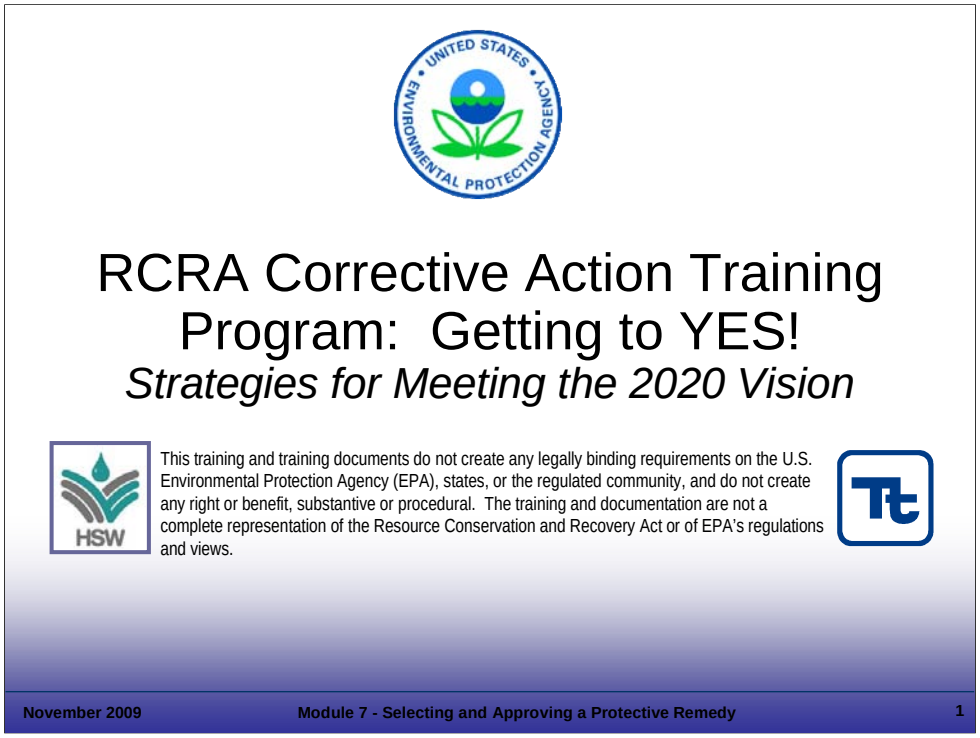


Notes:

Purpose of Slide

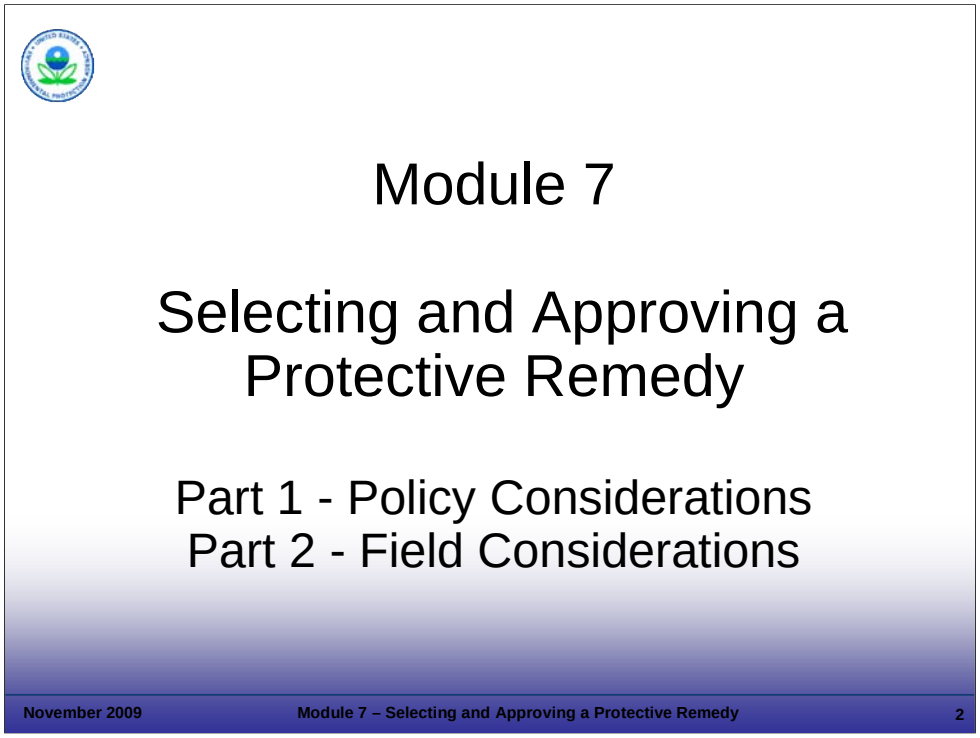
- This is the introductory slide to Module 7, Selecting and Approving a Protective Remedy.

Key Points

- None.

References

- None.



Notes:

Purpose of Slide

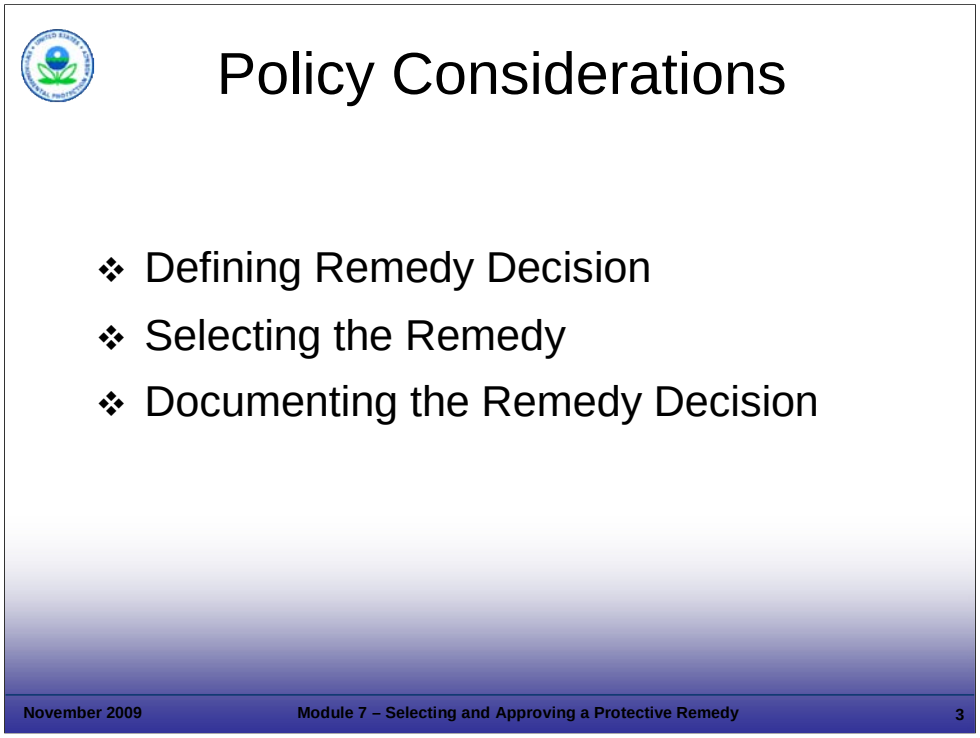
- This module familiarizes the class with how remedies are chosen and documented. The module is broken into two sections: policy considerations and field considerations.

Key Points

- Examples of policy considerations are cleanup goals and objectives, EPA's threshold and balancing criteria, selecting institutional controls (ICs), and documenting remedy decisions (CA 400).
- Field considerations include hydrogeology and contaminant distribution at the facility. Field considerations also include facility operations that limit access for characterization or cleanup.
- Both policy and field considerations play significant roles in making a remedy decision.

References

- None.



Notes:

Purpose of Slide

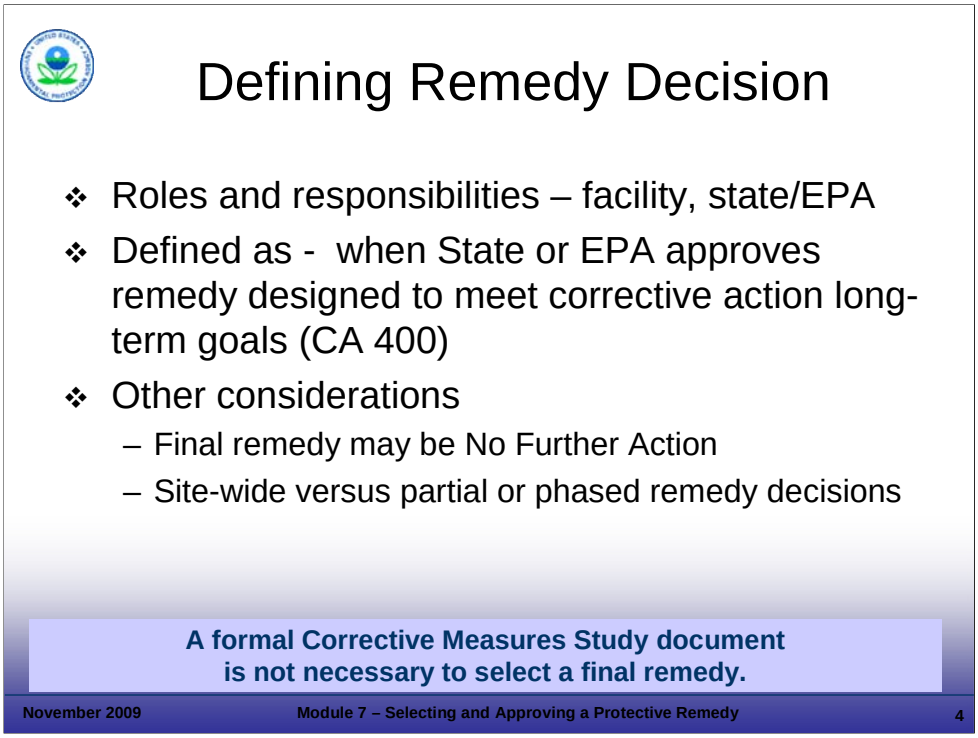
- Provide an overview of policy considerations related to selecting a remedy that is protective of human health and the environment (HH&E).

Key Points

- This module will discuss policy considerations in selecting a remedy and achieving a Remedy Decision including:
  - Key elements and considerations in making a Remedy Decision
  - Factors considered in selecting an appropriate remedy including land use, remediation goals, remedy evaluation criteria, and use of institutional controls .
  - We will end this portion of the module by discussing the process of documenting the remedy decision.

References

- EPA. 2000. Final Remedy Selection for Results-Based RCRA Corrective Action (Fact Sheet #3).



Notes:

Purpose of Slide

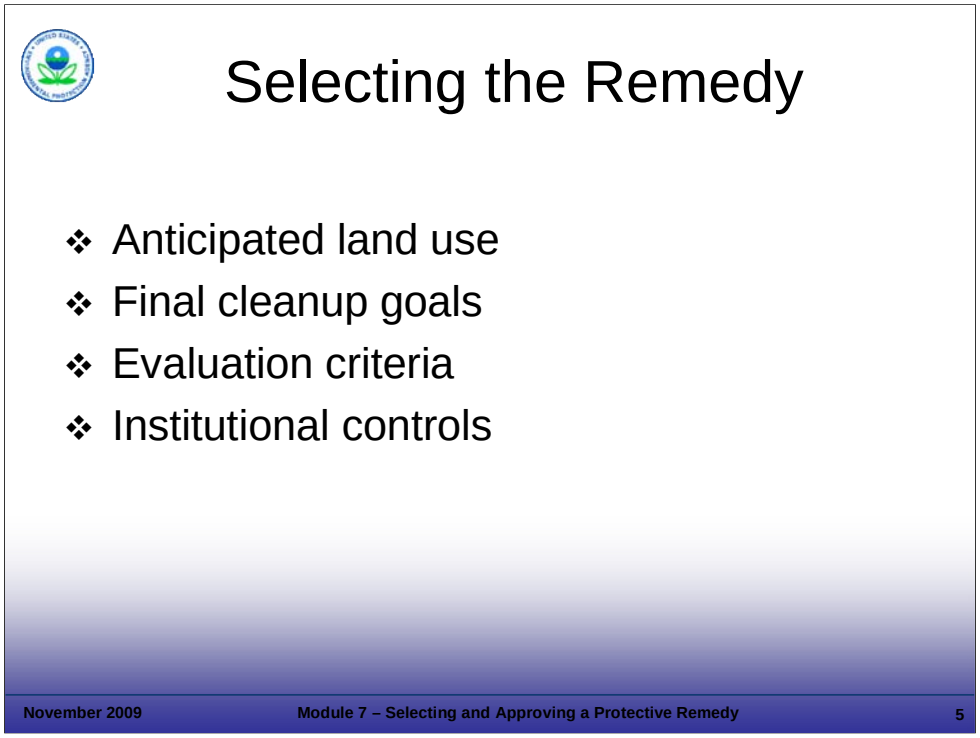
- Provide the key elements of Remedy Decision, as specified in EPA's definition of the measure. Remedy Decision is a milestone toward the 2020 Vision.

