may be done separately for each medium; permit applicants may perform them for one medium only (for example, a preliminary ground-water and subsurface assessment) or for a number of media. Permit writers should evaluate the adequacy of preliminary assessments, using information submitted as part of the Subpart X unit characterization, waste characterization, and information on likely releases from the unit in question (see Section 3 of this manual for a discussion of these

Table 4-2

Types and Sources of Information by Media to be Included in Preliminary Assessments

MEDIA	INFORMATION TYPES	INFORMATION SOURCES
GROUND WATER AND SUBSURFACE ENVIRONMENT	• Information on regional geologic strata • Depth to and yield of aquifers • Location and use of regional aquifers • Location of nearest drinking-water wells	• U.S. Geological Survey • U.S. Soil Conservation Service • Local well drilling logs
SURFACE WATER, WETLANDS, AND SOIL SURFACE	• Distance to nearest wetlands • Regional soil types and distribution • Distance to nearest surface-water body • Use and location of nearest surface water • Intensity of storm events	• U.S. Geological Survey • U.S. Soil Conservation Service • U.S Department of Agriculture Soil Stabilization Service • State and local water-use boards • National Climatic Data Center
AIR	• Wind rose information • Temperature means • Humidity means • Annual precipitation data • Population data	• National Climatic Data Center • National Weather Service offices • Census bureau

factors). If the information indicates that releases from a unit will be above acceptable levels, the permit writer should require, through a NOD, that a detailed assessment be performed.

Preliminary assessments should be prepared on a media-specific basis according to the three types of media (ground water and subsurface environment; surface water, wetlands, and surface soils; and air) identified in the environmental performance standards under 40 CFR 264.601. Preliminary assessments are appropriate from applicants that can successfully demonstrate that (1) no actual or potential releases are expected from the unit or (2) any actual or potential releases are predictable (in terms of quantity, composition, and concentration), controllable, and below acceptable levels. Before accepting a preliminary assessment, the permit writer should be certain, judging by information submitted by the permit applicant on the unit and the quantities of hazardous waste constituents in the unit, that releases from the unit of hazardous waste constituents at levels above health-based or environmental levels will not occur, even when the most conservative assumptions possible are applied.

In most cases, permit applicants must provide the permit writer with descriptions of regional geology, hydrology, and meteorology as part of a preliminary assessment. The types and sources of information needed for such descriptions are summarized in Table 4-2. If the permit writer is not satisfied with the information submitted as part of a preliminary assessment, a NOD should be issued that requires either additional information or the conduct of a detailed assessment.

Figure 4-2 provides guidance for permit writers in evaluating preliminary assessments. If, for a given medium, the answer to any of the questions on the checklist in Figure 4-2 is no, the permit writer should require the applicant to conduct a detailed assessment for that medium.

Figure 4-2

Checklist for Preliminary Assessments

1. Is the facility proposing to use environmental controls (for example, secondary containment or air pollution control equipment) for the unit?

2. Has the facility provided adequate information on the quantities of wastes and concentrations of hazardous waste constituents in the wastes entering the unit?

3. Has the facility provided adequate information on the process conducted in the unit, including reaction rates, temperatures, pressures, and residence times?

4. Has the facility provided adequate justification (for example, sound engineering judgment or monitoring results) to substantiate its claims that hazardous waste constituents will not be released from the unit?

5. Have no releases of hazardous waste constituents at levels above health-based standards to environmental media from the unit been documented?

6. Is there no evidence of complaints by neighbors to the facility concerning potential releases from the facility?

7. Has the facility provided adequate information on regional meteorology, topography, geology, and hydrology (see Table 4-2)?

If, for a given medium, the answer to each of the above questions is yes, that medium should be considered a candidate for a preliminary assessment.

4.1.2 Detailed Assessments

Permit applicants that cannot demonstrate through a preliminary assessment that a given unit meets the environmental performance standard for one or more media must conduct a detailed assessment for such media. Such a detailed assessment will require the use of information on the wastes managed in the units and a detailed description of the unit. Procedures for evaluating the waste descriptions and unit descriptions submitted by permit applicants are discussed in Section 3. As part of a detailed assessment, a permit applicant also must provide estimates of releases of hazardous constituents from the unit at potential receptor locations in the three environmental media and detailed information on the hydrology, geology, and meteorology of the vicinity of the facility where the unit is located. Sources of this information are discussed

in the remainder of this section for the three environmental media that must be evaluated by permit applicants -- that is, air; ground water and the subsurface environment; and surface water, wetlands, and surface soils.

Detailed assessments generally will be submitted by permit applicants in one of two forms: (1) as a worst-case constituent release, fate and transport, and exposure scenario to demonstrate compliance with the environmental performance standards even under unrealistically severe conditions or (2) as estimates of actual constituent releases and of fate and transport mechanisms likely to occur at the site to demonstrate that the unit will meet the environmental performance standards.

For this guidance manual, detailed assessments that use worst-case scenarios are referred to as screening assessments, because they can be used by permit applicants to avoid the need for a detailed assessment that use estimates of actual constituent releases by demonstrating that releases from the unit will be at levels below health-based and environmental levels at locations of potential receptors, even when worst-case release and dispersion assumptions are used. The permit writer should examine information obtained from the applicant's Subpart X unit characterization and waste characterization; the permit writer should be able to verify "worst-case" releases from such information. Once worst-case releases from the unit have been quantified, the applicant then must make a convincing demonstration that the releases do not exceed acceptable levels at locations of potential receptors. If the applicant cannot furnish such information to the satisfaction of the permit writer, a NOD should be issued that requires (1) that the applicant provide additional information to support a worst-case scenario or (2) that the applicant conduct a detailed assessment that uses estimates of actual releases from the unit and fate and transport variables for the facility.

Permit writers evaluating detailed assessments that use assumed or expected values usually must evaluate the values to determine their validity. Completion of the evaluation usually will require the permit writer to (1) consult with experts within EPA or the authorized state agency or (2) refer to existing guidances on the subject. If, after taking such steps, the permit writer cannot fully evaluate the techniques and assumptions used by the applicant, a NOD or permit denial should be issued. Detailed information for evaluating such assessments for each medium are presented in subsections 4.2, 4.3, and 4.4 of this section. These subsections also provide guidance on evaluating detailed assessments for each of the three environmental media that must be evaluated as part of a detailed assessment (that is, air; ground water and subsurface environment

and surface water, wetlands, and surface soils) and specify, for each medium, (1) minimum information requirements for permit applicants, (2) guidance on evaluating monitoring and modeling procedures proposed by permit applicants, and (3) sources of additional detailed guidance.

4.1.3 General Considerations for Evaluating Environmental Assessments

This subsection provides guidance on (1) determining when monitoring or modeling should be used by permit applicants and (2) evaluating the adequacy of a permit applicant's quality assurance and quality control procedures.

4.1.3.1 Use of Monitoring and Modeling By Permit Applicants

To evaluate the concentrations of hazardous waste constituents at receptor locations, detailed assessments generally will involve techniques for the quantification of releases, including (1) monitoring of actual concentrations in various environmental media and (2) modeling techniques. Monitoring includes field measurement techniques designed to quantify releases from Subpart X units as ground-water monitoring wells and continuous emissions monitors for air emissions. Modeling includes techniques to estimate difficult-to-measure releases from a Subpart X unit, using measurable parameters that affect rates of release to a given medium. These measurable parameters serve as inputs for the model designed to simulate environmental or unit-specific characteristics. A variety of models are available for all environmental media; however, many models are designed for a specific purpose within a given medium, and the models vary widely in degree of accuracy. Therefore, the permit writer must ensure that the model chosen by the applicant is reviewed by an expert.

The decision whether to require monitoring or modeling for a detailed assessment is based on several factors. When reviewing a detailed assessment, the permit writer likely will have to evaluate an applicant's (1) monitoring system for characterizing releases, (2) results of modeling, or (3) a combination of monitoring and modeling. Although the decision whether to allow the use of one option or the other has been the subject of controversy, the permit writer generally should consider the following factors when determining which approach to require of a permit applicant

- If monitoring is technically impracticable, modeling is preferable to monitoring. For example, permit applicants historically have had difficulty in capturing the entire plume from OB/OD units through the exclusive use of air monitoring, because of the unconfined nature of air releases from such units.

- Permit applicants that propose the exclusive use of monitoring often should be required to conduct modeling to verify that the monitoring locations selected are capturing the full extent of releases from the unit.

- Permit applicants that propose the exclusive use of modeling may be required to conduct confirmatory monitoring to verify the results of air modeling.

4.1.3.2 Quality Assurance and Quality Control

Permit writers must ensure that permit applicants have demonstrated quality assurance and quality control procedures that are adequate to ensure that data and information submitted by permit applicants as part of detailed assessments is credible. These procedures should be spelled out specifically by a permit applicant in a quality assurance project plan (QAPjP). Guidance on evaluating QAPjPs can be found in the document, *Preparation Aids for the Development of Category II Quality Assurance Project Plans*, (EPA, 1991). Guidance on EPA-approved quality assurance and quality control procedures is also available in Chapter 1 of SW-846. A draft Chapter 11 for SW-846 also provides specific quality assurance and quality control procedures for saturated and unsaturated zone monitoring. A copy of the draft Chapter 11 is provided as Appendix H to this guidance manual.

When reviewing QA/QC procedures submitted by permit applicants for detailed assessments, permit writers should evaluate the procedures for the following factors:

- Representativeness
- Accuracy
- Precision

Data should be representative of conditions at the unit and at the facility. To be considered representative, information submitted by permit applicants should account for variations over time and over areas near the unit. For example, a model that estimates concentrations of hazardous constituents at a downwind receptor over a period of one year

generally will be considered superior to an equivalent model that estimates concentrations over a period of a month, because inclusion of the longer period of time will account for seasonal variations. Similarly, a monitoring plan that includes monitoring locations in all directions from a Subpart X unit generally will be preferable to one that addresses only emissions from the predominately downwind direction.

The permit writer also should evaluate data submitted by an applicant for its accuracy. Accuracy is a measure of the difference between a value obtained as a result of measurement (or modeling) and an actual value. In many cases, the accuracy of models can be represented as the difference between results obtained from modeling (the predicted value) and monitoring for bench-, pilot-, or full-scale operation. If the permit writer determines that the data are not accurate, the permit writer either must request additional information through a NOD or must issue a permit denial.

The permit writer also should consider the precision of techniques used by permit applicants during evaluations of Subpart X permit applications. Precision is a measure of the reproducibility of results from the execution of one or more identical procedures. Precision can be evaluated if similar conditions are used for a modeling or monitoring scenario. For example, if two pilot-scale test burns for an open burning unit are conducted using the same quantity of the same waste under nearly identical conditions, similar results should be obtained. Permit writers should request additional information (through NODs) or issue a permit denial if an applicant cannot demonstrate precision in his or her assessment approach.

4.2 DETAILED AIR ASSESSMENTS

The purposes of a detailed air assessment are to define:

- The atmospheric, meteorologic, topographic, and existing air quality characteristics in the area surrounding the unit
- Potential receptors of releases from the unit
- The expected emission and dispersion rates of any releases from the unit
- The exposure to human and environmental receptors of releases from the unit and the risk to receptors from such releases (discussed in Subsection 4.5 of this manual)

Definition of the atmospheric, meteorologic, topographic, and existing air quality characteristics in the area surrounding the unit is essential to supply a frame of reference for any monitoring results obtained by the permit applicant or to identify input variables for emission and dispersion modeling. Subsection 4.2.1 provides examples of the types and amounts of data needed to properly define these important characteristics.

The expected emissions and dispersion rates of any releases from a Subpart X unit can be defined through modeling, monitoring, or a combination of the two approaches. Subsections 4.2.2 and 4.2.3 provide permit writers with information for evaluating modeling and monitoring strategies presented by permit applicants to define emissions and dispersion of hazardous waste constituents from Subpart X units.

When evaluating detailed air assessments, permit writers should consult with experts in the evaluation of air assessments. Such experts may include air modelers in EPA Regional offices and state environmental protection agencies and personnel in the Office of Air Quality Planning and Standards in Research Triangle Park, North Carolina. Permit writers also can refer to Appendix C to this guidance manual, which provides two example air assessment reviews of Subpart X permit applications for OB/OD units, for information to aid in the review of detailed air assessments.

4.2.1 Required Information for Detailed Air Assessments

When a permit applicant submits a detailed air assessment, the applicant must obtain information on (1) atmospheric, meteorologic, and topographic characteristics of the area surrounding the unit, (2) information on existing air quality, and (3) information on potential human and environmental receptors. The following guidance provides examples of the information permit applicants should furnish and sources of information that permit applicants should consult to obtain such information.

4.2.1.1 Atmospheric, Meteorologic, and Topographic Information

Permit applicants should provide information on meteorologic conditions that affect atmospheric dispersion of hazardous constituents from Subpart X units. These conditions include wind, temperature, and atmospheric stability indicators. Specific parameters include, but are not limited to, the following:

- Wind (direction and speed) roses
- Mean wind speeds
- Atmospheric stability distributions
- Temperature means and extremes
- Precipitation means
- Humidity means
- Data on atmospheric pressure

The parameters required and the required level of detail of information for those parameters will vary, depending upon the applicant's specific circumstances. Permit writers should consult with experts in meteorology to determine these requirements. Such experts include personnel in the Regional and state air pollution control offices and the Office of Air Quality Planning and Standards in Research Triangle Park, North Carolina.

The primary source of climatic information for the United States is the National Climatic Data Center (NCDC) in Asheville, North Carolina. The NCDC can provide climate summaries for National Weather Service stations in the vicinity of the applicant's facility. Standard NCDC references for climatic information include:

- National Climatic Data Center, annual. Local Climatological Data - Annual Summaries with Comparative Data, Asheville, North Carolina.
- National Climatic Data Center, 1973. Climates of the States, Asheville, North Carolina.
- National Climatic Data Center, 1968. Weather Atlas of the United States, Asheville, North Carolina.

Other sources of data from which permit writers may expect applicants to obtain meteorological information include Federal Aviation Administration stations, Air Force bases, nuclear power facilities, and some industrial facilities.

If a permit applicant's initial submission of data on meteorological conditions at the facility is deficient, the permit writer may require that the applicant conduct a meteorological monitoring survey to establish local wind flow patterns and other meteorological data. The results

of the survey can be used to determine local prevailing winds and unusual wind patterns. For example, certain areas near mountains may experience upslope winds during the day and downslope winds at night. Permit writers should require that such surveys be conducted for a period of at least one month (or a period of as much as one year if significant seasonal variations may occur at the facility) to adequately characterize wind patterns. The results of a meteorological survey also can be used to establish the location of monitoring stations to measure ambient air conditions.

Permit applicants also should demonstrate to the permit writers' satisfaction that the location of meteorological equipment will generate data that is representative of meteorological conditions at the site. Permit writers also may require the use of additional meteorological stations at sites having complex terrain, at sites located in coastal areas, or at sites where meteorological conditions may vary significantly near the facility or over short periods of time (for example, differences in conditions during the day and at night). Additional guidance on meteorological monitoring is provided in Table 4-3.

Information on the topography surrounding the facility also should be provided by the permit applicant. Such information should be sufficient to demonstrate to the permit writer the effects that local terrain, such as valleys and mountains, will have on ground-level and other concentrations of hazardous constituents that may adversely affect human or environmental receptors. Permit applicants should provide topographic maps for the immediate area surrounding the facility and all adjacent areas that may be affected by emissions from the Subpart X unit.

4.2.1.2 Existing Air Quality Data

Permit applicants must provide the permit writer with data on existing air quality in the area around the Subpart X unit, as required in 40 CFR 264.601(c)(5). To the extent possible, the submittal should include all available information on concentrations of hazardous constituents in the air for the vicinity of the Subpart X unit. Permit applicants should be required by permit writers to check Regional, state and local air pollution control offices for data on existing air quality data, including data required to be collected under the Clean Air Act. Permit writers also should require applicants to obtain and submit information concerning existing air quality that is available in site-specific investigative documents, including, but not limited to, environmental impact statements, environmental assessments, remedial investigations/feasibility studies (RI/FS), records of decision (ROD), site investigations, RFAs, and RFIs.

Table 4-3

Additional Guidance on Meteorological Monitoring

Permit writers can find additional guidance on evaluating meteorological monitoring programs in the following:

EPA, 1987. On-Site Meteorological Program Guidance for Regulatory Modeling Applications (EPA-450/4-87-013). Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina (June).

EPA, 1983. Quality Assurance Handbook for Air Pollution Measurements Systems: Volume IV, Meteorological Measurements (EPA-600/4-82-060) Office of Research and Development, Research Triangle Park, North Carolina (February).

EPA, 1986. Guidelines on Air Quality Models (Revised) (EPA-405/2-78-027R). Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina (July).

Additional information concerning meteorological instruments and stations, including performance specifications, station locations, sensor exposure criteria, and field methods for meteorological monitoring, are provided in the following:

EPA, 1980. Ambient Monitoring Guidelines of Preventions of Significant Deterioration (EPA-450/4-80/012R). Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina (November).

EPA, 1983. Quality Assurance Handbook for Air Pollution Measurements Systems: Volume IV, Meteorological Measurement (EPA 600/4-82-060). Office of Research and Development, Research Triangle Park, North Carolina (February).

EPA, 1986. Guidelines on Air Quality Models (Revised) (EPA 405/2-78-027R). Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina (July).

EPA, 1987. On-Site Meteorological Program Guidance for Regulatory Modeling Applications (EPA-450/8-87-013). Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina (July).

4.2.1.3 Information on Potential Receptors for Air Releases

Permit applicants should provide permit writers with information on potential human and environmental receptors of air releases. Although receptors will vary for each site, certain receptors likely will be applicable to every facility; some likely receptors are discussed below. Information submitted concerning receptors should indicate not only potential targets of direct releases of air, but also potential receptors of indirect exposure from releases to soil and surface water. For example, animals on the ground may be affected by particulate releases that result in deposition of hazardous constituents on the soil surface.

Permit writers always should receive information on population near the facility as part of the detailed assessment. When providing information on potentially exposed persons, permit applicants also should discuss potential on-site exposure (that is, worker exposure) and off-site exposure. Population information, which is usually available from the Bureau of the Census (U.S. Department of Commerce), should provide the permit writer with an estimate of the population within a given radius of the facility, within which people could be affected by releases to air from the facility. Although the minimum acceptable distance of the radius will vary, permit writers can evaluate submissions by permit applicants for factors such as: types and concentrations of hazardous waste constituents released (or potentially released) from the facility; meteorological patterns in the area; and the phase of the release (that is, vapor or particulate emissions). The permit applicant also should provide information on the nearest potential human receptor; this person is commonly referred to as the maximum exposed individual (MEI).

Permit applicants must provide permit writers with information on potential ecological receptors. Such receptors should include, at a minimum, birds and insects within an area likely to be affected by the release. Permit applicants also must provide a summary of all the trees and other plants in the area that could be affected by operation of the Subpart X unit. Finally, permit writers should receive information on the locations of and distances from the unit to sensitive environments and endangered species.

4.2.2 Evaluation of Approaches to Air Modeling

This subsection provides the permit writer with information on evaluating the appropriateness of models proposed for use by Subpart X permit applicants. It provides the

permit writer with (1) background information on models, (2) criteria for evaluating air modeling approaches, and (3) information on recommended air quality models.

4.2.2.1 Background Information on Air Modeling

Once the permit writer has obtained all the necessary information needed to evaluate a permit applicant's proposed modeling approach, the permit writer must determine if justification for the use of a model and data extracted from the model is both credible and applicable to the circumstances at the applicant's facility. Although making this evaluation often will require the help of air modeling experts, the permit writer can do some initial evaluation of air modeling approaches to eliminate certain submissions without performing an extensive evaluation.

In general, two types of models are used to predict concentrations of hazardous constituents in the vicinity of a Subpart X unit. They are air emissions estimation models and atmospheric dispersion models. Air emissions estimation models generally are used to predict emissions rates (that is, a release rate in terms of mass per unit time), using assumptions concerning the waste management unit. Air emissions estimation models generally are used only when they can be supplemented by atmospheric dispersion modeling. Emissions models used by Subpart X permit applicants should be based on verifiable, reasonable worst-case emissions factors.

Atmospheric dispersion models are used to estimate concentrations of hazardous waste constituents at receptor locations, using input data concerning emissions rates from a Subpart X unit, meteorological information, and topographic information. These models generally are used to estimate concentrations of hazardous waste constituents at various receptor locations, to assist in designing an air monitoring program, or to interpret or extrapolate air monitoring results. Dispersion modeling also can be used to identify conditions that are representative of a reasonable worst-case scenario by permit applicants attempting to demonstrate compliance with requirements for air assessments.

Models used by Subpart X permit applicants also will provide one of two levels of detail screening models or refined models. Screening models use conservative assumptions or input data to develop conservative estimates of emissions from Subpart X units. The purpose of such models is to eliminate the need for more detailed models when it can be shown clearly that emissions from a proposed Subpart X unit will not violate the environmental performance standard for

releases to air. The second level of sophistication includes those models referred to as refined models. Refined models are those that use more sophisticated techniques and require more detailed and precise input data. Such models typically will provide a more accurate estimate of emissions from a Subpart X unit.

Whatever type of model is selected, the permit writer should ensure that the model is relevant to the source (the Subpart X unit) and the conditions at the site. The model selected by the applicant should (1) account for all mechanisms of air emissions, (2) adequately describe the source, (3) account for variations over time and over areas near the source, and (4) account for variations in the operation of the source. If the model does not meet these requirements, a NOD requiring the use of other methods (or models) should be issued, or the permit should be denied.

Air emissions from Subpart X units may consist of vapor phase emissions or particulate emissions. Vapor phase emissions primarily consist of volatile and semivolatile organic compounds but also may include certain metal fumes (for example, from mercury) and may result from the following processes:

- Volatilization
- Biodegradation
- Photodecomposition
- Hydrolysis
- Combustion
- Detonation

Particulate emissions may be generated from wind erosion, mechanical disturbances, and combustion. Particulate matter may be generated as hazardous waste or hazardous constituents, or constituents may be adsorbed onto particulate matter itself. Hazardous constituents of concern with regard to particulate emissions primarily include metals, but may also include various volatile and non-volatile organics.

Permit writers should verify that models selected by applicants are appropriate for the type of source the Subpart X unit represents. Categories of sources of air emissions include point, line, area, and volume sources. Point sources include vents and stacks, while area sources are

more likely to include such disposal units as geologic repositories. Line sources typically are not applicable to Subpart X units, but include sources that are long in relation to their width, such as ditches. Table 4-4 provides examples of dispersion model input requirements for various categories of sources.

When submitting information to permit writers on a proposed modeling approach, permit applicants should have considered possible variations in conditions regarding a Subpart X unit. Such variations include those possible in meteorological conditions, changes in waste composition, and changes in the operating conditions for the unit. For example, the permit applicant must have used inputs to simulate meteorological conditions throughout the course of the year; that is, the applicant must have addressed changes in meteorological conditions associated with the change in seasons. Owners or operators also must use input data in models that represent all wastestreams that will be managed in the Subpart X unit. Finally, permit applicants should have provided the results of modeling for the full range of proposed operating conditions for the unit.

4.2.2.2 Criteria for Evaluating Approaches to Air Modeling

Permit writers should apply several criteria when evaluating the use of a model in a particular situation. These criteria include:

- The meteorological and topographic complexities of the area
- The level of detail and accuracy needed for the analysis
- The technical competence of the applicant with respect to conducting the modeling
- The detail and accuracy of the data base supporting the model being used (for example, emissions inventory, meteorological data, and air quality data)
- The location of the property boundary of the facility
- Dispersion coefficients
- Stability categories
- Plume rise
- The degree of chemical transformation of hazardous constituents
- The extent of gravitational settling and deposition

Table 4-4

Examples of Input Requirements for Various Source Categories for Air Dispersion Models

Input Parameter	Source Category			
	Point	Line	Area	Volume
Source location	Coordinates of the point	Coordinates of the center of the Line	Coordinates of the southwest corner of the area approximated by a square	Coordinates of the center of the source
Source dimension	--	Length Width Height	Width of the square area source	Height of the volume source, width
Source emissions rate for each constituent under consideration	Mass per unit time		Mass per unit time per unit area	Mass per unit time
Adjacent obstructions	Height Width Length	--	--	--
Particle mass-size distribution and deposition velocity	--	Initial horizontal and vertical dimensions		

- Urban or rural classification of the facility
- Assumptions used to develop input data
- Constituents that are modeled
- Quality of data used and its applicability to the situation

EPA has developed several guidance manuals to assist Subpart X permit writers in evaluating air modeling approaches proposed by Subpart X permit applicants. These guidance documents include:

EPA, 1986. Guideline on Air Quality Models and Supplement A (Revised) (EPA 450/12-78-027R). Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina (July).

EPA, 1988. Procedures for Conducting Air Quality Pathway Analyses for Superfund Applications (Draft). Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina (December).

4.2.2.3 Recommended Air Quality Models

This subsection presents information on models that have been developed by EPA and have been found suitable for various applications in EPA's air programs. The models were evaluated by category, using statistical measures of model performance in comparison with measured air quality data, as suggested by the American Meteorological Society and scientific peer reviews. The permit writer should note that this discussion focuses on models that have been reviewed by EPA and that it should not be construed to exclude the use of other models that currently exist or that will be developed in the future. Table 4-5 shows refined dispersion models that, based on such review, have been found to perform better than other models in their respective categories. Table 4-6 depicts preferred screening models.

In general, the preferred models in Tables 4-5 and 4-6 should be used by permit applicants, unless an applicant can demonstrate that an alternative model is equivalent to them. Permit writers should consider a model equivalent to preferred models if it meets one of the following criteria:

- The proposed alternative model produces estimates of concentrations equivalent to the estimates obtained by using the preferred model.