Key Points

- The Remedy Decision milestone is met when the State or EPA approves a remedy designed to meet RCRA CA long-term goals of protection of HH&E. The RCRA Info Code is CA 400.
- As we discussed previously, the owner/operator (o/o) studies and identifies the recommended remedy.
- The regulatory authority reviews and approves the recommended remedy. Later in this module, we will discuss how EPA or the state can document the remedy decision.
- A Remedy Decision also applies when no further CA is required because stabilization measure(s) have already been implemented or because site characterization has demonstrated the attainment of long-term RCRA CA goals. In some cases, especially at lower concern facilities, successful remedies may have been achieved through means such as stabilization measures and long-term CA goals met before they receive formal regulatory attention. In these cases, the regulatory agency need only affirm the remedies and address any needed long-term controls through appropriate processes.
- When a site-wide remedy decision has been made, Remedy Decision must be linked to the entire facility. Partial or phased remedies or other remedy decisions pertaining only to specific areas of the facility are to be linked only to the specific areas of implementation (not the "Entire Facility").

References

- EPA. 2005. Permitting and Corrective Action (PCA) Program Area Analysis (PAA) Report: Appendix D, National Details for Corrective Action Event Codes. Final Report. Win/Informed Executive Steering Committee. July 28.



Notes:

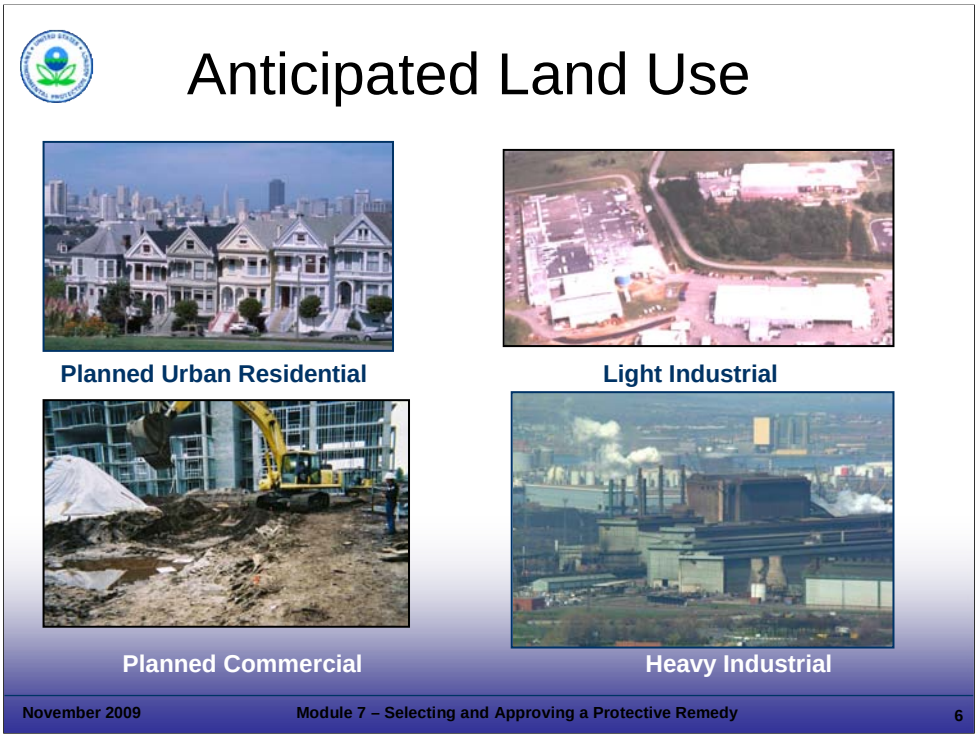
Purpose of Slide: Review key factors that go into selecting a remedy to meet the remedy objectives we discussed.

Key Points

- Anticipated land and groundwater use - One of the most important aspects of remedy selection is anticipated land and groundwater use, which will influence cleanup objectives, including: timing, cleanup criteria, and points of compliance. Land use will also affect design considerations and construction options – for example, aesthetics may not be as important to operating facilities as facilities planned for redevelopment.
- Final Cleanup Goals – Final cleanup goals for all sites involve 1) protecting human health and the environment (HH&E) and maintain that protection over time 2) addressing all environmental media, and 3) no unacceptable risk based on current and reasonably anticipated future land and groundwater uses control sources
- Remedy Evaluation Criteria - EPA has established performance standards that are useful for evaluating and selecting remedies. These standards are known as threshold criteria and balancing criteria. Threshold criteria are used to determine if a remedy is acceptable (that is, protective of HH&E); balancing criteria assist in selecting from a range of acceptable remedies.
- Institutional Controls – The selected remedy will often be a combination of engineering controls (ECs) and ICs. ICs are non-engineered instruments, such as administrative and legal controls, that help to minimize the potential for human exposure to contamination and protect the integrity of the remedy.

References

None



Notes:

Purpose of Slide

- Current and reasonably anticipated land use and a groundwater use designation by EPA or the State will help to define the cleanup objectives necessary for the remedy. Companies should select remedies based on the current and reasonably anticipated use of the site; the regulator should approve the remedies based on that use. Anticipated use planning ties back to the 2nd and 4th principles we discussed in Module 2 (2nd – environmental cleanup to risk-based levels is the goal and 4th – tailor sustainable solutions considering risk management and revitalization).

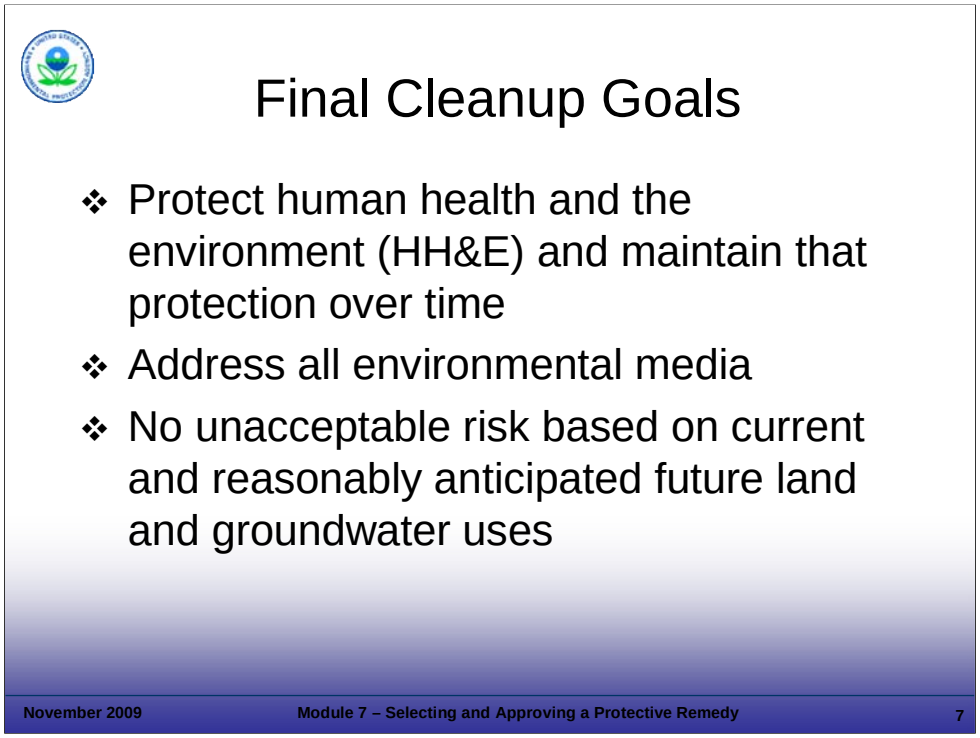
Key Points

- Establishing the current and reasonably anticipated land and groundwater uses is the first step in risk-based CA. It is necessary to establish the land and groundwater uses to determine actual and potential receptors, which in turn form the basis for establishing risk-based cleanup criteria.
- It is important to realize that land use and groundwater use should be evaluated separately: for example, a currently operating manufacturing facility may be anticipated to remain industrial, but may overlie an aquifer currently used as a drinking water supply.
- Facilities must select remedies that are protective of HH&E. MCLs may be cleanup criteria for protecting drinking water sources. EPA's position is that decisions on cleanup criteria should relate to current and reasonably anticipated land and groundwater uses. EPA does not expect that MCLs or other drinking water criteria will necessarily be the applicable cleanup criteria in areas that are not reasonably expected to be sources of drinking water. As stated in the Groundwater Handbook:

  Groundwater cleanup levels for human health should typically be developed by using existing cleanup standards (e.g., drinking water standards) when they are available and when using them is protective of current and reasonably expected exposures. If a cleanup standard is not available for a constituent, a facility should first assess all actual and potential exposures to the contaminant(s). Then, a groundwater cleanup level should be developed based on the magnitude of exposure (i.e., dose), and the toxicity of the contaminant resulting in an estimate of risk. Groundwater cleanup levels are then calculated to fall within generally acceptable levels of risk….Higher cleanup levels may be appropriate, for a given facility, for example, when: … the groundwater designation is not a current or reasonably expected source of drinking water, and contaminants in groundwater would not result in unacceptable impacts to hydraulically connected surface water bodies. (pp. 5.1-5.3)
- State regulators have the responsibility of regulating groundwater use in their state, and states may have a position relating to groundwater protection or cleanup that is more stringent than the federal guidance. For instance, a state may designate all groundwater as a current or potential drinking water source, even in industrial areas where groundwater is not currently or likely ever to be used as a water supply. In this case, state regulators may find longer-term remediation solutions, such as monitored natural attenuation coupled with ICs, to be acceptable. While it may take years or decades to achieve drinking water standards, HH&E would be protected during the cleanup period while the facility remains industrial.
- There are special considerations for establishing cleanup criteria for facilities where NAPLs are present; we will cover such situations in subsequent slides.

References

- EPA. 2004. Handbook of Groundwater Protection and Cleanup Policies for RCRA Corrective Action for Facilities Subject to Corrective Action Under Subtitle C of the Resource Conservation and Recovery Act. EPA 530-R-04-030. Update. April.



Notes:

Purpose of Slide: Review remedy goals and the factors that impact remedy decisions.