Table 4-5

Examples of Preferred Refined Dispersion Models

Features	CDM[1]	ISC[2]	MPTER[3]	CRSTER[4]	INPUFF[5]
1. Source Configuration:					
Point	X	X	X	X	X
Area	X	X			
2. Land Use:					
Rural		X	X	X	X
Urban	X	X	X	X	X
3. Release Mode:					
Continuous	X	X	X	X	X
Instantaneous					X
4. Physical State of Contaminant					
Gas	X	X	X	X	X
Particulate	X	X	X	X	X
5. Building Wake Effect		X			
6. Stack Tip Downwash	X	X	X	X	X
7. Number of Sources:					
Single	X			X	
Multiple	X	X	X		X
8. Concentration Averaging Time	More than one month, to one year or longer.	1,3,8, and 24 hours and annual	1 hour to 1 year	1,3, and 24 hours and annual	
9. Comments	A climatological plume model for determining long-term pollutant contaminants at any ground-level urban receptor	A steady-state plume model that can be used to assess pollutants from a variety of industrial sources	A dispersion model for estimating air quality concentrations of nonreactive pollutants from multiple point sources	A dispersion model for estimating air quality concentrations of nonreactive pollutants for point sources at a single location in rural or urban areas	A dispersion model for estimating concentrations of air pollutants from a single or multiple semi-instantaneous or multiple point sources

1 Climatological Dispersion Model
2 Industrial Source Complex Model
3 Multiple Point Gaussian Dispersion Algorithm with Terrain Adjustment Model
4 Single Source Model
5 Integrated Puff Model

Table 4-6

Examples of Preferred Screening Dispersion Models

Features	DEGADIS[1]	HEGADAS[2]	SLAB	AFTOX[3]	T-SCREEN
1. Source Configuration:					
Point				X	X
Area	X	X		X	
2. Land Use:					
Rural	X	X	X	X	X
Urban	X	X		X	
3. Release Mode:					
Continuous	X	X	X	X	X
Instantaneous	X	X		X	
4. Physical State of Contaminant:					
Gas	X	X	X	X	X
Particulate				X	X
Liquid					
5. Building Wake Effect					
6. Stack Tip Downwash		X	X	X	X
7. Number of Sources:					
Single		X	X	X	X
Multiple					
8. Concentration Averaging Time:	One hour or less than 1 year	Less than 1 hour	1 hour or less	1 minute to 1 hour	Case-by-case basis
9. Comments		A dispersion model for the transport of toxic chemical releases into the atmosphere, regardless of buoyancy	A dispersion model used for ground level and transient releases of dense toxic gas formed from area sources	An interactive puff model to compute concentrations of liquid or gas	A dispersion model to estimate impairment of visibility for lines of sight

1 Dense Gas Dispersion Model
2 Heavy Gas Dispersion Model
3 Air Force Toxic Chemical Dispersion Model

- The applicant has conducted a statistical evaluation of performance for the proposed alternative model and has demonstrated that the model preforms as well or better than a preferred model.

- There is no preferred model for a particular application, and the proposed model must be used to satisfy regulatory requirements under another federal statute or under a state or local statute.

Permit writers also may obtain information concerning air quality models through EPA's Model Clearinghouse. The clearinghouse provides information on a variety of air quality models proposed for use in various regulatory applications. Permit writers can access the clearinghouse through a PC computer hookup (phone (919) 541-5742) to the Support Center for Regulatory Air Models, Bulletin Board System (SCRAM BBS). The purpose of the clearinghouse is to:

- Provide an overview of decisions by EPA Regional offices with respect to the use of modeling techniques and data bases

- Summarize the results of visits to EPA Regional offices designed to gather information pertinent to the use of air quality models

- Develop information to aid in the preparation of an annual report summarizing clearinghouse activities, including specific determinations regarding the use of air quality models made during the course of the year

4.2.3 Evaluation of Air Monitoring Programs

This subsection provides the Subpart X permit writer with (1) background information on approaches to air monitoring, (2) criteria for evaluating air monitoring plans submitted by Subpart X permit applicants, and (3) sources of additional guidance for evaluating air monitoring programs.

4.2.3.1 Background Information on Air Monitoring

Permit applicants generally will use one of two types of air monitoring: source emissions monitoring and air monitoring networks. Source emissions monitoring is used to measure emissions at the source -- that is, the Subpart X unit -- with the results typically being entered into a mathematical dispersion model for estimation of downwind concentrations. This approach generally works best for point sources (for example, stacks) and may not work well for area sources because of the difficulty of measuring emissions over the full area of the source.

Permit applicants also may use an air monitoring network to quantify emissions from a Subpart X unit. Such networks typically use upwind-downwind air monitoring systems. In such systems, a series of air monitors are constructed in the predominant upwind direction from the source and used to determine background concentrations of hazardous waste constituents. The results from the upwind monitors then can be compared with the results from a series of downwind monitors. The difference in levels of concentrations of hazardous waste constituents in the air between the two sets of monitors then can be attributed to the Subpart X unit.

A third potential type of air monitoring approach that may be proposed to permit writers by permit applicants is the use of monitoring data from laboratory tests. If an applicant proposes to use air monitoring data from laboratory studies, the applicant must justify the use of the data by demonstrating that the data can produce results equivalent to those produced by a full-scale monitoring program.

In addition to different types of air monitoring programs, permit writers also usually will be required to review two different levels of detail for air monitoring programs: screening sampling and detailed air monitoring. Screening sampling typically is used to determine the extent of full-scale air monitoring required, including source emissions monitoring and air monitoring networks. Screening sampling may be conducted either to verify the existence of releases to the air or to supplement modeling conducted at the facility.

Detailed air monitoring is performed by permit applicants if the results of screening sampling are insufficient to characterize releases from a Subpart X unit. If a permit writer feels that the results of screening sampling, in conjunction with air modeling, do not provide sufficient information to demonstrate compliance with the air assessment requirements for Subpart X units, the permit writer should (1) issue a NOD requiring detailed air monitoring or (2) deny the permit.

4.2.3.2 Evaluation Criteria for Air Monitoring Programs

Permit writers should require applicants to fulfill certain minimum information requirements in their applications so that the permit writer thoroughly evaluate the applicant's proposed monitoring program. The information required includes, but is not limited to, information on:

- Physical and chemical characteristics of constituents to be detected

- Detection limits for the air monitoring equipment and associated analytical equipment
- Sampling frequency
- Duration of the air monitoring program

The permit applicant should provide information on the physical and chemical characteristics of the constituents to be detected. The permit writer should require that the constituents to be detected be specified clearly because the detection of organic constituents usually will require different sampling and analytical methods from the detection of inorganic constituents. The phase of the emissions to be detected (that is, vapor phase or particulate phase) also will affect the selection of equipment that will be effective in detecting such constituents.

Permit applicants also should provide the permit writer with information on detection limits for monitoring equipment. The limits should be at levels at least as low as health-based levels used in the air assessment by the owner or operator of the Subpart X unit. Finally, permit applicants should provide permit writers with information on sampling frequencies and duration of air monitoring programs to allow the permit writer to determine whether the monitoring program will provide enough data to adequately characterize emissions from the Subpart X unit.

4.2.3.3 Guidance on Evaluating Emissions Monitoring

Depending upon the type of unit involved, permit writers will evaluate two types of emissions monitoring: point source emissions monitoring and area source emissions monitoring. Point source emissions monitoring may be used by permit applicants to monitor emissions from such point sources as vents and stacks. Permit applicants may use area source emissions monitoring for sources at which fugitive emissions may be a problem. Whatever approach to source emissions monitoring is used, permit writers should ensure that results from emissions monitoring are representative of reasonable worst-case emissions, as indicated by information on the facility's waste characterization, waste feeds to the unit, and treatment or disposal process.

Although in many cases source emissions monitoring is an acceptable means to measure emissions from a Subpart X unit, permit writers should be aware of its limitations. Source emissions monitoring is not in itself sufficient for a detailed assessment of releases to the air; permit applicants must either (1) use such data as inputs for dispersion modeling, or (2) collect

additional data (for example, through the use of an upwind-downwind monitoring network). In addition, because most source emissions monitoring techniques rely on capturing emissions near the source (that is, the Subpart X unit), emissions monitoring should not be used when emissions from the unit cannot be isolated for sampling and analysis (for example, for OB/OD units). Additional sources of guidance for evaluating emissions monitoring are provided in Table 4-7.

4.2.3.4 Guidance on Evaluating Air Monitoring Networks

Permit applicants typically will submit proposals for air monitoring networks in the form of an upwind-downwind monitoring system. Permit writers should require applicants to provide the following when submitting information concerning air monitoring networks:

- Location of air monitors
- Height above ground of sampling points
- Duration of monitoring program
- Sampling frequency
- Detection limits of monitoring equipment
- Physical and chemical characteristics of constituents to be detected

Permit writers should request that Subpart X permit applicants identify the locations of all sampling points in the proposed air monitoring design. The applicant should provide justifications for each location, including information that clearly demonstrates that monitors are both upwind and downwind of the Subpart X unit. One common approach incorporates the use of monitors in four locations: upwind of the unit, downwind at the boundary of the unit, downwind at the facility boundary, and downwind at a location outside the facility boundary. Permit writers should require additional monitoring locations for facilities located in complex terrain (for example, near large mountains) and coastal facilities that have pronounced secondary air flow patterns. An example of a situation in which additional air monitoring locations may be required is that of a facility where primary wind directions differ during the day and at night.

Permit writers also should require applicants to specify the height of air monitoring locations. The height above the ground of sampling points is important to determine their relevance to potentially affected receptors. Typically, the inlet exposure height of air monitors

Table 4-7

Sources of Additional Guidance on Emissions Monitoring

Guidance on point source emissions monitoring is provided in the following documents:

U.S. Environmental Protection Agency (EPA), 1986. Measurement of Gaseous Emission Rates from Land Surfaces Using an Emission Isolation Flux Chamber: User's Guide (EPA/600/8-86/008). Environmental Monitoring Systems Laboratory, Las Vegas, Nevada.

EPA, 1988. Procedures for Conducting Air Pathway Analyses for Superfund Applications (Draft). Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina (December).

Guidance on area source emissions monitoring is provided in the following documents:

EPA, 1985. Practical Guide - Trial Burns for Hazardous Waste Incinerators. Office of Research and Development, Cincinnati, Ohio (November).

EPA, 1992. Volume 40 of the Code of Federal Regulations, Part 60, Appendix A: Reference Methods. Office of the Federal Register, Washington, D.C.

EPA, 1978. Stack Sampling Technical Information, A Collection of Monographs and Papers, Volumes I-III (EPA 450/2-78-042a,b,c). Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina.

EPA, 1985. Modified Method 5 Train and Source Assessment Sampling System Operator's Manual (EPA 600/8-85-003). Office of Research and Development, Research Triangle Park, North Carolina (February).

EPA, 1984. Protocol for the Collection and Analysis of Volatile POHCs Using VOST (EPA 600/8-84-007). Office of Research and Development, Research Triangle Park, North Carolina (March).

EPA, 1984. Sampling and Analysis Methods for Hazardous Waste Combustion (EPA 600/8-84-002). Office of Solid Waste, Washington, D.C. (February).

EPA, 1981. Source Sampling and Analysis of Gaseous Pollutants (EPA-APTI Course Manual 468). Air Pollution Control Institute, Research Triangle Park, North Carolina.

EPA, 1979. Source Sampling for Particulate Pollutants (EPA-APTI Course Manual 450) Air Pollution Control Institute, Research Triangle Park, North Carolina.

should be 2 to 15 meters to represent actual exposure conditions as opposed to other factors such as wind erosion; however, the height may vary because of site-specific and unit-specific conditions. For example, the monitoring location for an OB/OD unit may be much higher to meet the need to capture emissions from a plume that is rising very quickly because of its high temperature. The other factors listed above -- duration of air monitoring, sampling frequency, detection limits for air monitors, and physical and chemical characteristics of hazardous waste constituents to be monitored -- should be specified by permit applicants for the same reasons as those concerning proposed air modeling approaches (see Subsection 4.2.2 of this manual).

4.3 DETAILED GROUND-WATER AND SUBSURFACE ASSESSMENTS

The main purposes of a detailed ground-water and subsurface assessment are to define:

- The hydrogeologic setting of the area surrounding the unit
- Potential receptors of releases into the ground water or subsurface environment from the unit
- The expected migration and dispersion rates of releases from the unit into the ground water and the subsurface environment
- The exposure to potential human and environmental receptors from releases from the unit and the risk to the receptors from such exposures (discussed in Subsection 4.5 of this manual)

The hydrogeologic setting of the area surrounding the unit includes the existing ground-water quality, quantity, and direction of flow; the proximity to and withdrawal rates of current and potential users; and local land-use patterns. Data on these hydrologic features are needed to provide a framework for interpreting monitoring data and as input variables to be entered into hydrogeologic models. Subsection 4.3.1 provides information on the types and amounts of data needed to define these features.

The expected migration and dispersion rates of releases from a Subpart X unit can be defined through monitoring, modeling, or a combination of both approaches. Subsections 4.3.2 and 4.3.3 provide permit writers with information for evaluating modeling and monitoring strategies presented by permit applicants to define migration and dispersion of hazardous waste constituents in the ground water and subsurface environment around a Subpart X unit.

Permit writers usually will want to enlist the help of experts when reviewing detailed ground-water and subsurface assessments. Such experts may include geologists and hydrogeologists in EPA Regional and state environmental protection offices, personnel from the U.S. EPA Environmental Research Laboratory in Ada, Oklahoma, and personnel from the Office of Ground-Water Protection at EPA Headquarters.

4.3.1 Required Information for Detailed Ground-Water and Subsurface Assessments

As part of detailed ground-water and subsurface assessments, permit applicants must submit information on (1) the hydrologic and geologic characteristics of the area, (2) the uses and characteristics of ground water and land in the area, and (3) potential receptors. Information on these three areas is presented in the following sections.

4.3.1.1 Hydrologic and Geologic Characteristics

Permit writers should require permit applicants to submit certain data as part of a detailed ground-water and subsurface assessment. This information includes, but is not limited to, the following:

- Types and distribution of geologic materials
- Occurrence of ground water in geologic formations
- Movement of ground water through geologic formations
- Location of the facility in relation to regional ground-water-bearing formations
- Relative permeability of geologic formations
- Potential physical and chemical interactions among constituents released from the Subpart X unit and the materials that make up the geologic formations at the facility

Permit applicants should provide permit writers with information concerning the movement, both horizontally and vertically, of ground water below the facility. In order to make a proper determination of ground-water flow rates, permit applicants should be required to determine the hydraulic conductivity of geologic formations, the hydraulic gradient, and the effective porosity of the geologic formations near the facility. Hydraulic conductivity can be

determined through slug tests or pump tests, using one or more ground-water observation wells. (The use of both these tests is preferable to the use of a single test.) Permit writers should require that the hydraulic conductivity of each geologic layer below the facility be determined, because it may vary in different strata. The hydraulic gradient typically is determined through the use of piezometers. The effective porosity usually can be determined from standard references according to the type of material that make up the particular formation.

The permit applicant must describe potential physical and chemical interactions among constituents released from the Subpart X unit and the geologic materials underlying the facility. Geochemical and biological interactions may produce transformation or biodegradation products different from the original constituents in the waste. Permit writers should require the applicant to describe the potential for such interactions and their resultant effects on the subsurface environment.

Permit writers also should receive information on the ground-water hydrology of the facility. The information should include a description of the aquifer system underlying the facility, including a discussion of any perched or seasonal aquifers. Information provided by applicants should include depth to aquifers, the specific yield of aquifers, and the direction and rate of flow of ground water. Permit applicants also should provide permit writers information on the locations of ground-water discharge and recharge areas and the locations and types of any aquitards in the area.

Possible sources of information on local or regional geology include U.S. Geological Survey (USGS) reports, maps, and files; the U.S. Department of Agriculture Soil Conservation Service; state geologic survey records; state environmental and natural resources offices; and local well drilling logs. Sources of information concerning ground-water hydrology include the USGS, state geological surveys, local well drillers, and state and local water resources boards. Permit applicants may wish to consult a list of local offices available from the Water Resources Division at the USGS in Reston, Virginia or EPA Regional offices. Other sources of information concerning the subsurface environment may include the following:

- U.S. Department of Agriculture Agricultural Stabilization and Conservation Service
- U.S. Department of Interior, Bureau of Reclamation

- Local planning boards
- County or city health departments
- Local libraries

4.3.1.2 Ground-Water and Land Use

Permit writers should ask permit applicants to provide information concerning the existing use and quality of ground water and land use in areas near the facility. The information generally should include withdrawal rates, which may influence the rate and direction of ground-water flow, and specific uses of the ground water, such as an industrial or drinking-water supply. Information on the quality of the ground water is required in a Subpart X permit application, and that information should include its classification for use as potable, suitable for industrial use, or unusable. Information concerning ground-water use and quality may be available from state or local water-use authorities. Land use information should specify the zoning in the vicinity of the facility (for example, industrial or residential); this information is typically available from the local zoning or land-use authority in the area of the facility.

4.3.1.3 Potential Receptors of Releases to Ground Water

Permit applicants are required to identify potential receptors of releases to the ground water from the Subpart X unit. Although the types of receptors will vary, they usually will include users of ground water for drinking water or for industrial use. Permit applicants must identify the location of all wells used for withdrawal of ground-water and specify the wells' proximity to the facility and the use of the ground water obtained from them. The information usually can be obtained from local well drilling logs or from the state or local water-use authority responsible for the jurisdiction in which the facility is located.

Permit writers must request information from permit applicants on the potential ecological receptors of release to ground water and to the subsurface environment. The information must include an assessment of any releases from the Subpart X unit that may affect food-chain crops or other vegetation. The assessment should include an evaluation of releases to the root zone of such vegetation and an evaluation of the probability that plants will take up hazardous waste constituents. For example, corn has been shown to have an affinity for the uptake of cadmium

Finally, permit applicants should provide permit writers with information concerning potential human or environmental receptors as the result of transfer of hazardous waste constituents from the subsurface environment to other environmental media. The evaluation should include an assessment of the probability of contamination of surface-water bodies, such as springs, that are hydraulically connected to ground water. In such a case, potential receptors should include humans and other animals that use the surface water as a drinking-water source and plants in the vicinity of the potentially affected surface water.

4.3.2 Evaluation of Approaches to Ground-Water and Subsurface Monitoring

Permit applicants often will identify the concentrations of hazardous waste constituents at potential receptors as a result of ground-water contamination by using a combination of ground-water monitoring and modeling. In such an approach, the concentrations of constituents are first determined through sampling and analysis of ground-water samples obtained from ground-water monitoring wells. The resulting concentrations, along with information on the subsurface environment, such as velocity and direction of the ground-water flow, then can be entered into a model to determine the dispersion of hazardous waste constituents to specific receptor locations.

Although ground-water monitoring is the primary method of characterizing releases to ground water, permit writers may be required to evaluate alternative methods of detecting releases to ground water. Permit writers should evaluate permit applicants' submissions to determine where the proposed approaches will generate results equivalent to the results generated by ground-water monitoring. This determination generally will involve experts in the proposed monitoring technology in the EPA or a state agency and may require consultation with such outside experts as consultants or university faculty. Alternative approaches also must demonstrate adequate quality assurance and quality control, in accordance with current EPA guidance. In general, permit writers should consider these alternatives to be invalid unless proven otherwise, because, to this point, monitoring approaches other than ground-water monitoring have not been demonstrated to achieve equivalent performance in the field.

Although ground-water monitoring is not explicitly required in 40 CFR Part 264 Subpart X for miscellaneous units, the owner or operators of any unit that has the potential to affect the ground water will be required to install a ground-water monitoring system that complies with the requirements of 40 CFR Part 264 Subpart F. Such units include disposal units and any treatment units that do not have engineering controls to prevent migration of hazardous waste or hazardous

constituents to soils or to the subsurface. Owners or operators of such units must provide adequate justification through a ground-water and subsurface assessment if they believe that the unit in question should not be required to have a ground-water monitoring system. A unit that is contained within a building is an example of a unit that may be eligible for an exemption from requirements for ground-water monitoring.

If it is determined that ground-water monitoring is necessary, owners or operators should be required to install a ground-water monitoring system before the permit is issued. Ground-water monitoring proposed by permit applicants should be conducted in accordance with the procedures for regulated units under regulations specified in 40 CFR Part 264 Subpart F. These procedures require the establishment of ground-water monitoring wells upgradient of the unit to establish background concentrations of indicator parameters and hazardous constituents and of downgradient wells that can be used to determine the impact of the unit on the quality of ground water. The proposal by the owner or operator should include the following elements:

- Indicator parameters and hazardous waste constituents to be monitored
- Monitoring locations
- Frequency and duration of sampling
- Sampling and analysis techniques
- Statistical analysis procedures
- QA/QC procedures

When establishing permit conditions for ground-water monitoring parameters, permit writers should start with a broad list of parameters (for example, constituents listed in Appendix IX of Part 264) and require permit applicants to justify any reduction in the number of parameters to be analyzed. Owners and operators can be required to monitor for parameters other than Appendix IX constituents under the authority of 40 CFR 270.14(c). An example of such a requirement is monitoring for explosive constituents that are not listed in Appendix IX, but that may migrate from open burning or detonation units.

Permit applicants also should provide permit writers with information on the point of compliance (POC) for ground-water monitoring. The POC for ground-water monitoring is defined in 40 CFR 264.93 as an imaginary line circumscribing the downgradient edge of the unit

In some cases, an alternative POC for ground-water monitoring for Subpart X units may be warranted. An alternative POC may be appropriate when (1) physical obstacles prevent its placement at the edge of the unit or (2) there is risk of damage to monitoring equipment. For example, many OB/OD units are located within the boundaries of an active impact range. In such cases, the POC should be located where ground-water monitoring wells will not be damaged by ongoing range activities or by shock waves or heat from OB or OD activities.

The adequacy of a proposed design of a ground-water monitoring system is determined in large part by the geology and ground-water hydrology at the facility. The placement of wells will be determined by physical characteristics of the subsurface environment, as described in Subsection 4.3.1.1. Direct or indirect investigative methods can be used to make the determination of well placement. Direct methods include soil boring and rock core samples, with subsequent laboratory analysis to determine the subsurface structure. Indirect methods include geophysical techniques, such as seismic refraction and electrical resistivity, that can be used to extrapolate information obtained from direct methods, that is, to determine the geology in areas between wells.

The adequacy of a proposed ground-water monitoring system also is determined by the construction of the wells. Criteria for evaluating proposals by permit applicants for the construction of ground-water monitoring designs, as well as guidance on placement of wells can be found in the *RCRA Ground-Water Monitoring Technical Enforcement Guidance Document*[8] and *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities - Interim Final Guidance*.[9] Permit writers also may wish to take a course like, "Site Characterization for Subsurface Remediation,"[10] which deals with several aspects of ground-water and unsaturated zone monitoring. Additional documents on guidance on the design and installation of ground-water monitoring systems are provided at the end of this section. A draft bibliography is available that summarizes current literature on assessing and remediating subsurface contamination. The

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[8] Available from NTIS, NTIS #PB87-107 751/AS.

[9] Available from NTIS, NTIS #PB89-151-047. In addition, the EPA Office of Solid Waste offers a supplemental training course, "Statistical Training Course for Ground-Water Monitoring Data Analysis," June 1991, available through the RCRA Hotline at 1-800-424-9346.

[10] Available from the ORD Publications Office, Center for Environmental Research Information, 26 West Martin Luther King Drive, Cincinnati, OH 45268-1072, (513) 569-7562, #CERI-89-224.

summary is listed in a bibliography of references included as Appendix A to this manual.

In addition to ground-water monitoring, permit writers should require perm conduct vadose-zone monitoring (also referred to as unsaturated zone monitoring). applicants should be required to monitor both horizontal and vertical migration of co the vadose zone. Permit applicants should use soil borings and piezometers to measu thickness of the unsaturated and capillary fringe zones. Permit writers should refer to *Treatment Guidance Document for Unsaturated Zone Monitoring for Land Treatment F* additional guidance on evaluating vadose zone monitoring approaches. Permit writers cautioned, however, that many of the methods referred to in this document often are in As of the time of the publication of this manual, a new guidance on vadose zone monito being developed; permit writers should use that document as soon as it becomes availabl

Additional guidance on the installation of ground-water monitoring wells and gro water monitoring procedures can be obtained from the following documents:

EPA, 1989. RCRA Facility Investigation Guidance, Volume II of IV: Soil, Ground and Subsurface Gas Releases (EPA 530/SW-89-031). Waste Management Di Office of Solid Waste (May).

EPA, 1985. Practical Guide for Ground-Water Sampling (EPA-600/2-85/104), Offic Research and Development.

EPA, 1985. RCRA Ground-Water Monitoring Compliance Order Guidance. Office Solid Waste.

EPA, 1988. Practical Guide for Assessing and Remediating Contaminated Ground Wate Office of Emergency and Remedial Response.

EPA, 1986. Permit Writers Guidance Manual for the Location of Hazardous Waste Land Storage and Disposal Facilities - Phase II: Method for Evaluating the Vulnerabil of Ground Water. Office of Solid Waste.

EPA, 1986, Guidance Criteria for Identifying Areas of Vulnerable Hydrogeology Under the Resource Conservation and Recovery Act (Interim Final).

4.3.3 Evaluation of Approaches to Ground-Water Modeling

Ground-water modeling has two primary applications for conducting detailed ground-water assessments for Subpart X units: to determine dispersion of hazardous waste constituents in the subsurface environment once they have been detected in a ground-water monitoring system and to assist in the placement of ground-water monitoring wells. Because many of the models are complex and require extensive expertise to run, permit writers may wish to elicit help from personnel in their respective Regional or state ground-water protection office to aid them in evaluating modeling approaches proposed by owners or operators. The usefulness of models may be limited because the results generally are not as reliable as actual ground-water monitoring data (for example, the actual structure of the subsurface may be different from the conditions the models are based upon). However, the following subsections will provide general guidance on the evaluation of modeling proposed by Subpart X permit applicants.