Key Points

- CA remedies must be protective of HH&E and maintain protection over time.
- Remedy decisions must address contamination in all environmental media – groundwater, surface water, soil, sediment, and air – and be designed to meet the cleanup objectives.
- RCRA requires that cleanup be achieved to levels that are protective of HH&E, and EPA interprets that to mean that cleanup objectives should address risk based on current and reasonably anticipated land and groundwater uses. As stated in the Groundwater Handbook:

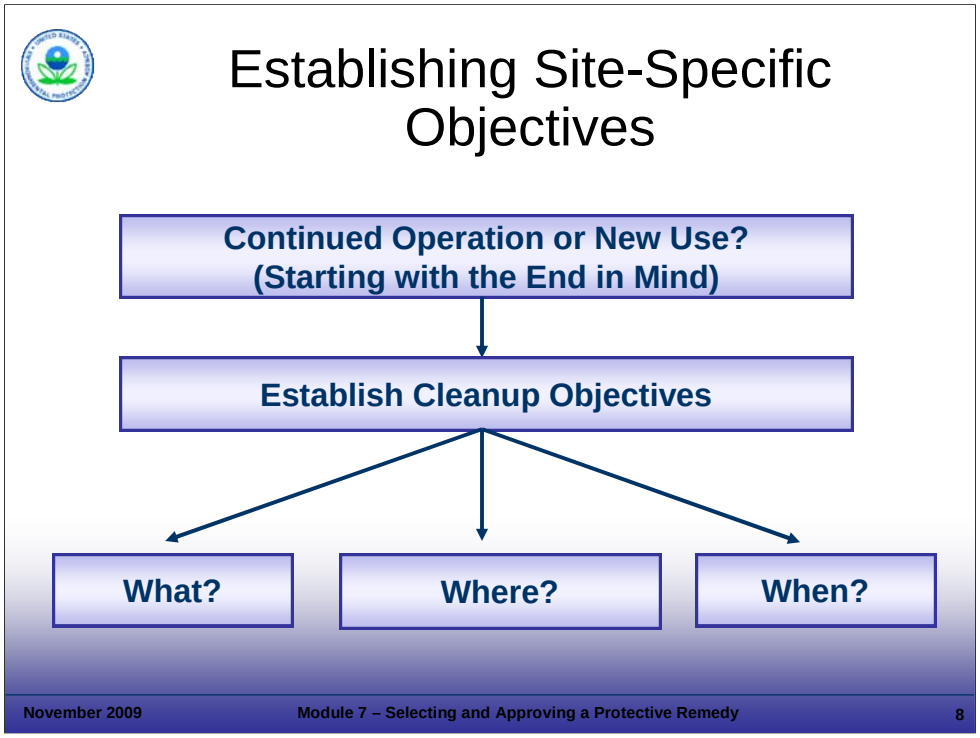
  EPA recommends that groundwater cleanup levels be based on the maximum beneficial use to ensure that groundwater is cleaned up to levels that protect HH&E both now and in the future. (p. 5.1)

  The maximum beneficial use, determined by EPA or State regulators, is the current or reasonably expected use that warrants the most stringent groundwater cleanup levels. (p. 5.3)
- A few examples include:
  - From a federal perspective, cleanup criteria at manufacturing facilities where groundwater is not a current or reasonably anticipated future source of drinking water do not need to be set at maximum contaminant levels (MCLs), but rather at levels based on potential exposure.
  - Similarly, groundwater cleanup criteria at facilities that are being revitalized under a Brownfields agreement for urban residential use, for instance, may not be set at MCLs (from a federal perspective) if groundwater is not a current or reasonably anticipated source of drinking water.
- In each of these cases, ICs and ECs are expected to provide long-term protection. For instance:
  - The state may require the manufacturing facility to have a restrictive covenant, which would prohibit groundwater use.
  - The urban residential area may have a requirement for each home to be constructed with a vapor intrusion barrier, and with restrictions relating to well drilling for home irrigation.
- Cleanup criteria should be set at MCLs when there is a reasonable expectation that groundwater will be used as a drinking water source, or if the contaminated groundwater is hydraulically connected to an aquifer used for drinking water. From the Groundwater Handbook:

  For groundwater that is currently used or designated as a current or reasonably expected source of drinking water, EPA recommends that regulators identify cleanup levels based on a residential drinking water exposure scenario. Even if no one is currently drinking the groundwater, the cleanup level should generally be based on drinking water use if the aquifer is considered by EPA or the State to be a reasonably expected future source of drinking water. (p. 5.4)

References

- EPA. 2007. Final Memorandum. Ensuring Effective and Reliable ICs at RCRA Facilities. June 14.
- EPA. 2004. Handbook of Groundwater Protection and Cleanup Policies for RCRA Corrective Action for Facilities Subject to Corrective Action Under Subtitle C of the Resource Conservation and Recovery Act. EPA 530-R-04-030. Update. April.



Notes:

Purpose of Slide

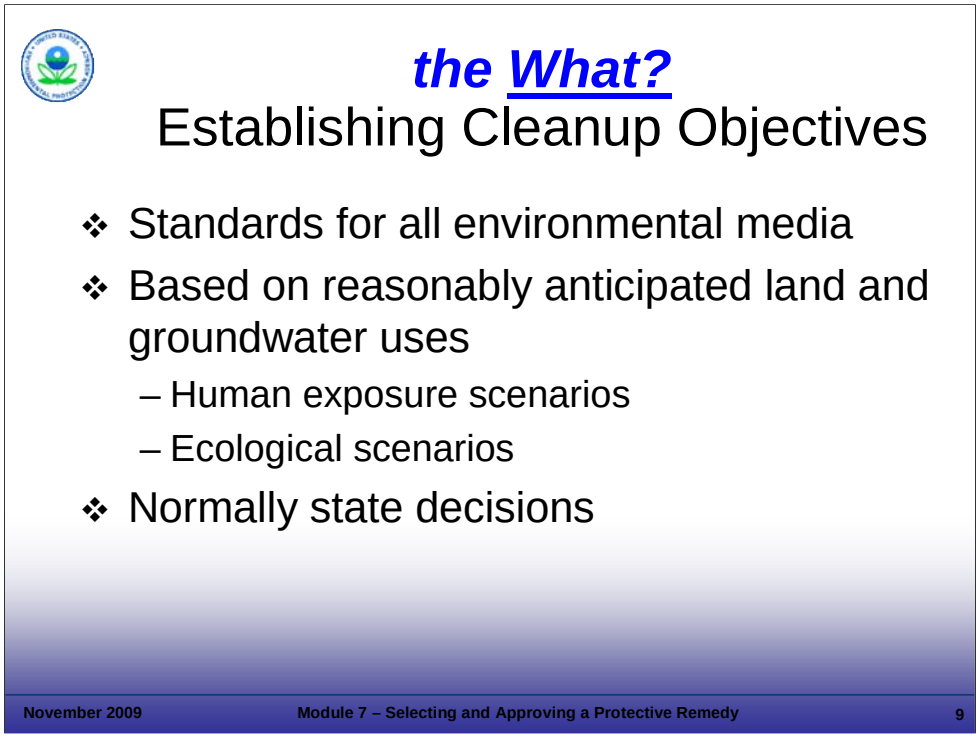
- Reiterate that reasonably anticipated use aligns with the approach discussed in Module 4, Starting with the End in Mind.

Key Points

- Once the reasonably anticipated use is established, specific cleanup objectives can be identified.
- The cleanup objectives are the "what," "where," and "when" of final remedies.
- We will explain these "what," "where," and "when" objectives further in the following slides.

References

- EPA. 2004. Handbook of Groundwater Protection and Cleanup Policies for RCRA Corrective Action for Facilities Subject to Corrective Action Under Subtitle C of the Resource Conservation and Recovery Act. EPA 530-R-04-030. Update. April.



Notes:

Purpose of Slide

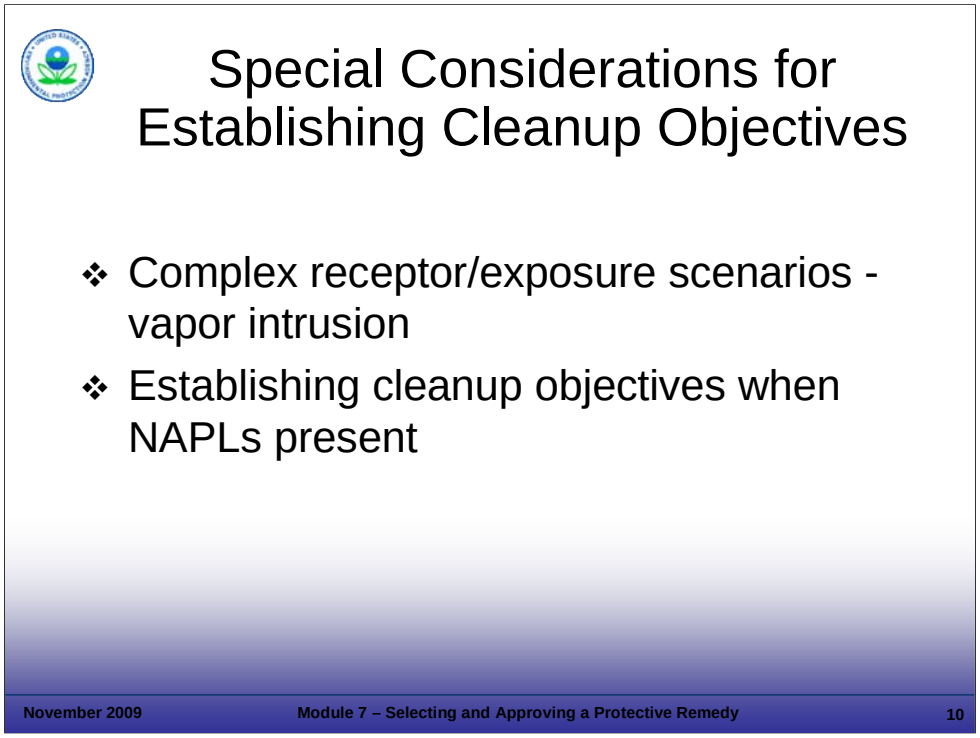
- Discuss establishing cleanup objectives in all environmental media – air, groundwater, surface water, sediment, soil, and air.

Key Points

- Cleanup criteria typically represent *what* specific numerical cleanup levels a facility needs to meet. These criteria are established for all contaminated media based on reasonably expected land uses, State or EPA groundwater use designations, and/or cross media transfer (e.g., soil to groundwater).
- Cleanup criteria for soil and groundwater are typically based on human exposure scenarios such as direct contact, ingestion, and inhalation (vapor intrusion) whereas sediment and surface water criteria are more often established based on ecological considerations.
- Cleanup criteria should typically be developed by using existing cleanup standards or guidelines (for example, drinking water standards or surface water criteria for protection of aquatic organisms) when they are available and when using them is protective of current and reasonably expected exposures.
- If a cleanup standard or guideline is not available to establish an applicable cleanup criterion for a site contaminant, the facility may conduct a risk assessment to develop a cleanup level based on the magnitude of exposure and the toxicity of the contaminant.
- State regulations and guidance are important in establishing cleanup levels. If a State is not authorized for CA, EPA will make these decisions.
- Cleanup criteria should be consistent with the identified groundwater use designation, reasonably expected worker or public exposure, and ecological considerations at the facility. The facility should always verify that the groundwater use designation is correct and that the cleanup criteria are protective of surface water and sediments.
- Cleanup criteria at NAPL sites do not always need to be numerical. Rather, the criteria may be to (1) remove sufficient NAPL to contain it, and (2) control movement of the dissolved plume and/or treat the dissolved plume to numerical standards.

References

- EPA. 2004. Handbook of Groundwater Protection and Cleanup Policies for RCRA Corrective Action for Facilities Subject to Corrective Action Under Subtitle C of the Resource Conservation and Recovery Act. EPA 530-R-04-030. Update. April.



Notes:

Purpose of Slide

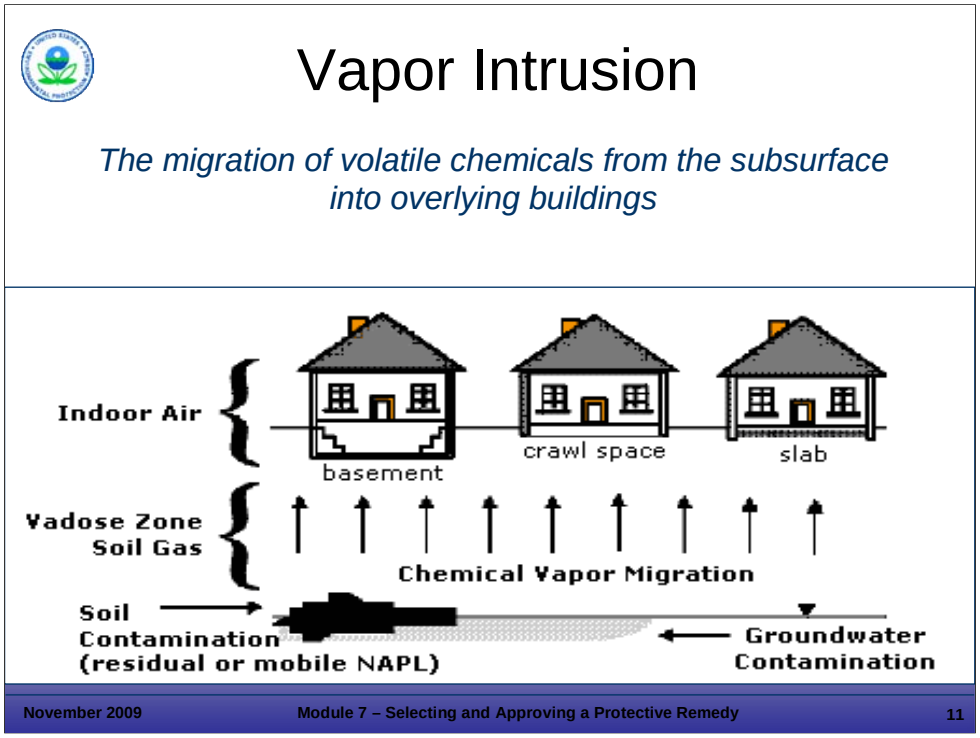
- Introduce the concept that there are some special considerations that may impact the cleanup objectives for some sites.