Ground-water modeling can be used to establish the placement of wells for a ground-water monitoring system. Permit writers should not, however, allow the use of models as the sole source of information for well placement, because models may not account for variations in conditions encountered in the field. Models used for such applications therefore should be used only in conjunction with geophysical methods, such as electromagnetic surveys. Permit applicants should provide permit writers with the following information when proposing the use of a given model:

- Assumptions used in the model
- Justification for the use of the model
- Sensitivity analysis on input parameters entered into the model
- Results of field sampling verification

Permit writers may obtain additional information on ground-water modeling through a clearinghouse operated by the International Ground Water Modeling Center (IGWMC). The IGWMC distributes information on ground-water models and distributes ground-water modeling software. Permit writers can obtain information or a list of available publications by contacting the IGWMC at ~~(317) 283-9458.~~

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Permit applicants also may propose the use of modeling to estimate the dispe hazardous waste constituents once they have been detected in ground-water monitori The type of model selected for this application will depend upon whether the owner c conducting a detailed ground-water assessment based on a worst-case scenario or is at estimate actual concentrations at potential receptor locations. Guidance on the selectio for both situations is described below.

Permit writers may encounter a variety of screening models used to determine w concentrations at receptor locations. However, two models currently are in use in the R(delisting process, the Vertical-Horizontal Spread (VHS) and the Organic Leachate Model are accepted by EPA as the preferred models for use in such applications. The OLM can to estimate concentrations of organic constituents when they reach the ground-water table. (Permit writers should note that this model estimates only concentrations of organics at the table; the model assumes that concentrations of metals will be approximately the same as th concentrations in the original release from the Subpart X unit.) Once the results of the OL been obtained, the VHS then can be used to estimate concentrations at a potential receptor, t into account dilution and dispersion. Guidance on the use of the OLM and the VHS can be f in the *Federal Register* of November 27, 1985 and November 13, 1986, respectively. Permit applicants that wish to use alternative models for worst-case ground-water assessments may u such models only after having demonstrated their equivalence to the OLM and the VHS, b demonstrating similar results and proper QA/QC procedures. If the results of such modeling show that levels of hazardous waste constituents are above health-based or environmental levels the permit writer should issue a NOD requiring the use of more detailed models or should deny the permit.

Permit applicants also propose the use of more detailed models that, at least theoretically, will generate more accurate estimates of concentrations of hazardous constituents at potential receptors. The models provide better concentration estimates by more accurately accounting for transmissive and dispersive soil and ground-water properties. Permit writers may encounter submissions by permit applicants that use the Vadose Zone Interactive Process (VIP), Trace Element Transport Model (TETRANS), and Method of Characteristics (MOC), the Princeton Transport Code (PTC), and the Modular Finite Difference Flow (MODFLOW) models. References for obtaining and using each of these models are presented at the end of this subsection.

The accuracy of detailed ground-water models is a direct function of the input parameters entered into such models. Permit applicants may propose the use of a variety of input parameters. However, generally accepted parameters for use in ground-water models can be found in the TEGD, Volume II of the RFI guidance for ground-water releases and in Chapter 11 of the SW-846. (A copy of Chapter 11 of the SW-846 is included as Appendix H to this guidance manual.)

References for permit writers who wish to obtain models referred to in this section are:

Ahlfeld, D.P., D.K. Babu, A. Niemi, and G.F. Pinder, 1988. PTC- Princeton Transport Code. Princeton University (January).

Bredehoeft, J.D., and L.F. Konkow, 1989. MOC - USGS Two-Dimensional Solute Transport Model. United States Geological Survey (November). (NOTE: This document is available from the IGWMC.)

Grenney, et al., 1987. VIP - Vadose Interactive Zone Model. Utah State University.

U.S. Department of Agriculture - ARS, 1990. TETRANS - Trace Element Transport Model. U.S. Salinity Laboratory, Riverside, California (March).

EPA, 1987. IBM Compatible Computer Program and User's Guide. Federal Computer Products Center, National Technical Information Service.

EPA, 1985. DRASTIC - A Standardized System for Evaluating Ground-Water Pollution Potential Using the Hydrologic Settings (EPA/600/2-88/018).

U.S. Geological Survey. MODFLOW model. National Water Information System, Reston, Virginia.

Permit writers can use the following references to verify parameter values for surface soils and ground water used by permit applicants in ground-water models:

American Society for Testing and Materials (ASTM), 1984. Annual Book of ASTM Standards. ASTM, Philadelphia, Pennsylvania.

Brady, 1974. The Nature and Properties of Soils (8th Edition). MacMillan Publishing Company, Inc., New York.

Callahan, et al., 1979. Water-Related Environmental Fate of 129 Priority Pollutants (EPA-440/4-79-029).

Sowers, G.F., 1981. Rock Permeability or Hydraulic Conductivity - An Overview in Permeability and Ground Water Transport. American Society for Testing and Materials, Philadelphia, Pennsylvania.

Freeze and Cherry, 1979. Ground Water. Prentice-Hall, Inc., Englewood Cliffs, New Jersey.

4.4 DETAILED SURFACE-WATER AND SURFACE-SOIL ASSESSMENTS

The main purposes of a detailed surface-water, wetlands, and surface-soil assessment are to define:

- The hydrologic and surficial geologic setting of the area surrounding the unit
- The potential human and environmental receptors of releases from the unit
- The expected migration and dispersion rates of releases from the unit into the surface water, wetlands, and surface soils
- The exposure of potential human and environmental receptors of releases from the unit and the risks to the receptors from such exposures (discussed in Subsection 4.5 of this manual)

Necessary information on the hydrologic and surficial geology includes the unit's proximity to surface water, the existing quality and uses of surface water, ground-water flow, and the topography and land use in the area. Data on these hydrologic and surficial geologic features are needed to provide a framework for interpreting monitoring data and as input variables to be entered into hydrologic models. Subsection 4.4.1 provides information on the types and amounts of data needed to define these features.

The expected migration and dispersion rates of releases from a Subpart X unit can be identified through surface-water and soil monitoring. Subsections 4.4.2 and 4.4.3 provide information permit writers can use to evaluate monitoring strategies presented by permit applicants to define the migration and dispersion of hazardous waste constituents in surface water, wetlands, and surface soils around a Subpart X unit.

Permit writers may wish to employ experts when reviewing permit applications containing detailed surface-water and surface-soil assessments. Such experts may include hydrologists and soil scientists in EPA Regional and state environmental protection offices; personnel from the offices of Wetlands Protection and Water Enforcement and Permits in EPA Headquarters; and outside sources, such as consultants and university faculty.

4.4.1 Required Information for Detailed Surface-Water and Surface-Soil Assessments

Permit applicants must provide permit writers with a variety of information when conducting a detailed surface-water and surface-soil assessment. Required information includes (1) hydrologic information, including information concerning surface water, ground-water, and precipitation; (2) information concerning surface soils, including topographic and land-use information; and (3) information on potential receptors of releases from the unit. A discussion of the types of information that should be provided to permit writers and possible sources of such information is provided in the following sections.

4.4.1.1 Hydrologic Information

As part of detailed surface water assessments, permit writers should expect to see hydrologic information concerning the facility, including information on surface-water hydrology. The information should include:

- Size and location of surface-water bodies (for example, lakes and impoundments) in the vicinity of the facility
- Flow data for streams and rivers
- Wetlands information
- Information on marine environments, including estuaries and oceans
- Information on precipitation patterns
- The quantity, quality, and direction of ground-water flow (see Subsection 4.2.3.1 for a discussion of how to obtain this information)

Permit applicants should provide permit writers with information concerning uses of surface water. Possible uses, such as for drinking water, recreation, and aquaculture, should be identified. If surface water is used (for example, for drinking water), the permit applicant also should identify the rates of use.

If information on surface-water hydrology or use is deficient in an application, the permit writer should issue a NOD requiring additional information. The Central Forecast System (CFS), operated by the U.S. Soil Conservation Service, contains a variety of information compiled by the National Oceanic and Atmospheric Administration (NOAA) and the Department of Commerce

National Weather Service (NWS). This information includes data on snowfall and snow accumulation and may include data on stream flows and rainfall. Stream flow data has been compiled for many surface-water bodies in EPA's GAGE computer data base. The U.S. Geological Survey (USGS) also has compiled stream flow data for many areas throughout the country. Possible sources of hydrologic surface-water information include state and local water-use authorities, the Department of Interior's Fish and Wildlife Service, and any environmental reports prepared for the facility, including RFA or PA/SI reports. Information on precipitation patterns usually can be obtained from the National Climatic Data Center in Asheville, North Carolina. Intensities of storms (for example, 5-year precipitation events) may be available from a local office of the NWS. Finally, information on the use of surface waters may be available from the state or local water-use authority.

Information on the current quality of surface water, if available, also should be provided to the permit writer by the permit applicant. EPA's STORET water quality data base contains ambient monitoring data for many streams and rivers in the United States. The information in the data base also may include monitoring data generated to meet requirements of a National Pollutant Discharge Elimination System (NPDES) permit or a state equivalent. Other potential sources of information include environmental reports prepared for the facility, such as RFAs or PA/SIs.

4.4.1.2 Information on Surface Soils

Information provided to permit writers on surface soils should include physical and chemical characteristics of the soils, land use, and topography. Physical and chemical characteristics of surface soils that should be specified by the permit applicant as part of a detailed assessment include, but are not limited to:

- Information on the types of soils present (that is, soil classifications)
- Relative permeability
- Moisture content
- Particle or grain size
- Porosity
- Hydraulic conductivity
- Cation exchange capacity

- Organic carbon content
- pH

Permit applicants can obtain many of the above parameters rather easily though sampling and analysis or from standard references on the area in which the facility is located. Possible sources of information on regional soils include the U.S. Soil Conservation Service, the Agricultural Stabilization and Conservation Service, the U.S. Geological Survey, state soils bureaus, agricultural extension services, university soil science departments, and consultants. Additional sources of information may include geotechnical boring logs for foundation studies and well logs made during drilling of water supply wells. Permit applicants also should be required to examine any available documents that concern site investigations (for example, RFA or PA/SI reports).

Permit applicants also should provide the permit writer with information on topography and land use in the vicinity of the Subpart X unit. Topographic information, including topographic maps, is usually available from USGS. Information on land use, such as agricultural, recreational, or wildlife habitat uses, usually is available from the local land-use or zoning authority in the area in which the facility is located.

4.4.1.3 Potential Receptors of Releases to Surface Water and Surface Soils

Permit writers should receive information from permit applicants concerning potential receptors of releases of hazardous waste constituents from Subpart X units through the surface-water and surface-soil pathways. The information should identify all receptors and the distance from the unit to such receptors. Potential receptors of such releases include human and environmental receptors, as discussed below.

Potential human receptors of releases to surface water or surface soils should be identified as part of a detailed assessment for those media. For surface-water assessments, potential receptors include persons using surface water as a source of drinking water; to conduct this assessment, the permit applicant should determine the location of drinking water intakes. Human receptors also include persons using surface water for recreation, such as swimming or boating For surface-soil releases, persons likely to come into direct contact with surface soils, especially small children, should be identified.

Permit writers must require applicants to furnish information on environmen as part of a detailed surface-water and surface-soil assessment. Potential environme of surface-water releases include fish and other marine or aquatic animals present in streams, rivers, or oceans. Marine or aquatic plants that could be affected by a releas Subpart X unit also should be identified by the permit applicant. As part of the surfa evaluation, the permit applicant should provide the permit writer with information on that may come into contact with contaminated soils, including burrowing animals, such groundhogs. On-site and off-site vegetation that may be affected by releases from the should be identified by the permit applicant and their locations specified. Permit writer wish to require the applicant to submit additional information on the locations of sensitiv environments (for example, wetlands) or endangered species.

4.4.2 Evaluation of Monitoring Approaches Proposed for Use In Surface-Water Assessments

Permit writers often will be required to evaluate monitoring programs proposed by p applicants to monitor releases to surface water from Subpart X units. This section provides p writers with (1) background information on surface-water monitoring, (2) criteria for evaluat approaches to surface water monitoring proposed by owners or operators, and (3) sources of additional guidance for evaluating surface-water monitoring programs.

4.4.2.1 Background Information on Surface-Water Monitoring

Permit applicants may propose the use of several different types of surface-water monitoring plans; however, permit writers generally can expect to evaluate three basic types of surface-water monitoring programs. The three types of monitoring programs may be used independently or in conjunction with one another at a given facility. The basic types of surface water monitoring are:

- Surface-water monitoring
- Runoff monitoring
- Sediment monitoring

Surface-water monitoring normally consists of the collection of samples in plastic, metal, or Teflon bottles in various surface-water bodies, including streams, rivers, and lakes. This type of monitoring usually is limited to taking grab samples on a periodic basis; however, composite samples also may be taken.

Runoff monitoring should be conducted by permit applicants when there is a possibility of releases of hazardous waste constituents during periods of high runoff (for example, snowmelt or storm events). Equipment used to sample runoff often consists of automatic samplers equipped with a flow-measuring device, such as a weir with a continuous-head recorder, but also may be similar to surface-water sampling equipment. Use of automatic samplers generally is preferred to manual sampling approaches when periods of high runoff are predictable (for example, during the summer in areas where thundershowers are common).

Sediment monitoring consists of the collection of a sample of solids that have accumulated at the bottom of a surface-water body. Sediment monitoring usually is accomplished with corers or with grabs or dredges. Permit writers should require that sediment monitoring be conducted unless the permit applicant can demonstrate that there will be no significant impact on sediments as a result of the operation of the Subpart X unit; usually, such a demonstration can be made only if the surface-water body itself is unaffected by the operation of the applicant's Subpart X unit.

4.4.2.2 Criteria for Evaluating Surface-Water Monitoring Programs

Permit writers should require permit applicants to provide certain minimum information as part of a surface-water monitoring program. This information, which serves as a basis on which the permit writer can evaluate submissions by Subpart X permit applicants, includes:

- Hazardous waste constituents to be monitored
- Indicator parameters to be monitored
- Monitoring locations
- Frequency of sampling and analysis
- Types of monitoring equipment
- Quality assurance and quality control procedures
- Provisions for accounting for dilution (if necessary)

The permit writer should require applicants to submit information on the hazardous waste constituents and indicator parameters to be monitored to ensure that they will provide adequate assurance that releases from the unit will be detected. The parameters to be monitored should be representative of the physical and chemical properties of the wastes in the unit. Although the types of indicator parameters will vary, most of them provide an indication of physical, chemical, or biological alteration of surface waters as a result of the introduction of hazardous waste constituents. Indicator parameters may include chemical oxygen demand (COD), biological oxygen demand (BOD), pH, temperature, total dissolved solids, and specific conductance.

Permit writers also should require permit applicants to specify surface-water monitoring locations. Monitoring locations should include both upstream and downstream sampling locations that will take into account the loading of hazardous waste constituents from the Subpart X unit. The placement of monitors is important because it may influence the types of monitoring equipment selected. For example, a monitoring program designed to detect constituents with a specific gravity greater than that of water must include sampling locations near the bottom of the surface- water body being monitored; any monitors used in this way must be able to function under the conditions (for example, flow rate and depth) at the bottom of the surface-water body.

The frequency of sampling and analysis and the types of monitoring equipment must be specified by the permit applicant so that the permit writer can determine whether the monitoring program will provide enough data to adequately represent conditions at the facility. Finally, the permit applicant must describe quality assurance and quality control procedures to demonstrate that the results of surface-water monitoring, specifically those from sampling and analysis, will be credible.

Permit writers should also ensure that applicants have correctly accounted for dilution when conducting surface-water monitoring. In many cases, when monitoring is conducted upstream and downstream of a discharge point, the discharge from the facility (for example, from a stormwater discharge) will be diluted to the point that downstream monitoring results will not be representative of the true impact of the discharge. The permit writer should refer to the *RFI Guidance for Surface Water Releases*, EPA, 1989, to determine whether the permit applicant is adequately accounting for dilution.

4.4.2.3 Sources of Additional Guidance for Surface-Water Sampling

In addition to the guidance listed in the subsections above, the following guidances are available to aid the permit writer in evaluating approaches to surface-water monitoring proposed by Subpart X permit applicants:

EPA, 1987. A Compendium of Superfund Field Operations Methods, Volume 2 (OSWER Directive No. 9355.0-14). Office of Emergency and Remedial Response.

EPA, 1984. Characterization of Hazardous Waste Sites - A Methods Manual: Volume II. Available Sampling Methods, Second Edition (EPA-600/4-84-076). Environmental Monitoring Systems Laboratory, Las Vegas, Nevada (December)

EPA, 1989. RCRA Facility Investigation Guidance, Volume III of IV (OSWER Directive No 9502.00-6D). Waste Management Division, Office of Solid Waste (May).

4.4.3 Evaluation of Monitoring Approaches Proposed for Use In Surface-Soil Assessments

Permit writers often will be required to evaluate monitoring programs proposed by permit applicants to monitor releases to surface soils from Subpart X units. The following subsections provide permit writers with (1) background information on surface-soil monitoring, (2) criteria for evaluating surface-soil monitoring approaches proposed by owners or operators, and (3) sources of additional guidance for evaluating surface-soil monitoring programs.

4.4.3.1 Background Information on Surface-Soil Monitoring

Permit writers should require applicants proposing to use surface-soil monitoring to determine background soil concentrations of hazardous waste constituents and concentrations of hazardous waste constituents in the vicinity of the Subpart X unit. For purposes of the surface-soil assessment, background concentrations represent natural concentrations of hazardous waste constituents in surface soils that have not been affected by the operation of the Subpart X unit. If the permit applicant can demonstrate to the permit writer that the concentrations of hazardous waste constituents do not exceed background levels or do not exceed acceptable health-based or environmental levels, the conditions of the environmental performance standards for surface soils should be considered to have been met. Although there is currently no universal methodology to determine whether concentrations of hazardous constituents in soils have increased over background levels, in most cases, an increase must be "statistically significant." The accepted

definition of the term "statistically significant increase" has been shown to vary among EPA Regional and state environmental protection offices. Therefore, permit writers should consult with appropriate experts to determine Regional or state policies regarding this issue.

The primary means of demonstrating compliance with the environmental performance standard for surface soils is through field screening methods and surface soil sampling techniques. Field screening methods can be used to determine, usually quickly, whether soils are contaminated. For example, a photoionization detector or an organic vapor analyzer (OVA) can be used to detect organic vapors in shallow excavations such as boreholes. The permit writer is cautioned, however, that such methods by themselves will not satisfy the requirements for a detailed surface-soil assessment. They are used primarily to identify areas for further investigation; if one of these techniques reveals contamination of surface soils, the permit writer should require more detailed surface-soil monitoring techniques.

Permit writers will be expected to evaluate a number of different types of techniques for detailed surface soil monitoring. Although there are several different types of monitoring techniques, they consist almost exclusively of soil sampling procedures. Soil sampling techniques that the permit writer is likely to encounter include:

- Soil punches
- Ring samplers
- Shovels, spatulas, and scoops
- Soil probes or tube samplers
- Hand augers

These techniques for detailed surface soil monitoring and their applications are described in the *RFI Guidance for Soil, Ground Water, and Subsurface Gas Releases, EPA, 1987.*

4.4.3.2 Guidance on Evaluating Approaches Surface-Soil Monitoring

Permit writers should base evaluations of approaches to surface-soil monitoring submitted by permit applicants on ability of the approaches to accurately determine concentrations of

hazardous waste constituents that have been released from the Subpart X unit. This evaluation should be conducted based on the following factors:

- Constituents and indicator parameters to be monitored
- Sampling and analysis methods
- Sampling locations
- Sampling frequency and duration
- Quality assurance and quality control procedures

Permit writers should require permit applicants to monitor for hazardous waste constituents and indicator parameters that are representative of wastes in the Subpart X unit to allow detection of releases from the unit. To determine whether the monitoring program for a facility has included a sufficient number of monitoring parameters, permit writers should use information obtained from the facility's waste description (discussed in Section 3).

Information on sampling and analysis methods for surface-soil assessments provided by permit applicants should be sufficient to allow the permit writer to make a determination whether conditions in surface soils at the site will be characterized adequately. Sampling locations and sampling frequencies and durations specified by permit applicants should demonstrate to the permit writer's satisfaction that the sampling effort will be representative of variations in concentrations of hazardous waste constituents over areas and soil depths at the facility and over time.

4.4.3.3 Sources of Additional Guidance on Surface-Soil Monitoring

Permit writers may obtain additional information concerning the evaluation of surface-soil monitoring in the following documents:

EPA, 1987. A Compendium of Superfund Field Operations Methods: Volume 1 (OSWER Directive Number 9355.0-14), Office of Emergency and Remedial Response (August).

EPA, 1989. RCRA Facility Investigation Guidance, Volume II of IV: Soil, Ground Water and Subsurface Gas Releases. Waste Management Division, Office of Solid Waste (May).

EPA, 1989. Soil Sampling Quality Assurance User's Guide (EPA/600/8-89/046). Environmental Monitoring Systems Laboratory, Las Vegas, Nevada (March).

4.5 RISK ASSESSMENTS

As part of environmental assessments, permit applicants must conduct a risk assessment to demonstrate that releases from the Subpart X unit will not pose unacceptable risks. The risk assessment must include evaluations of risks to human health (that is, a human health risk assessment) and to plants and other animals (that is, an ecological risk assessment). Risk assessments should concentrate on risks posed throughout the life of the unit, not just at the time the permit is issued. The primary goal of risk assessments for Subpart X units is to provide a means to communicate the risk caused by the operation of the unit during the permit life of the unit. These risk assessments should use information obtained from other parts of the detailed assessments, including information on potential receptors and concentrations of constituents in various media. When evaluating risk assessments, the permit writer can use a variety of risk assessment manuals developed by EPA, including the following:

EPA, 1989, Risk Assessment Guidance for Superfund, Volume I - Human Health Evaluation Manual (Part A), Office of Emergency and Remedial Response (December).

EPA, 1989, Risk Assessment Guidance for Superfund, Volume II - Environmental Evaluation Manual. Office of Emergency and Remedial Response (December).

EPA, 1991, Risk Assessment Guidance for Superfund, Volume I - Human Health Evaluation Manual, Supplemental Guidance, Standard Default Exposure Factors. Office of Emergency and Remedial Response (December).

Permit writers should expect to see the following as part of a risk assessment:

- Information on the physical and chemical characteristics of hazardous waste constituents released from the unit
- Identification and location of potential human and environmental receptors
- An estimate of the concentrations of hazardous waste constituents at receptor locations
- An estimate of the rate of uptake of each hazardous waste constituent by each human and environmental receptor
- An estimate of the duration of exposure by each constituent by each receptor

- Information on the toxicity of each hazardous waste constituent to each receptor at the levels and durations of exposure estimated for each constituent

- A quantification of the risk to human and environmental receptors

- A discussion of the uncertainties associated with the human health and ecological risk assessments

Permit writers should examine information from the facility's unit description and associated waste characterization to determine the types of hazardous waste constituents that could be released. The permit writer then should be able to determine the concentrations of hazardous waste constituents at receptor locations through a combination of information provided by the permit applicant, including monitoring or modeling results, information on existing air quality, and information on the receptors that have been identified by the permit applicant. When evaluating permit applications, the permit writer must ensure that the locations where modeling and monitoring are being conducted correspond to the locations of potential receptors.

Once information on concentrations at receptor locations has been reviewed, the permit writer should evaluate assumptions made in estimating intake of hazardous constituents by receptors. The evaluations should focus on the inhalation and skin absorption routes of exposure for humans and other animals and on the effects of direct exposure on trees and other plants. Although the routes of exposure identified above generally will be of the greatest concern, permit applicants also must be required to account for secondary routes of exposure. For example, humans may be affected by direct contact with soil that has been contaminated with hazardous constituents through the deposition of particulate matter from the Subpart X unit.

As part of the risk assessment, permit writers should require applicants to develop information on the toxicity of hazardous constituents that may be released from Subpart X units. Although applicants may obtain toxicity values from a variety of sources, EPA recommends a hierarchy of sources for obtaining such information:

- The Integrated Risk Information System (IRIS)

- Health Effects Assessment Summary Tables (HEAST)

- Consultation with EPA staff in the Environmental Criteria and Assessment Office (ECAO) in the ECAO Chemical Mixtures Branch at (513) 569-[illegible]

Permit applicants proposing to use values other than those obtained from the sources identified above must provide justification for the use of such alternative values.

In order to correctly perform a detailed assessment, permit applicants must demonstrate, through the risk assessment process, that concentrations of hazardous waste constituents at potential receptors will not exceed acceptable levels. The definition of the term "acceptable levels" is broad, but selection of such levels generally will be based on the following criteria:

- If accepted federal or state health-based levels -- for example, maximum contaminant levels for drinking water, ambient water quality criteria for surface water, or verified reference doses for soil -- are available, they should be used by permit applicants.
- If no widely accepted health-based levels are used, the background concentration in the particular media should be used by permit applicants.
- As an alternative to the above approaches, a permit applicant may propose the use of an alternative level and provide justification for its use. The permit writer and the applicant then must negotiate an acceptable level.

Once all the above information has been compiled, the permit writer should evaluate the permit applicant's estimates of risk to human health and the environment. Because there is no level of risk that is universally considered to be acceptable, this determination is very subjective and normally will require the help of an expert in human health or ecological risk assessments. Experts may include EPA Regional National Environmental Policy Act (NEPA) coordinators and personnel from EPA's Office of Research and Development, the U.S. Fish and Wildlife Service, the National Oceanic and Atmospheric Administration, and such nongovernment personnel as consultants and university faculty. Permit writers may opt to take one of a number of courses on risk assessments currently being offered by EPA.

Although the general procedures described above are preferred for the conduct of risk assessments, in certain cases it may not be possible for the permit applicant to complete all the activities described and to quantify the risk caused by the unit. If a permit applicant claims that not all the information described above is available, the permit applicant should provide justification for not furnishing the information usually required in risk assessments. In such instances, the permit applicant should be required to perform more qualitative evaluations of risk, as opposed to the quantitative approach described above.