Key Points

- Complex receptor/exposure scenarios caused by vapor intrusion
- Establishing cleanup objectives when non-aqueous phase liquids are present

References

None



Notes:

Purpose of Slide

- This slide provides an introduction to VI concepts; a more detailed discussion will be provided in Module 8.

Key Points

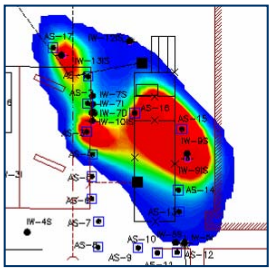
- EPA defines VI as the migration of volatile chemicals from the subsurface into overlying buildings.
- EPA environmental indicators (EIs) require evaluation of the indoor air pathway for the human exposures under control EI. If a site has volatile chemicals, remedy selection must also evaluate VI.
- Historical observations indicate that VI into structures is a potential exposure pathway.
- Estimating human exposures by the VI pathway is complex and the subject of ongoing research and reevaluation.

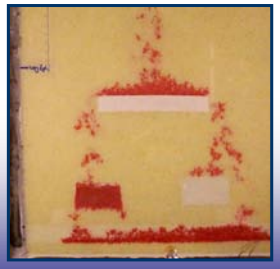
References

- EPA. 2002. Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance). OSWER. EPA 530-D-02-004. August. Accessed On-Line at: http://www.epa.gov/osw/hazard/correctiveaction/eis/vapor/complete.pdf.
- EPA. 2004. Design Solutions for Vapor Intrusion and Indoor Air Quality. EPA 500F-04-004. March. Accessed On-line at: http://epa.gov/brownfields/tools/vapor_intrusion.pdf.
- EPA. 2004. User's Guide For Evaluating Subsurface Vapor Intrusion Into Buildings. August. Accessed On-line at: http://www.epa.gov/oswer/riskassessment/airmodel/johnson_ettinger.htm.
- ITRC. 2003. Background Document: Vapor Intrusion Issues at Brownfield Sites. ITRC Brownfields Team. December. Accessed On-line at: http://www.itrcweb.org/Documents/BRNFLD-1.pdf.

Special Case: NAPL Remediation

- Non-numeric cleanup criteria
  - Stabilization
  - Containment
- Engineering solutions to reduce source
- Institutional controls to protect HH&E
- Dissolved phase criteria





November 2009 Module 7 – Selecting and Approving a Protective Remedy 12

Notes:

Purpose of Slide

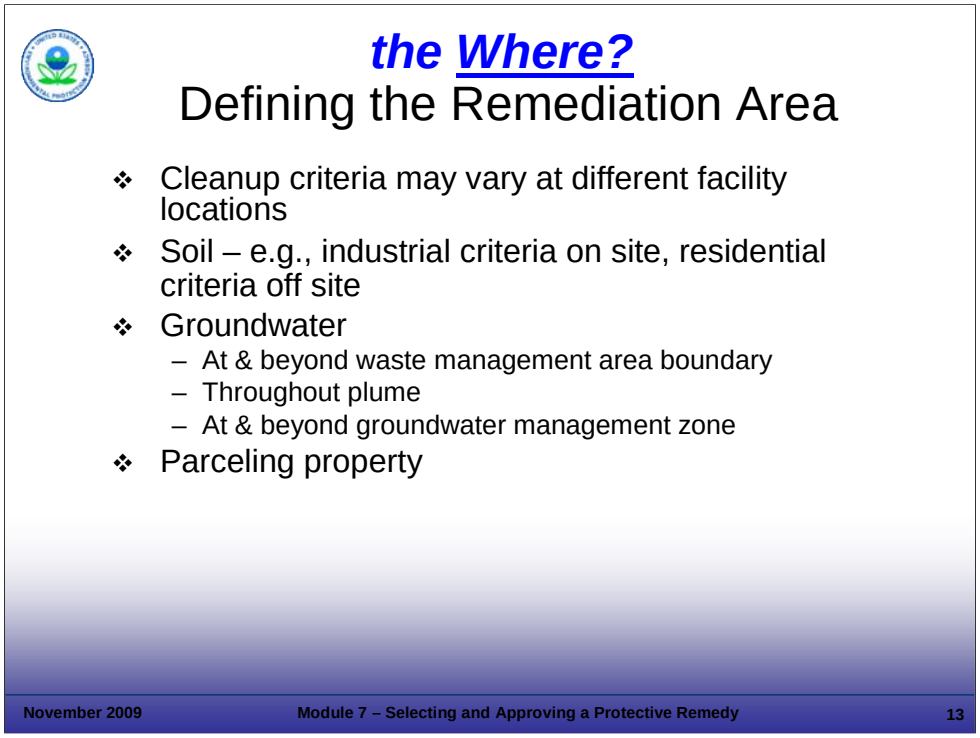
- Discuss special considerations associated with establishing cleanup objectives for facilities where nonaqueous phase liquids (NAPLs) are present.

Key Points

- NAPLs may be in the form of dense nonaqueous phase liquids (DNAPLs, "sinkers") or light nonaqueous phase liquids (LNAPLs, "floaters").
- NAPLs, especially DNAPLs in the subsurface are extremely difficult to locate and delineate, and present real challenges to remediate completely, other than through excavation.
- Given the technical challenges associated with NAPL remediation, a successful remediation strategy might focus on containment and stabilization of NAPL source areas, and remediation of the dissolved portion of the plume to meet cleanup criteria.
- A Remedy Decision (CA 400) can be made for a facility where NAPL is present and no numerical cleanup criteria are established for the NAPL. In this case, the key to an effective Remedy Decision is assuring long-term protection of HH&E with appropriate ECs and ICs.
- Technical impracticability (TI) would apply if the established cleanup criteria could not be met, and under RCRA CA, an achievable cleanup goal for protection of HH&E (i.e., stabilization or risk management) can be set.
- In states that designate all groundwater as drinking water, it may be necessary to make a TI determination for NAPL sites.

References

- EPA. 2004. DNAPL Remediation: Selected Projects Approaching Regulatory Closure. EPA 542-R-04-016. December.
- EPA. 2004. Handbook of Groundwater Protection and Cleanup Policies for RCRA Corrective Action for Facilities Subject to Corrective Action Under Subtitle C of the Resource Conservation and Recovery Act. EPA 530-R-04-030. Update. April.
- ITRC. 2003. Technology Overview. An introduction to Characterizing Sites Contaminated with DNAPLs. September.
- ITRC. 2000. Technology Overview. DNAPLS: Review of Emerging Characterization and Remediation Technologies. June.



Notes:

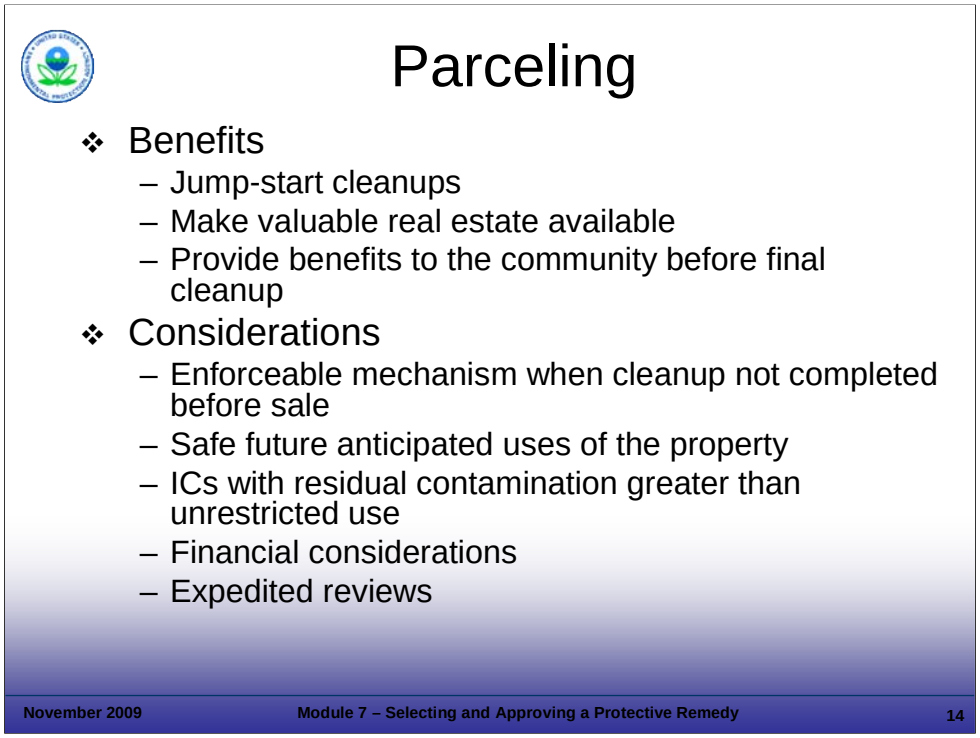
Purpose of Slide: Discuss that the Remedy Decision (CA 400) applies to the entire facility, but there may be different cleanup objectives established for different portions of the facility. This concept is particularly important for facilities that are subdivided for sale or for reuse of parcels.

Key Points

- The remedy decision applies to the entire facility, but where cleanup criteria apply may vary.
- For instance, at an operating chemical plant, contaminated soil may be allowed to meet industrial exposure scenario values within the plant and residential values at and beyond the facility boundary.
- For groundwater, cleanup criteria may apply either at the unit boundary (such as the edge of a landfill), throughout a groundwater plume, or within a defined groundwater management zone.
- Some states use the concept of a defined groundwater management zone, where groundwater criteria may be set at and beyond the boundary of the management zone.
- There are many RCRA facilities across the country that are being subdivided for reuse under different ownership and land uses.
- Once parcels have achieved numerical cleanup criteria, they may no longer be subject to CA (depending on the requirement in facility permits or orders).
- Parcels that have appropriate ECs and/or ICs in place for the anticipated land use may or may not remain subject to the permit or other regulatory mechanism. The parcel will remain a part of the CA "facility" until a permit or order modification is made.
- In some cases, different cleanup criteria would be established for a given parcel than for other portions of the property, depending on the intended land use for the parcel.

References

- None.



Notes:

Purpose of Slide

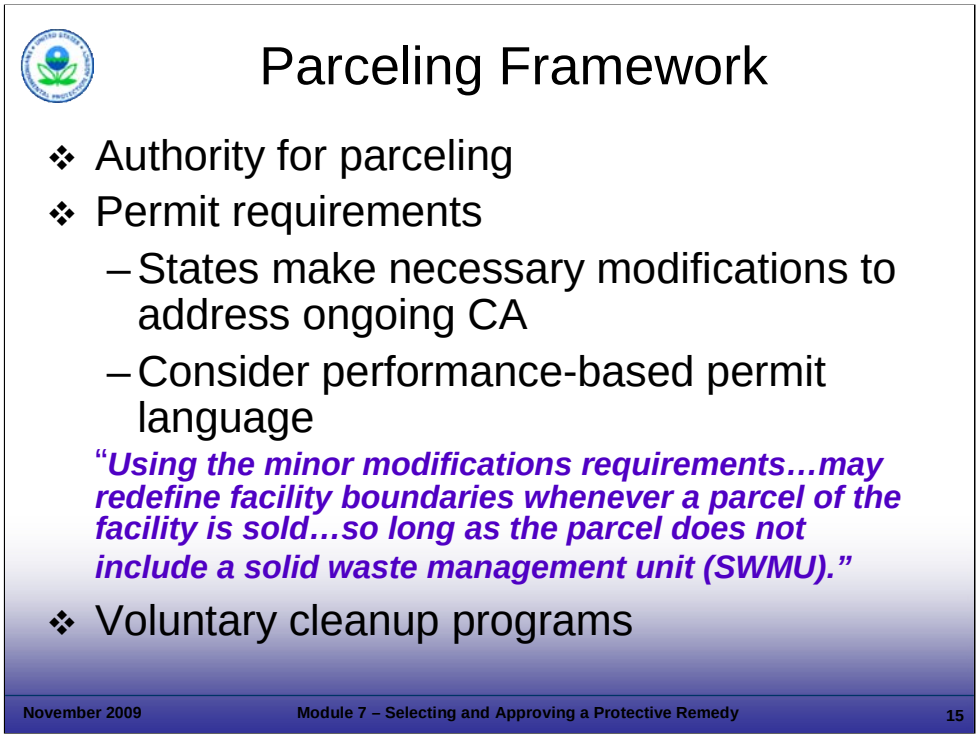
- In the previous slide, property parceling was mentioned as a factor in defining the remediation area. This and the following slide will provide more details on property parceling concepts.

Key Points

- RCRA facility parceling is selling or leasing a portion of a RCRA facility, normally with the intent of revitalization or productive reuse. Parceling makes valuable real estate resources available for revitalization, provides benefits to the community sooner, and can help move cleanups more quickly.
- Facilities can be parceled regardless of cleanup status. Considerations for parceling include:
  - Most parcels have had cleanup addressed prior to sale or lease. However, when a property sale happens before a parcel is cleaned up, an enforceable mechanism is needed to ensure the cleanup will be carried out by the original or new owner.
  - The remedy should allow for safe future anticipated uses of the property.
  - If waste is left in place, ICs will be appropriate.
  - Financial considerations should include: (1) preventing bankruptcy and future Superfund sites, (2) ensuring a party is responsible for CA and financial assurance for the rest of the facility, and (3) the mechanics of implementation.
  - Regulators should expedite reviews and cleanup decisions when reuse interests are involved because the redevelopment window of opportunity may be brief.

References

- EPA. Presentation on Parceling (David Hockey, EPA Office of Resource Conservation and Recovery).



Notes:

Purpose of Slide

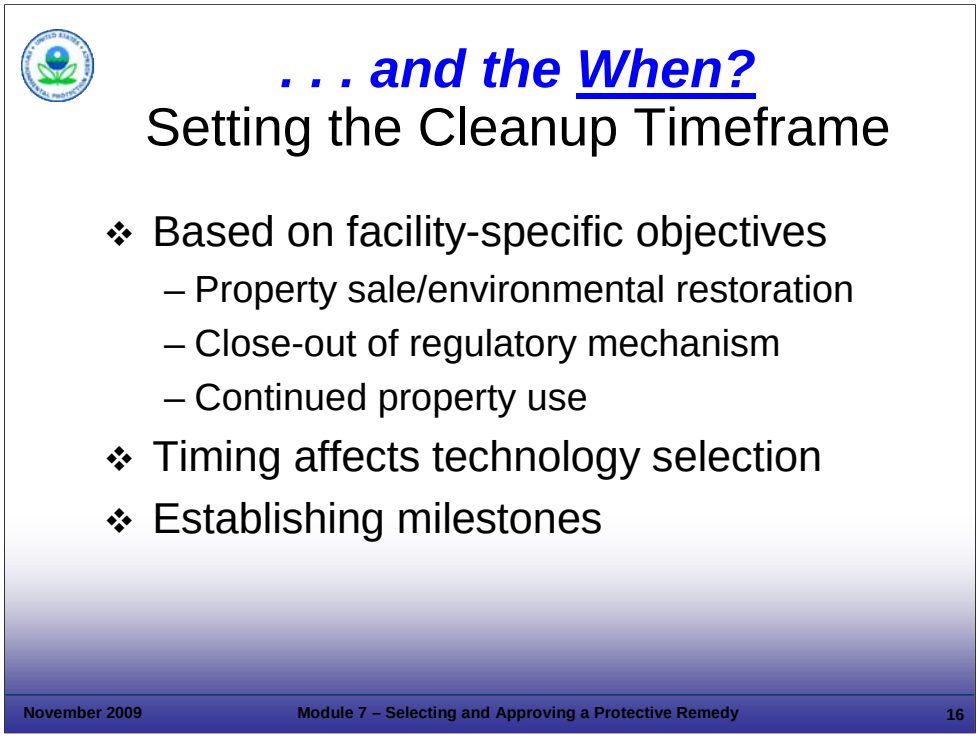
- Further explain how parceling can and should be implemented to expedite cleanup and revitalization.

Key Points

- States with authorized CA programs have authority to make parceling decisions. EPA Regions may make these decisions for non-authorized states.
- For permitted facilities, the permitting authority has responsibility for any permit modifications required to address CA requirements for parcels.
- Language can be incorporated into permits to address future parceling. In the example shown, the facility can parcel any portion of its property through a simple Class 1 permit modification, as long as no SWMUs are on the parcel.
- Voluntary cleanup programs or other State programs have been used in getting parcels addressed in a timely fashion.

References

- EPA. Presentation on Parceling (David Hockey, EPA Office of Resource Conservation and Recovery).



Notes:

Purpose of Slide

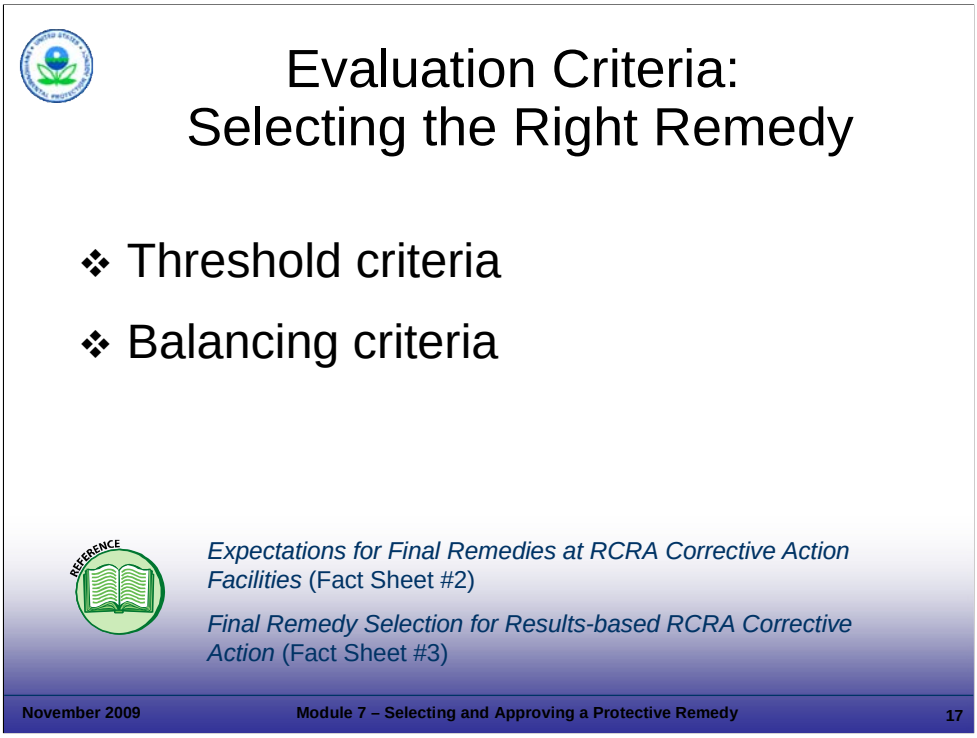
- Cleanup timeframes generally represent ***when*** specific numerical standards need to be met. Or in the case of NAPL, when stabilization or containment criteria have been met.

Key Points

- Regulators should work with facilities to establish reasonable timeframes for meeting cleanup criteria. Timeframes to meet cleanup goals may differ for different parts of a facility or in different media.
- Cleanup timeframes should be reasonable, linked to specific objectives, and based on facility-specific conditions.
- A cleanup timeframe is an estimate of the schedule for meeting groundwater or other media cleanup criteria at a specified location. The timeframe may include the schedule for developing and constructing a remedy to achieve the cleanup goals.
- Some facilities may be on a fast-track for cleanup, which would generally be considered a few years. Facilities on a fast-track are often those undergoing revitalization efforts that include changing land uses or facilities that are focused on reducing permit requirements and eliminating environmental liabilities.
- Facilities on a fast track will tend to select more aggressive remedies such as excavation or bioremediation, whereas facilities with fewer time constraints will be more inclined to choose passive remedies such as monitored natural attenuation (MNA).
- Industrial facilities selecting MNA, where no new future land uses are anticipated, could consider a timeframe that spans decades. Some facilities have even adopted timeframes of centuries; one example is the Casper, WY facility we saw in the video for Module 6. That facility anticipates meeting groundwater cleanup criteria in 400 years. In the meantime, ECs and ICs have been implemented at the facility and are protective of HH&E. This facility has been redeveloped and is currently being used as a golf course and business park.
- Regulators may approve a Remedy Decision (CA 400) that will take many years to achieve numerical cleanup levels, as long as the remedy is protective of HH&E for its current and reasonably anticipated uses.
- In working with facilities, the regulator should establish a timeframe for intermediate goals such as achieving environmental indicators and other RCRA CA Measures (such as Human Exposures under Control and Groundwater Migration under Control by 2008 and Remedy Selected and Remedy Constructed by 2020).
- There are many uncertainties associated with estimating a cleanup timeframe, but it is prudent to do so, because the cleanup timeframe affects the Exit Strategy.

References

- None.



Notes:

Purpose of Slide

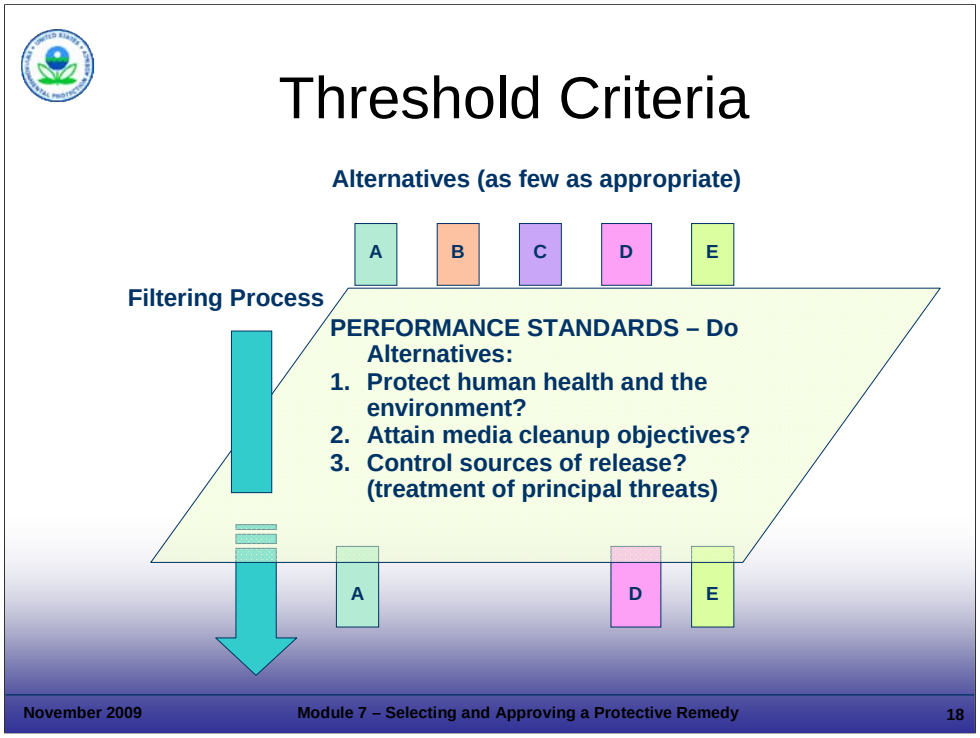
- Discuss EPA's guidance for the selection of final remedies.