Whatever approach is used by a permit applicant to perform a risk assessment, several criteria must be met before the risk assessment can be accepted by the permit writer. First, risk assessments must be credible, as evaluated according to information submitted by the permit applicant in other parts of the permit application, including information on the unit design and operation and information on release rates generated from monitoring or modeling. To determine whether a risk assessment for an existing unit is credible, the permit writer may wish to visit the facility to examine the operations firsthand. Once convinced that a risk assessment is credible, the permit writer should then require it to be defensible. To make such a determination, the permit applicant will have to use quantitative data or best engineering judgment or a combination of the two.

5.0 WASTE CHARACTERIZATION AND TREATMENT EFFECTIVENESS

Waste characterization is an essential part of any Subpart X permit application. The application must fully describe the wastes entering a Subpart X unit and the residues and degradation products generated as a result of treatment. Waste characterization ensures the safe and effective handling of wastes. Therefore, if an applicant does not provide adequate waste characterization, the permit writer should request additional information through a NOD or deny the permit. Subsection 5.1 specifies criteria for evaluating waste characterization procedures proposed by permit applicants.

In addition to the requirement that permit applicants characterize their wastes, those applying for a permit for a Subpart X unit that uses treatment technologies are required to provide a report on the effectiveness of such treatment (see 40 CFR 270.23(d)). At publication of this manual, no universal definition of treatment effectiveness had yet been established. However, Subsection 5.2 discuses factors that can be used in the evaluation of reports by permit applicants concerning treatment effectiveness.

5.1 WASTE CHARACTERIZATION

Permit applicants must follow the general procedures for the identification of hazardous waste when evaluating potential hazardous wastes on site. The procedures are outlined in 40 CFR Part 261. An owner or operator first must determine whether a potential waste is excluded from the definition of a solid waste according to the criteria in 40 CFR 261.4. The second step is evaluating whether a material is a solid waste; the criteria in 40 CFR 261.2 are used to complete this evaluation. These criteria primarily concern evaluation of the type of and use of the material. Once it has been determined that a material is a solid waste, the owner or operator then should determine whether the waste is hazardous, using the procedures specified in 40 CFR 261.3.

The identification of a material as a solid waste is a key determination that must be made in order to address the applicability of Subpart X permitting standards. The basic decision-making criterion is that a material must be discarded to be a solid waste. Several issues concerning the identification of solid waste have arisen in relation to Subpart X permitting. These include:

- **Firing ranges** - The discharge of ball and sport ammunition at shooting ranges does not constitute hazardous waste activity. Shooting bullets is within the normal and expected pattern of use of the manufactured product. However, a recent decision by a Connecticut court reported in the "National Environmental Enforcement Journal," (February 1992), ruled that the shooting and subsequent placement of lead met the definition of "discarding" under RCRA and therefore was subject to the RCRA requirements.

- **Serviceable versus unserviceable** - Department of Defense (DoD) munitions and ordnance, so long as they are within the life cycle, are not waste. The life cycle includes manufacture and remanufacture, storage, and maintenance of pyrotechnics, explosives, and propellant munitions items. "Serviceable" and "not serviceable" are categories that indicate the ordnance's position in the national stockpile; they do *not* indicate whether the munitions or ordnance is waste. Rather, the point at which the munitions or ordnance is deemed a waste is when the transfer record is signed, acknowledging receipt at a demilitarization facility. However, this policy *does not* include items that have not become part of DoD's official inventory, such as manufacturing residues and off-specification products.

Once a material has been deemed a solid waste, the permit applicant should determine whether the waste is hazardous. In most cases, this determination is relatively straightforward. However, several issues regarding identification of hazardous waste have been the subject of controversy in relation to permitting issues under Subpart X. Such issues generally involve treatment of wastes in Subpart X units. Two examples of policies that affect of identification of hazardous waste are:

- Some Department of Transportation (DOT) Class C explosives are not reactive according to the RCRA definition under 40 CFR 261.23. Such explosives include small arms ball ammunition of 50 caliber or less. These items may be hazardous because of some other characteristic (for example, toxicity).

- Contaminated materials that exhibit a characteristic of a hazardous waste are regulated as such until the materials no longer exhibit any characteristics of a hazardous waste. Items like tools, containers, and process equipment, from which contaminants have been removed in cleaning operations before the items are placed in a Subpart X unit, generally will be considered nonhazardous wastes. Listed wastes and the resultant treatment residues must be properly excluded (for example, through the delisting process) from regulation before they are nonhazardous.

Owners or operators of Subpart X units should conduct waste characterization according to a waste analysis plan. The waste analysis plan must be submitted as part of the permit application and should meet all the requirements of 40 CFR 264.13. The waste analysis plan may provide two means of identifying wastes: (1) use of knowledge of the physical and chemical properties of the waste, including the use of information provided by off-site generators or facility personnel or (2) sampling and analysis of the waste. In certain cases, the waste analysis plan may specify the use of information on the process that generates the waste to characterize wastes treated or disposed of on site. However, in most cases, owners or operators of Subpart X units will be required to perform sampling and analysis of their wastes. The required elements for a waste analysis plan are described below, with particular emphasis placed on issues related to Subpart X units. Additional guidance on preparing waste analysis plans can be found in the document *Waste Analysis Plans, A Guidance Manual*, EPA, 1984. Additional criteria for evaluating waste analysis procedures specific to certain Subpart X permit applications that involve the treatment of energetic wastes can be found in a sampling and analysis guidance as Appendix B to this guidance manual.

5.1.1 Selection of Rationale for Parameters

The permit application should provide a list of the parameters that will be analyzed for in the waste. The parameters should be specific for the type of waste to be analyzed, and the rationale for their selection should be provided. In general, presenting an adequate rationale involves providing a convincing discussion of how monitoring of the selected parameters will provide the best information on the fate of hazardous waste and hazardous constituents. When establishing parameters, permit applicants should *not* be allowed to use non-specific categories of wastes, such as "other explosives" for an OB/OD unit.

5.1.2 Selection of Test Methods

Owners or operators should submit a list of test methods for evaluating wastes for parameters of concern. When possible, the test methods should be drawn from SW-846. In general, use of the sampling and analysis methods outlined in Appendix I of 40 CFR Part 261 is required for obtaining a representative sample of the waste. Owners and operators also should use the tests outlined in 40 CFR Part 261 Subpart C to determine whether such representative samples of wastes exhibit any characteristics of hazardous waste. Permit writers also should require the

applicant to use test methods specified in SW-846, including the TCLP and total waste analyses, to determine compliance with the land disposal restrictions, as required in 40 CFR 268.7.

Standard analytical procedures can be used to analyze most constituents in 40 CFR Part 264 Appendix IX. Permit writers should be aware, however, that for many constituents commonly found in wastes managed in Subpart X units, no test methods are specified in SW-846. For example, there are no approved solid and hazardous waste test methods for several explosive compounds typically treated in OB/OD units. In such cases, permit applicants should attempt to use other EPA (for example, test methods specified in EPA's *Test Methods for Water and Waste*) or non-EPA (for example, American Society of Testing and Materials test methods) standardized test methods. Finally, in some cases, the facility may propose alternative test methods. Whenever an applicant proposes to use a test method that is not specified in SW-846, the applicant should explain the method in detail and provide justification for its use. In evaluating the suitability of methods not found in SW-846, permit writers may wish to enlist the help of experts in evaluating test methods, such as those found in the Methods Section in the Office of Solid Waste.

5.1.3 Frequency of Analysis

Owners or operators are required to specify the frequency of analysis provided for in the waste analysis plan, with respect to when waste will be reevaluated to ensure that the waste analysis is accurate and up-to-date. Although the waste analysis plan requirements in 40 CFR 264.13 do not specify a particular frequency for reevaluation of wastes, permit writers should require that analysis be repeated at least annually and whenever the process generating the waste or the waste management procedures change. Permit writers also may specify more frequent analysis because of (1) health and safety considerations, (2) variability in the types of wastes to be treated, (3) frequency (or volume) of waste treatment or disposal in the unit, or (4) any other factors that the permit writer determines might result in a need for more frequent analysis. In the case of certain explosive wastes, less frequent analysis may be warranted if the permit applicant can demonstrate that analysis of the waste poses a threat to persons conducting the analysis through risk of fire, explosion, release of toxic vapors or gases, or other conditions that may pose unwarranted health and safety or environmental risks.

5.1.4 Requirements for Facilities That Receive Off-Site Wastes

Facilities that have prospective Subpart X units that receive wastes from off-site generators are subject to additional waste analysis requirements. Such facilities are required to specify any procedures for using information supplied by off-site generators in lieu of actual analysis at the site. A permit applicant also must specify procedures to be implemented to ensure that the wastes actually received match the description of those wastes on the hazardous waste manifest.

5.2 TREATMENT EFFECTIVENESS

As part of the Subpart X permit application process, permit writers will be required to evaluate submissions by permit applicants concerning the treatment effectiveness of a Subpart X unit. Permit applicants are required to provide this information under 40 CFR 270.23(d), which requires applicants to provide information on a demonstration based on laboratory or field data, of the effectiveness of the treatment. In performing such evaluations, permit writers may consult with experts in evaluating treatment effectiveness. Experts may include process engineers from EPA Regional and state environmental offices, personnel from CERI, and outside sources, such as university faculty and consultants. Permit writers also may wish to consult EPA bulletin boards and libraries for information on the effectiveness of treatment demonstrated for certain technologies. To further assist permit writers, two case studies that incorporate a review of information presented with respect to treatment effectiveness for two Subpart X permit applications also are included as Appendix C to this manual.

When evaluating permit applications for information on treatment effectiveness, permit writers should look for evidence of effectiveness that is based on (1) laboratory, pilot-scale, or bench-scale results or (2) field data for existing units. Data on the wastestreams being treated, both before and after treatment, in terms of physical or chemical properties of the waste, should be presented. The reports should also detail the effectiveness of the treatment for each individual wastestream to be treated by the unit. Permit writers should base their evaluation of submissions by owners or operators on the following factors:

- Hazardous waste constituents that are monitored
- Evaluation of physical properties conducted by the applicant

- Location of sampling points
- Sampling frequency
- Sample collection and preservation techniques
- Methodologies for evaluation of data
- Quality assurance and quality control procedures

If the permit writer determines from evaluation of the above elements (or of other factors) that the report demonstrating treatment effectiveness is inadequate, a NOD requiring the submission of additional information or the conduct of different procedures should be issued, or the permit should be denied.

Permit applicants may generate data on treatment effectiveness by obtaining a research, development, and demonstration (RD&D) permit under the requirements of 40 CFR 270.65. Such permits can be issued for a period of up to one year (with a possibility of three separate 1-year renewals). The RD&D permitting procedures give the permit writer a wide range of authorities to incorporate provisions similar to those in a full RCRA permit (for example, operation, monitoring, closure, and corrective action provisions). Permit writers should note, however, that RD&D permits should not be issued to full-scale treatment units. Additional information on the issuance of RD&D permits can be found in the following reference:

EPA, 1986. Guidance Manual for Research, Development, and Demonstration Permits Under 40 CFR Section 270.65 (EPA/530-SW-86-008).

One of the major purposes of the requirements for treatment effectiveness is to allow the permit writer to determine whether subsequent treatment of residues generated by a permit applicant's treatment process is necessary. Permit writers should evaluate the data generated from treatment processes to determine whether the treatment should be allowed as a final treatment step or whether additional treatment of residues from the process should be required. For example, if results from the operation of an OB/OD unit show that the concentration of certain key constituents in the waste is reduced by only 60 percent, a permit writer may wish to require additional treatment, such as incineration, for the treatment residues from the process.

When evaluating reports on treatment effectiveness permit writers should bear in mind that no specific measure of treatment effectiveness can be applied to all Subpart X units. The

determination whether treatment is effective is a site-specific determination that must be made on a case-by-case basis. However, there are a number of guidelines that permit writers can use in evaluating treatment effectiveness. These aids include guidances prepared for other types of hazardous waste management units that discuss how to determine treatment effectiveness. For example, for units that use combustion principles, guidances for incinerators and boilers and industrial furnaces may prove helpful to the permit writer in evaluating treatment effectiveness. Table 5-1 provides examples of guidances that may be used to assist the permit writer in evaluating permit applicants' submissions regarding treatment effectiveness.

If a permit writer determines that a proposed treatment method is not effective, the permit writer has no clear authority to compel the use of an alternative technology. This approach has been used in the past with mixed results. Region IV attempted to require the use of alternative technologies for OB/OD units, but it was determined that there is no authority under RCRA to compel the use of alternative technologies. The state of Utah, however, has been able to compel owners or operators to use alternative technologies. In any event, the permit writer may always suggest alternative technologies to a permit applicant. The issue of treatment effectiveness historically has been troublesome for Subpart X permit writers with respect to OB/OD units; lists of potential treatment and disposal methods for energetic compounds (as alternatives to OB/OD) are presented in Appendix E to this guidance manual.