Key Points

- EPA has established useful guidance for selecting remedies, particularly for complicated sites. The guidance provides threshold and balancing criteria for evaluating multiple technologies. Facilities must meet threshold criteria in evaluating technologies. Facilities may also use balancing criteria to evaluate the effectiveness of remedies, but there is no EPA requirement to do so; the balancing criteria are considered guidance. First, potential remedies are evaluated using threshold criteria, which are general performance standards that serve as filters or screens. If a remedy under consideration does not meet these performance standards, it is screened out and does not move on for further evaluation.
- Potential remedies that pass the threshold criteria screen are then evaluated against EPA's balancing criteria, which serve as the "scale" to balance different remedy selection considerations (for example, effectiveness and cost). Remedies do not have to "meet" balancing criteria but are simply measured against them. For example, if a property is undergoing redevelopment, the short-term effectiveness and implementability of a remedy may weigh more heavily in the remediation decisions than long-term effectiveness or cost. This evaluation affects the remedy decision.
- When a single remedy alternative is being considered, these criteria serve as a basis to determine that the remedy will be adequate.
- For multiple alternatives, the criteria allow identification of a recommended or "best" remedial approach.
- It is not necessary to evaluate multiple remedies for a site; a single, proven remedy can be selected and approved.

References

- EPA. 2000. Expectations For Final Remedies At RCRA Corrective Action Facilities, RCRA Corrective Action Workshop On Results-Based Project Management (Fact Sheet #2). March. http://www.epa.gov/epawaste/hazard/correctiveaction/pdfs/workshop/expect.pdf.
- EPA. 2000. Final Remedy Selection for Results-Based RCRA Corrective Action (Fact Sheet #3). March. Accessed On-line at: http://www.epa.gov/epawaste/hazard/correctiveaction/pdfs/workshop/select.pdf.



Notes:

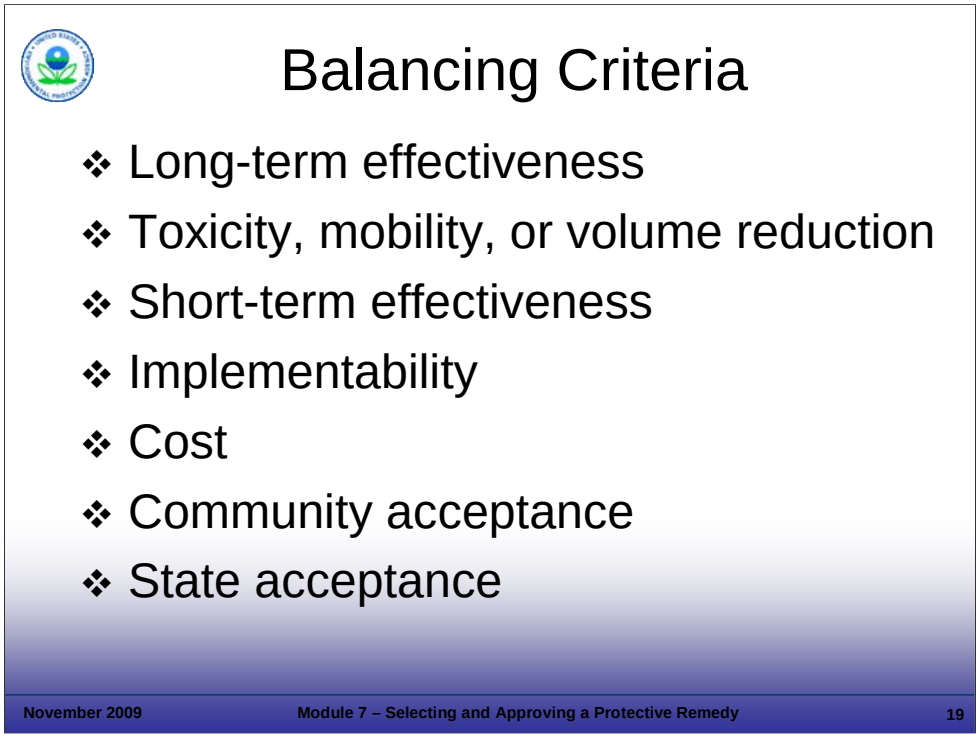
Purpose of Slide: Present and review EPA's threshold criteria for remedies.

Key Points

- There are three threshold criteria, which can serve as general performance standards. The facility, regulators, and public agree to the standard and the facility has the flexibility to decide how to meet the standard.
- Protecting HH&E is the mandate of the RCRA statute and regulations. Also, remedies must meet the second and third criteria as a means of achieving the overall mandate to protect HH&E.
- Protecting HH&E is a function of current and reasonably anticipated uses and receptors. For instance, if air stripping is being evaluated against this criterion, the projected air emissions from the stripper to the ambient air must be protective of surrounding populations.
- Protecting the environment involves, among other things, considering the ecological setting around a facility when evaluating and selecting a final remedy. For instance, if groundwater pump and treat is being evaluated, it may be eliminated as a remedy if lowering the water table through groundwater extraction would negatively impact a fragile wetland area.
- The criterion of "attaining media cleanup objectives" reflects three concepts that we discussed earlier: (1) "what" cleanup criteria have to be met, such as numerical cleanup criteria or stabilization and containment measures; (2) "where" cleanup criteria need to be met, such as a unit boundary or throughout the plume; and (3) "when" cleanup criteria need to be met. Each of these concepts is influenced by the anticipated use of the property.
- The criterion of "controlling sources of releases" focuses on reducing or eliminating further releases of hazardous wastes or constituents that may pose a threat to HH&E. In satisfying this criterion, EPA expects facilities to use treatment for wastes and contaminated media that are principal threats and ECs for wastes and contaminated media that can be reliably contained, pose relatively low long-term threats, or for which treatment is impracticable.

References

- EPA. 2000. Final Remedy Selection for Results-Based RCRA Corrective Action (Fact Sheet #3). March.
- EPA. 2004. Handbook of Groundwater Protection and Cleanup Policies for RCRA Corrective Action for Facilities Subject to Corrective Action Under Subtitle C of the Resource Conservation and Recovery Act. EPA 530-R-04-030. Update. April.



Notes:

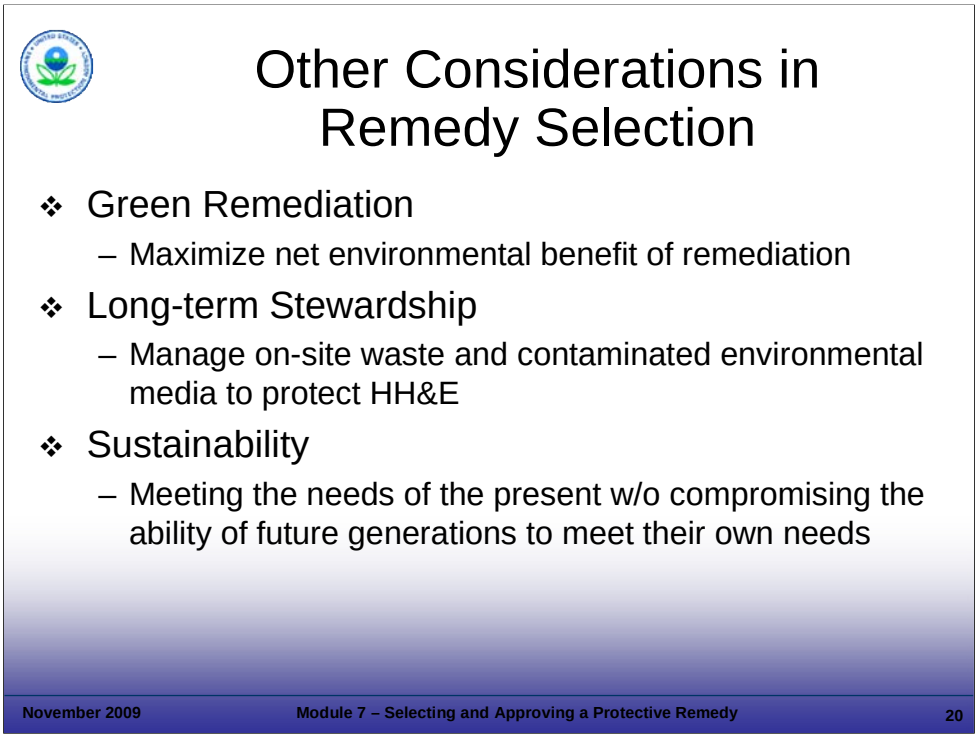
Purpose of Slide: Describe EPA's balancing criteria for final remedy selection. These criteria are provided as guidance, particularly for complicated sites.

Key Points

- Balancing criteria are used to evaluate remedies that have passed the threshold screening criteria. Balancing criteria use the 7 factors shown on this slide. The facility is not required to evaluate multiple remedies, if the selected engineering solution has proven effective in similar situations.
- Decision-makers should evaluate final remedies based on their anticipated long-term effectiveness and reliability in protecting HH&E. Long-term effectiveness should consider reasonably anticipated future uses.
- Reducing the toxicity, mobility, or volume of hazardous waste and contaminated media helps achieve the broader objectives of long-term reliability and permanence in reducing the risks posed by hazardous wastes and constituents.
- Short-term effectiveness addresses the amount of time it will take for remedy design, construction, and implementation. This criterion may be important to address risks to the community, workers, and the environment. It also may be most important criterion to a facility undergoing revitalization.
- Decision-makers should evaluate remedies based on the implementability, or technical feasibility, of constructing, operating, and monitoring the remedy. This would include the administrative feasibility of obtaining needed permits and approvals and the availability of services and materials.
- Facilities can propose lower cost remedies as long as they are effective. Some facilities may prefer to keep short-term capital expenditures to a minimum, while other facilities focus on life cycle costs. Net present value estimates of remediation costs can be considered, including operation and maintenance costs. Tools that can be used to evaluate potential remedial costs include EPA's CostPro Software and the U.S. Air Force Remedial Action Cost Engineering and Requirements System (RACER).
- Evaluation of community acceptance is important and should address, among other things, community concerns regarding reuse of the property. Individuals or local groups may have input.
- Finally, the State's acceptance is important, particularly when EPA selects the remedy.

References

- EPA. Final Remedy Selection Module. EPA Region 7 Delivery of the EPA Headquarters RCRA Corrective Action Workshop. Delivered by Guy Tomassoni.
- EPA. 2000. Final Remedy Selection for Results-Based RCRA Corrective Action (Fact Sheet #3).



Notes:

Purpose of Slide

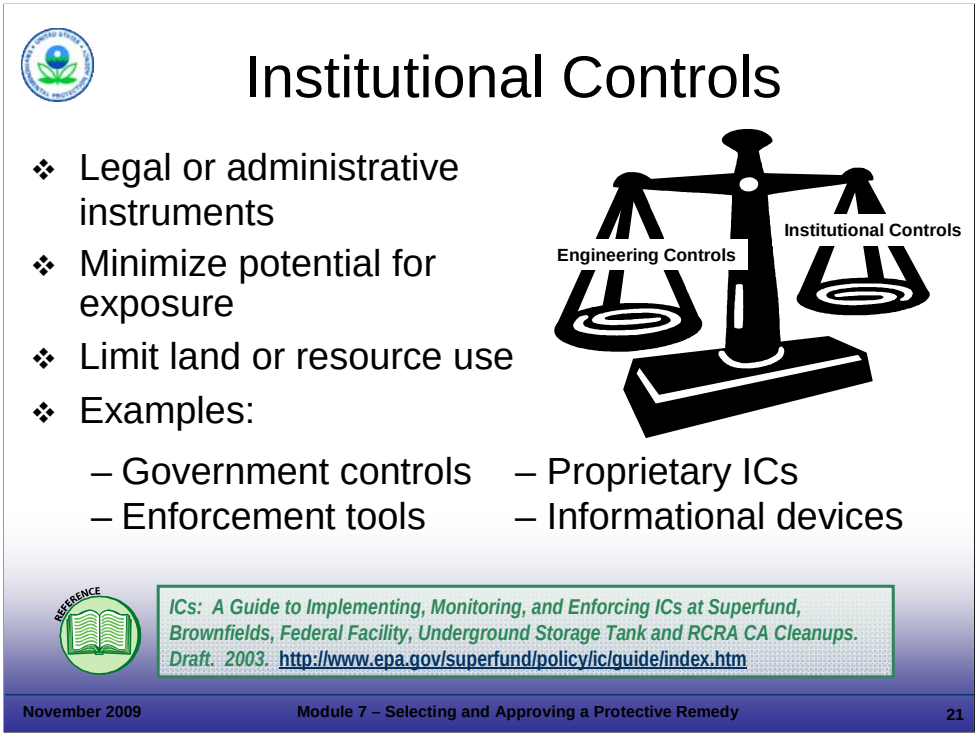
- Introduce additional considerations relevant to remedy selection.

Key Points

- Green remediation considers the environmental impacts of remediation activities at every stage of the remedial process to maximize the net environmental benefit of a cleanup. Considerations include: energy requirements, efficiency of on-site activities, and reduction of impacts on surrounding areas. Many pump and treat systems currently in place were designed and installed when energy was less expensive and designers did not consider the full impacts of using non-renewable energy. Alternative energy sources are now available for powering remediation systems and reducing the emission of greenhouse gases. Green remediation will be discussed in more detail in Module 8.
- Long-term stewardship typically centers on physical and legal controls to prevent inappropriate exposure to contamination that is left in place at a site. We will describe how to maintain ECs through efficient and effective operation and maintenance in Module 11 and how to select, implement, and maintain ICs to minimize the potential for human exposure to contamination by limiting land or resource use later in this module.
- As discussed in Module 6, sustainability means meeting the needs of the present without compromising the ability of future generations to meet their own needs, in terms of environmental cleanup. This means considering remedies that minimize or eliminate energy consumption, maximize the reuse of land and recycling of materials, preserve natural resources, and minimize or eliminate ancillary environmental impacts such as carbon dioxide (CO_2) emissions.

References

- EPA Website. Sustainability. Accessed On-line at: http://www.epa.gov/sustainability.
- Goldblum, Deborah (EPA). 2007. Integrating Sustainability into EPA's Cleanup Programs Region 3 RCRA/DuPont Pilot. June 27.
- Dellens, Amanda. 2007. Green Remediation and the Use of Renewable Energy Sources for Remediation Projects. National Network for Environmental Management Studies Fellow Case Western Reserve University (developed for EPA). August. Accessed On-line at: http://clu-in.org/download/studentpapers/Green-Remediation-Renewables-A-Dellens.pdf.



Notes:

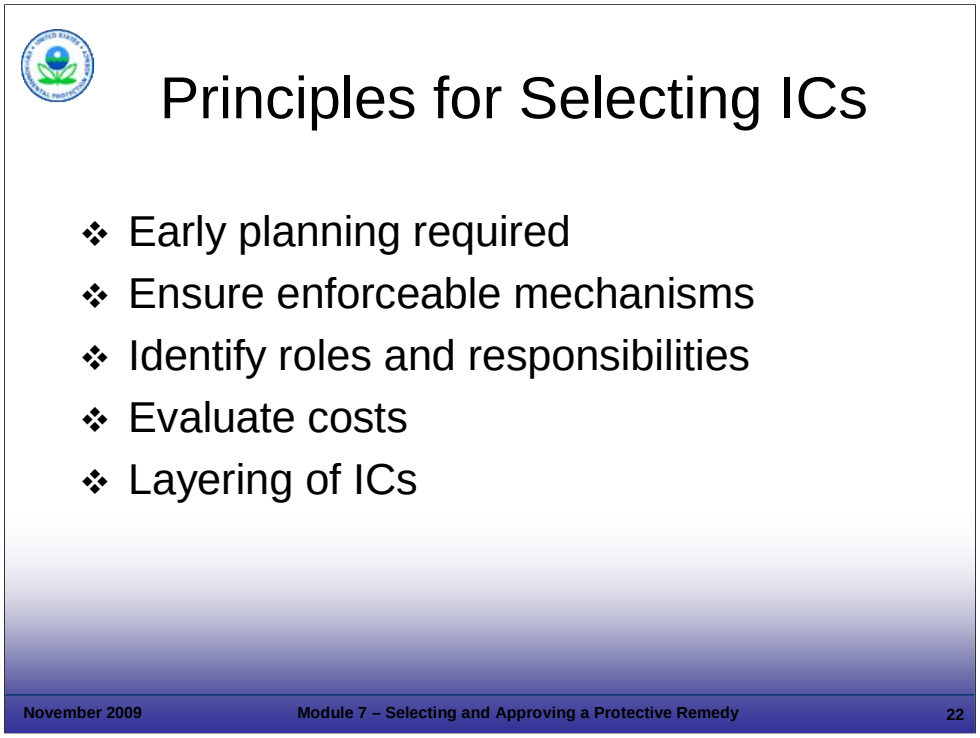
Purpose of Slide: Discuss the purposes for, and types of, ICs.

Key Points

- Many remedy decisions include the incorporation of ECs and ICs.
- In the past, facilities and agencies have focused first on selecting and developing good engineering designs, followed by a decision regarding the applicability of ICs to ensure long-term protectiveness.
- Today's remedy decision process involves evaluating, integrating, and balancing engineering solutions and ICs from the beginning of the process -- to establish a holistic approach to facility remediation.
- EPA defines ICs as "non-engineered instruments, such as administrative and legal controls, that help to minimize the potential for human exposure to contamination and protect the integrity of the remedy." For example, a remedy may use an engineered cap to cover contaminated soils and an IC (for example, an excavation permit) to restrict excavation through the cap.
- A remedy generally should include ICs if contamination will remain in place at the facility above residential risk-based levels. ICs should minimize the potential for exposure to contamination by limiting land or resource use.
- Various types of ICs can be used including:
  - Government Controls: These controls impose land or resource use restrictions using the authority of an existing government. Examples include: (1) zoning, (2) laws regarding well drilling or water usage, and (3) legal authorities involving licensing or permitting processes.
  - Proprietary ICs: These include legal instruments placed in the chain of title that convey a property interest from the owner to a second party. Proprietary ICs impose restrictions on land and water use. Examples include: (1) restrictive easements and (2) covenants. These controls often include the right of access to inspect and monitor.
  - Enforcement Tools: Enforcement tools include orders, permits, and consent decrees, which may incorporate ICs. Prohibitions on certain land uses or activities can be made a condition of the permit.
  - Informational Devices: A notice of land use restrictions (sometimes referred to as a deed notice) may be placed in the land records or statewide registries by the owner. Such notices are usually not enforceable, but have informational value. The term "Deed Restriction" is not a property law term or concept. To avoid confusion, site managers should avoid the term and instead be specific about the types of ICs under consideration.

References

- EPA. 1999. Final Remedy Selection Module. Kansas City Version of EPA HQ Corrective Action Workshop. Delivered by Guy Tomassoni.
- EPA. 2000. ICs: A Site Manager's Guide to Identifying, Evaluating, and Selecting Institutional Controls. Fact Sheet. OSWER 9355.0-74FS-P. EPA 540-F-00-005. OSWER 9355.0-74FS-P. September.
- EPA. 2003. ICs: A Guide to Implementing, Monitoring, and Enforcing ICs at Superfund, Brownfields, Federal Facility, UST and RCRA CA Cleanups. Draft. February.
- EPA. 1996. Advanced Notice of Proposed Rulemaking. 61 FR 19432. Corrective Action for Releases form Solid Waste Management Units at Hazardous Waste Management Facilities. May 1.
- EPA. 2007. Final Memorandum. Ensuring Effective and Reliable ICs at RCRA Facilities. June 14.



Notes:

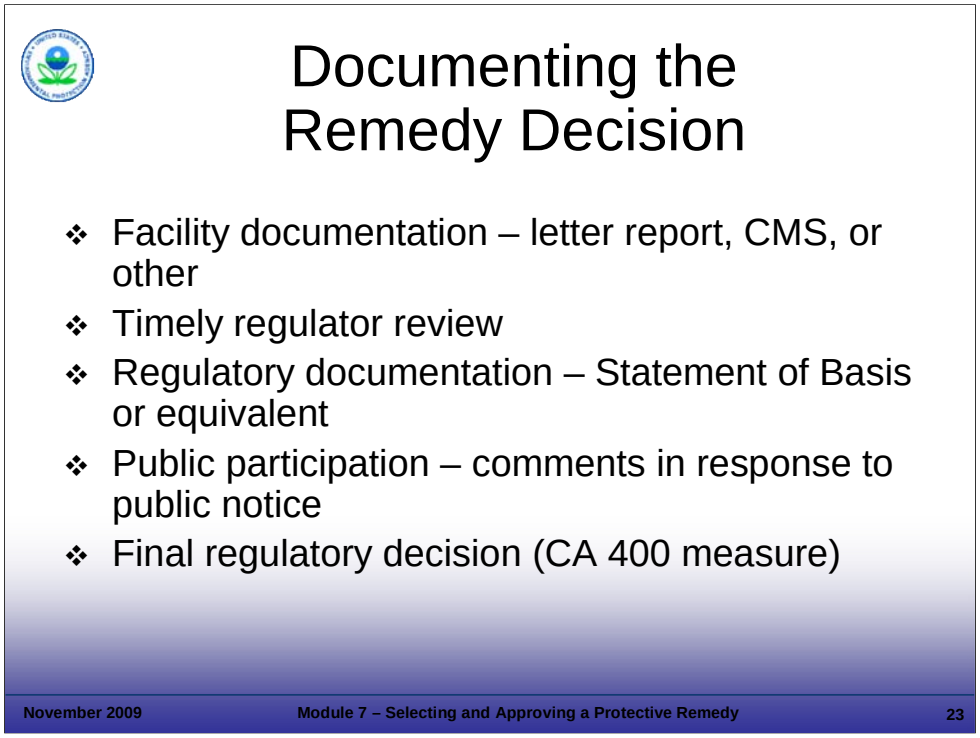
Purpose of Slide: Present guiding principles for evaluating and selecting ICs.

Key Points

- Assessment of potential ICs requires early planning – evaluation should begin as early as possible during the remedy selection process and carry on through remedy implementation.
  - ICs may be either short- or long-term; applied to a portion of a site or the entire site; and can be part of interim or final actions.
  - ICs may be needed to limit short-term exposures before cleanup is completed.
  - Evaluation of long-term ICs should continue through remedy selection and implementation.
  - The availability of viable IC tools may be location specific; therefore, the facility should determine early on what enforceable ICs exist under state and local law.
- Establishing and implementing ICs through enforceable mechanisms is important to ensure long-term effectiveness. ICs need to be effective and reliable for as long as they are needed, including whenever the property is transferred.
- Roles and responsibilities of all parties involved in implementing the selected ICs over time should be identified. These parties should have the financial and organizational capabilities and interest to reliably accomplish their tasks.
- The facility should consider short- and long-term costs associated with ICs and include these costs in financial assurance.
- Implementing more than one IC at a particular facility increases reliability; this approach is known as layering.

References

- EPA. Final Remedy Selection Module. Kansas City Version of EPA HQ Corrective Action Workshop. Delivered by Guy Tomassoni.
- EPA. 2000. ICs: A Site Manager's Guide to Identifying, Evaluating, and Selecting Institutional Controls. Fact Sheet. OSWER 9355.0-74FS-P. EPA 540-F-00-005. OSWER 9355.0-74FS-P. September.
- EPA. 2003. ICs: A Guide to Implementing, Monitoring, and Enforcing ICs at Superfund, Brownfields, Federal Facility, UST and RCRA CA Cleanups. Draft. February.
- Federal Register (FR). 1996. Corrective Action for Releases from Solid Waste Management Units at Hazardous Waste Management Facilities; Advance Notice of Proposed Rulemaking (ANPR). 61 FR 19432. May 1.
- EPA. 2007. Final Memorandum. Ensuring Effective and Reliable ICs at RCRA Facilities. June 14.