Permit writers may, however, reject the use of technologies that are clearly ineffective, as evaluated according to the requirements of the environmental performance standard in 40 CFR 264.601. This authority can be used to issue NODs (or permit denials) when the failure of a treatment technology to be effective will pose a threat to human health or the environment. Permit writers should use this authority to prevent the use of technologies that are clearly ineffective. For example, an OB/OD unit that is being used to treat a waste containing metal casings should not be permitted if the metals from the waste are simply being volatilized and released to the air. In such a case, permit writers may state that the operation of the unit would violate the environmental performance standard for air for Subpart X units and require that additional procedures be performed, without specifying the use of a particular technology.

Table 5-1

Guidance Manuals That are Potentially Applicable to Permit Applicants' Demonstrations of Treatment Effectiveness

Type of Subpart X Unit	Guidance Manuals
Thermal Treatment Processes	EPA, 1989. Handbook - Hazardous Waste Incinerator Measurement Guidance Manual (EPA/625/6-89/021) Office of Solid Waste (June). EPA, 1990. Methods Manual For Compliance with the BIF Regulations (EPA/530-SW-91-010) Office of Solid Waste (December). EPA, 1991. Implementation Document for Boiler and Industrial Furnace Regulations Office of Solid Waste (November).
Land Treatment and Disposal Units	EPA, 1986. Permit Guidance Manual On Hazardous Waste Land Treatment Demonstrations, Office of Solid Waste.

6.0 APPLICABILITY OF EXISTING TECHNOLOGY STANDARDS

A matrix that matches potential Subpart X technologies with potentially applicable existing technology standards is provided in Table 6-1. The table presents information on the potential applicability of existing technology standards to controlling releases of hazardous wastes or hazardous constituents to the three environmental media (that is, air; ground water and subsurface environment; and surface water, wetlands, and surface soils) that would most likely be affected by the operation of each Subpart X unit.

The information in Table 6-1 is presented as general guidance for the permit writer on existing standards that may be useful for incorporation as permit conditions in the Subpart X permitting process. The actual permit conditions issued to a Subpart X unit are dependent on unit- and facility-specific considerations. Therefore, decisions on the incorporation of any of the requirements listed in Table 6-1 into Subpart X permits must be made on a case-by-case basis.

Once permit writers have identified applicable design and operating standards for other types of hazardous waste management units, permits writers should then refer to existing guidance manuals regarding the permitting of these units. Table 6-2 contains a list of guidance manuals that may aid permit writers in developing permit conditions for Subpart X units based on standards for conventional hazardous waste management units in 40 CFR Part 264 Subparts I through O.

Table 6-1

Potential Applicability of Existing Standards
to Subpart X Technologies

Type of Treatment Processes	Air	Ground Water and Subsurface Environment	Surface Water, Wetlands, and Surface Soils
Controlled Thermal Processes Sludge dryers Multiple hearth units Carbon regeneration units Other controlled non-Subpart O thermal technologies	40 CFR 270.19 Incinerator permitting requirements 40 CFR 270.62 Trial burn requirements 40 CFR 264.340 (Subpart O) Incinerator standards	40 CFR 264.90 (Subpart F) Releases from solid waste management units (SWMU) 40 CFR 264.92 Ground-water protection standard	
Uncontrolled Thermal Processes Open burning and open detonation units Other uncontrolled thermal processes	40 CFR 270.19 Incinerator permitting requirements 40 CFR 270.62 Trial burn requirements 40 CFR 264.340 (Subpart O) Incinerator standards	40 CFR 264.251 Design and operating requirements for waste piles 40 CFR 264.90 (Subpart F) Releases from solid waste management units (SWMU) 40 CFR 264.92 Groundwater protection standard	40 CFR 264.251 Design and operating requirements for waste piles

Table 6-1

Potential Applicability of Existing Standards
to Subpart X Technologies *(continued)*

Type of Treatment Processes	Air	Ground Water and Subsurface Environment	Surface Water, Wetlands, and Surface Soils
Wastewater Treatment Processes Ultraviolet (UV) ozonation Wet air oxidation Biological treatment Other wastewater treatment processes	40 CFR Part 264 Subparts AA and BB Air emissions standards for hazardous waste management units	40 CFR 270.16 Tank permitting requirements 40 CFR 264.190 (Subpart J) Tank standards 40 CFR 264.90 (Subpart F) Releases from solid waste management units (SWMU) 40 CFR 264.92 Ground-water protection standard	40 CFR 270.16 Tank permitting requirements 40 CFR 264.190 (Subpart J) Tank standards

Table 6-1

Potential Applicability of Existing Standards
to Subpart X Technologies *(continued)*

Type of Treatment Processes	Air	Ground Water and Subsurface Environment	Surface Water, Wetlands, and Surface Soils
Non-Aqueous Chemical and Biological Processes Chemical treatment Biological degradation Composting	40 CFR Part 264 Subparts AA and BB Air emissions standards for hazardous waste management units	40 CFR 270.16 Tank permitting requirements 40 CFR 264.190 (Subpart J) Tank standards 40 CFR 264.251 Design and operating requirements for waste piles 40 CFR 264.273 Design and operating requirements for land treatment 40 CFR 264.90 (Subpart F) Releases from solid waste management units (SWMU) 40 CFR 264.92 Ground-water protection standard	40 CFR 270.16 Tank permitting requirements 40 CFR 264.190 (Subpart J) Tank standards 40 CFR 264.251 Design and operating requirements for waste piles 40 CFR 264.273 Design and operating requirements for land treatment

Table 6-1

Potential Applicability of Existing Standards to Subpart X Technologies *(continued)*

Type of Treatment Processes	Air	Ground Water and Subsurface Environment	Surface Water, Wetlands, and Surface Soils
Geologic Repositories and Other Land Disposal Technologies Salt Domes Missile Silos Old mine shafts Caves Other land disposal technologies		40 CFR 264.301 (b) Design and operating requirements for landfills 40 CFR 146.4 Underground injection control, criteria for exempted aquifers 40 CFR 146.4 Underground injection control, information to be considered by the Director 40 CFR 264.90 (Subpart F) Releases from solid waste management units (SWMU) 40 CFR 264.92 Ground-water protection standard	40 CFR 264.301 (b) Design and operating requirements for landfills 40 CFR 146.4 Underground injection control, criteria for exempted aquifers 40 CFR 146.4 Underground injection control, information to be considered by the Director

Table 6-1

Potential Applicability of Existing Standards to Subpart X Technologies *(continued)*

Type of Treatment Processes	Air	Ground Water and Subsurface Environment	Surface Water, Wetlands, and Surface Soils
Miscellaneous Processes		40 CFR 264.250 (c) Exemption for indoor waste piles	40 CFR 264.250 (c) Exemption for indoor waste piles
Shredders			
Filter presses		40 CFR 264.90 (Subpart F) Releases from solid waste management units (SWMU)	
Indoor waste piles		40 CFR 264.92 Ground-water protection standard	

Table 6-2

Additional Guidance Manuals for Conventional Hazardous Waste Management Units

Containers

EPA, 1988. Guidance for Permit Writers: Facilities Storing Hazardous Waste in Containers. Office of Solid Waste.

EPA, 1982. Facilities Storing Hazardous Waste In Containers: A Technical Resource Document for Permit Writers.

Tanks

EPA, 1986. Technical Resource Document for the Storage and Treatment of Hazardous Waste in Tank Systems. Office of Solid Waste (December).

Surface Impoundments, Landfills, and Waste Piles

EPA, 1985. Draft Minimum Technical Guidance on Double Liner System for Landfills and Surface Impoundments - Design, Construction, and Operation. Office of Solid Waste (May 24).

EPA, 1988. Guide to Technical Resources for the Design of Land Disposal Facilities. Office of Research and Development, Cincinnati, Ohio (December).

EPA, 1989. Requirements for Hazardous Waste Landfill Design, Construction, and Closure. Office of Research and Development, Cincinnati, Ohio (August).

Land Treatment Units

EPA, 1986. Permit Guidance Manual on Hazardous Waste Land Treatment Demonstrations. Office of Solid Waste (November).

Incinerators

EPA, 1983. Guidance Manual for Hazardous Waste Incinerator Permits. Office of Solid Waste (July).

EPA, 1982. Guidance for Permitting of Hazardous Waste Incinerators. Office of Solid Waste (July).

7.0 CLOSURE AND POST-CLOSURE

Under the requirements of 40 CFR 264.603, Subpart X permit applicants are required to submit to the permit writer information on closure of the unit and, for units where wastes, contaminated structures, or contaminated environmental media will be left in place at closure, information on the provisions for post-closure care for the unit. Permit applicants must submit information on post-closure for all disposal units (for example, geologic repositories). Owners or operators of Subpart X units that are conducting treatment should also be required to submit contingent procedures for post-closure to be implemented in the event that all wastes or contaminated structures and environmental media (for example, contaminated soils) cannot be removed or decontaminated at closure.

Information on closure and post-closure procedures should be submitted as part of closure and post-closure plans, in accordance with the requirements of 40 CFR Part 264 Subpart G. When a Subpart X unit, (or portion of a unit) appears to be similar to another type of hazardous waste management unit permit writers also should require permit applicants to submit relevant unit-specific information for relevant hazardous waste management units. In doing so, permit writers should use information submitted by the applicant to apply technology-based standards for other types of units (see discussions in Sections 3 and 6 of this guidance) to the Subpart X unit. As part of this process, permit writers should require:

- For disposal units for which wastes will remain in place after closure, the closure and post-closure provisions for landfills in 40 CFR Part 264 Subpart N. These provisions also should be followed when treatment units cannot meet the closure performance standard under 40 CFR 264.111, that is, when contaminated structures and environmental media cannot be removed or decontaminated.

- For disposal units that are to be clean-closed, permit writers should require applicants to follow existing requirements for clean-closure of surface impoundments (see 40 CFR 270.1(c)(5)).

Further guidance for permit writers on closure and post-closure requirements is available in the following document:

EPA, 1987. RCRA Guidance Manual for Subpart G Closure and Post-Closure Care Standards and Subpart H Cost Estimating Requirements. Office of Solid Waste

To further assist permit writers, two case studies that incorporate the review of cl and post-closure information for OB/OD units in two Subpart X permit applications are p as Appendix C to this guidance manual.

As they must for other types of hazardous waste management units, permit applica provide financial assurance for closure and post-closure, according to the requirements of Part 264 Subpart H. All Subpart X units must have financial assurance for closure and liat coverage for sudden occurrences, such as releases caused by fires or explosions. In additio: Subpart X units classified as disposal units must have financial assurance for post-closure a liability for nonsudden occurrences, such as ground-water contamination resulting from th operation of a landfill. Guidance to assist permit writers in evaluating proposals for financ assurance by Subpart X permit applicants can be found in the following document.

EPA, 1982. Financial Assurance for Closure and Post-Closure Care: Requirements Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities. Office of Solid Waste (May).

Closure plans submitted by permit applicants should provide an indication of the exte which hazardous constituents will be removed from environmental media. For ground-water levels should be established in accordance with the procedures in 40 CFR Part 264 Subpart F. contaminated soils, either surface soils or those in the vadose zone, or for surface waters, leve should be established in accordance with procedures currently used for RCRA corrective acti and cleanups under CERCLA authority. The establishment of cleanup levels for closure norm should proceed according to the following hierarchy:

- If established federal or state health-based levels -- for example, action levels from the proposed corrective action regulations in 40 CFR Part 2(Subpart S, maximum contaminant levels for drinking water, ambient wa quality criteria for surface water, or verified reference doses for soil -- available, they should be used by permit applicants.
- If no widely accepted health-based levels are available, the background concentration in the particular media should be used by permit applicant
- As an alternative to the above approaches, a permit applicant may propos the use of an alternative level and provide justification for its use. The permit writer and the permit applicant then must negotiate an acceptable level.

Permit writers also should be aware of the requirements for units that would be permitted under Subpart X but will close under interim status. Such facilities should be required to close under 40 CFR Part 265 Subpart G and any other unit-specific requirements for the unit in question. Owners or operators of such interim status facilities also must submit information to demonstrate financial assurance as required under 40 CFR Part 265 Subpart H. Because many such units will have obtained interim status under Subpart P of Part 265, many must close in accordance with 40 CFR 265.382. Permit writers also can require these units to be closed as landfills if these units cannot meet applicable performance standards for closure. If such a unit must be closed as a landfill, a post-closure permit should be issued; in this case all applicable closure, financial assurance, and ground-water monitoring requirements will apply. Guidance on evaluating clean closures of units closing under interim status can be found in the following document.

EPA, 1989. Guidance on Demonstrating Equivalence of Part 265 Clean Closure With Part 264 Requirements. Office of Solid Waste.

Although the requirements stated above always will apply to closures of Subpart X units, there may be cases in which the permit writer will be required to use discretion in applying them. Such instances usually will involve the performance of limited closure activities at the time of closure of the Subpart X unit, with the full closure being completed at a later date. An example of such a case may be closure of a Subpart X unit (for example, an OB/OD unit) that is located within an active impact range. In such cases it may be difficult to determine whether contamination discovered near a unit is the result of the operation of the Subpart X unit or of ongoing activities at the range. In such cases a limited closure, consisting of all practical activities -- for example, removal of contaminated equipment and structures -- should be undertaken, with the remainder of closure activities being completed at the time the impact range is closed.