Notes:

Purpose of Slide

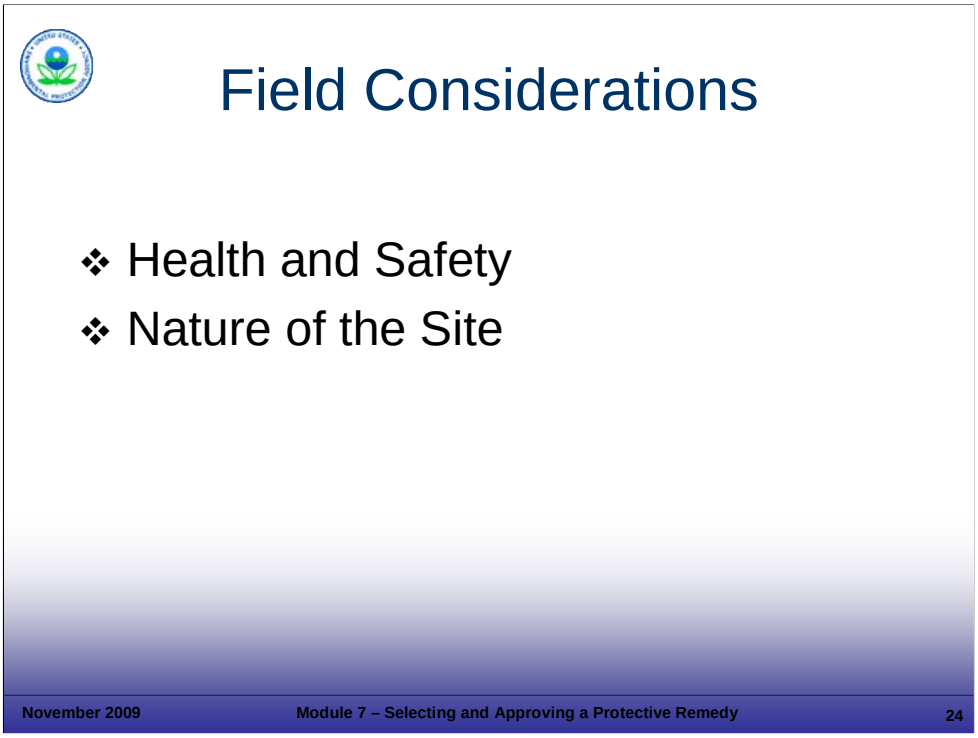
- Explain the process of documenting a Remedy Decision.

Key Points

- The regulated facility is responsible for developing a proposed remedy, and then submitting the proposed remedy to the regulatory agency with documentation in the form of a letter report, CMS, or other applicable document.
- The regulators should review remedies submitted by the facility expeditiously.
- Once the remedy is preliminarily approved by the regulator, the decision is announced through issuance of a decision document such as a Statement of Basis, which can be prepared by the regulatory agency or facility for public review and comment. A Statement of Basis may not be required in all cases, depending on the regulatory mechanism and state requirements. This is also the stage in the CA process where many facilities are required to demonstrate financial assurance.
- Following a public comment period, the regulatory agency makes a final decision, which is published along with a response to public comments.
- A "Remedy Decision and Response to Comments" or other appropriate decision document is used to formalize the agency's remedy decision (CA 400).

References

- EPA. 2005. Permitting and Corrective Action (PCA) Program Area Analysis (PAA) Report: Appendix D, National Details for Corrective Action Event Codes. Final Report. Win/Informed Executive Steering Committee. July 28.



Notes:

Purpose of Slide

- Overview the second part of this module, which presents field considerations related to selecting a remedy.

Key Points

- We have talked about some of the policy considerations that impact remedy selection.
- Field considerations are also important to remedy selection.
- During the remainder of this module, we will discuss factors that impact the remedy decision, such as:
  - Health and safety considerations; and
  - Nature of the site (location, status of the facility, accessibility issues, site conditions and contamination, waste management, and other site goals (for example, green remediation goals)).
- All of these factors should be considered as the remedy for a particular site is selected.

References

- None.

Notes:

Purpose of Slide

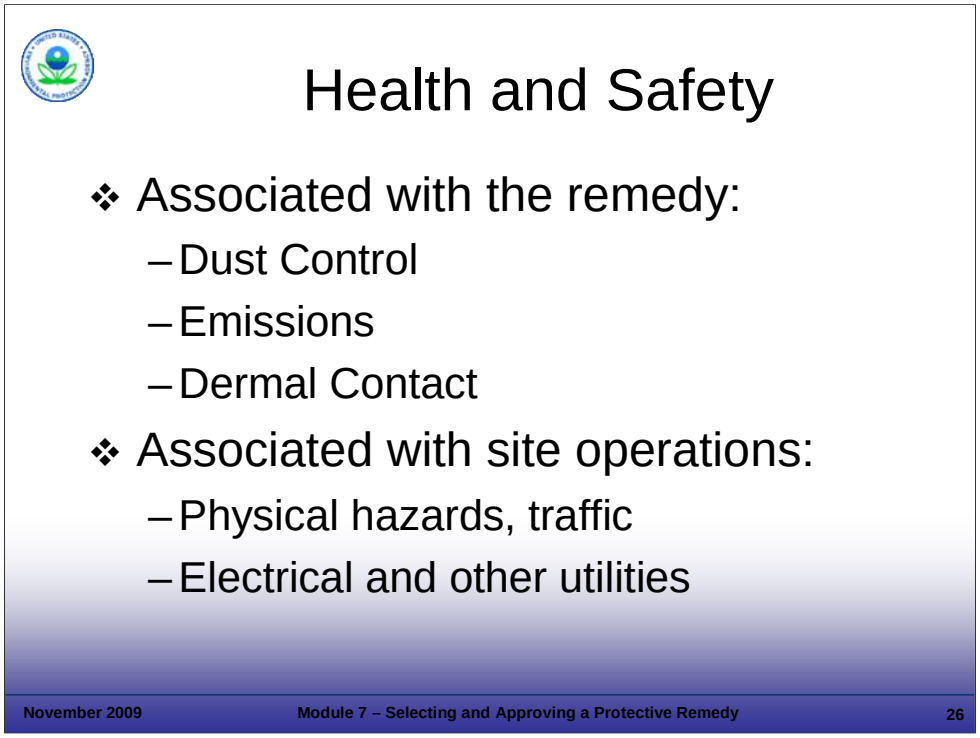
- Discuss health and safety considerations.

Key Points

- Health and safety impacts to the community must be considered.
- Frequently, sites are in close proximity to residential neighborhoods that may be impacted and the technology selected must consider its potential impact. In the case of excavation of highly contaminated soils, vapor suppression foam may be appropriate to minimize impacts. Modified excavation techniques may be appropriate where only very small areas may be open at any time. Pretreatment of an area (for example, dewatering and vapor extraction) also may be suitable before excavation.
- Air quality may not pose a health risk to neighbors but may create a problem with odors. Sometimes, engineers use air dispersion modeling to design a system based upon an acceptable odor threshold.
- Sites that have organic contaminants creating air emissions well below health-based risk levels and perhaps not even analytically detectable can still have an odor and a taste to downwind receptors.
- On site worker exposure also must be considered as part of technology selection. Intrusive activities may require breathing protection for site workers. The use of personal protective equipment can impact workers and these impacts can be aggravated by weather conditions (that is, think of Level B supplied air on a hot summer day). To reduce worker risk, the technology approach or timing may be modified to ensure worker safety.
- At large installations, employees may be located close to an area where intrusive remediation activities may allow emissions to impact them. The nature of duties may not allow the area to be evacuated or their work relocated.

References

- EPA. 1994. RCRA Corrective Action Plan. May.



Notes:

Purpose of Slide

- Discuss some specific impacts related to health and safety considerations.

Key Points

- Dust control during site remediation efforts may be a major issue. Contaminated dust must be controlled, but even non-contaminated dust can be a health problem for both site workers and neighbors. Traffic-generated dust can create problems to site neighbors, especially residential neighbors.
- Process emissions are also important. It is wise to use a basic screening model for air dispersion, such as Toxics Screen (TSCREEN), to assess the potential impact a remediation process will have on the area. If TSCREEN indicates a problem, a more detailed modeling approach using software, such as the Industrial Source Complex Short Term Model (ISCST3), can be used. This level of effort should be implemented for any remediation technology with a process that can emit contaminants.
- Fugitive emissions can be difficult to control and monitor. Site operators should inspect their systems for fugitive emissions and maintain equipment to reduce or eliminate them.
- Direct skin or dermal contact is also a factor. Remediation activities should take this into account so that contact is avoided.
- There are many health and safety issues associated with operating sites, including traffic and other physical hazards.
- Above-ground electrical lines and buried utilities can be safety concerns.
- Remedies should always be consistent with a facility's health and safety plans.

References

- NASA. 2007. Website on TSCREEN. Accessed On-line at: http://gcmd.nasa.gov/records/TSCREEN-Model.html.
- EPA. Industrial Source Complex Short Term Area Model (ISCST). Website. Accessed On-line at: http://www.epa.gov/scram001/dispersion_alt.htm.

Notes:

Purpose of Slide

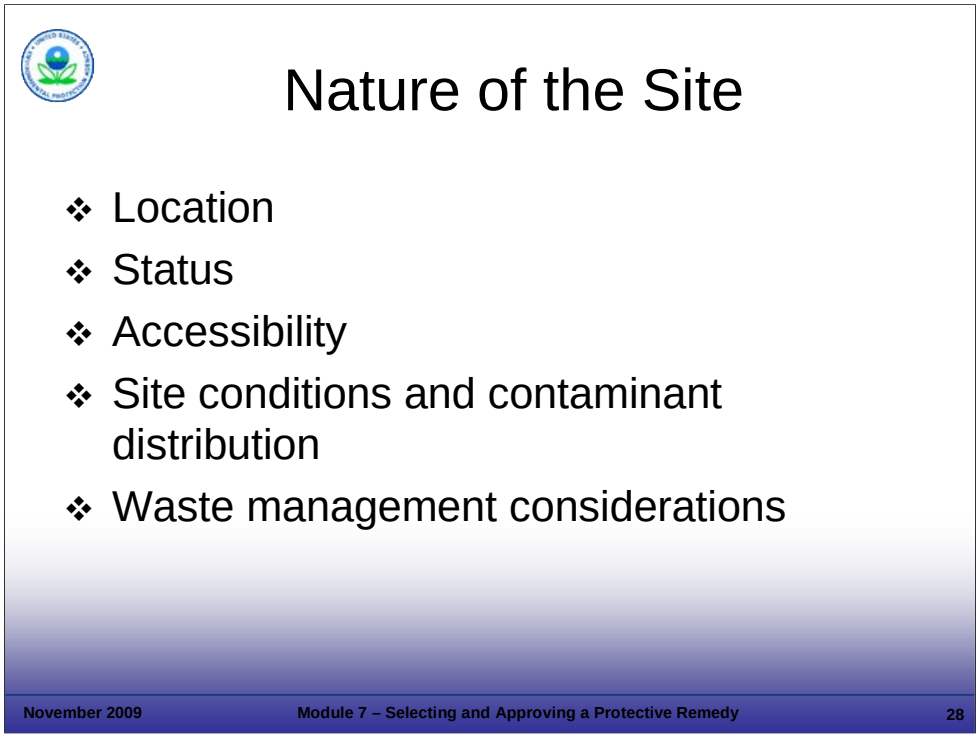
- Demonstrate how some areas of an operating facility are too dangerous to implement an active remedy. In addition, some areas of an operating facility need to be avoided so as not to interrupt facility operations and to avoid above-ground and underground obstructions.

Key Points

- These photographs show the congestion and complexity of operating facilities. Notice that some areas are roped off to limit access.
- At this operating plant (a refinery), drilling monitor wells or collecting soil samples would be too dangerous while the facility is operating. Numerous underground and above-ground obstruction exist and most have high pressure and high temperatures. In addition, the plant operations would be interrupted to collect samples or construct a remedy.
- An operating facility may achieve the performance measure of Ready for Anticipated Use by demonstrating that environmental conditions in operating areas are safe for their current and reasonably anticipated uses.
- Criteria that may be considered in selecting a remedy for an operating facility with limited access are:
  - Demonstrate that environmental conditions (for example, VI from product in the subsurface) are not contributing to worker exposures in excess of applicable standards;
  - Maintain control of contaminant plumes through the use of groundwater management zones or ECs;
  - Identify actions to ensure site conditions are protective of HH&E in the context of the use of the facility;
  - Record use restrictions in the deed;
  - Have plans for inspection and maintenance of ECs to make sure they are in place; and
  - Provide financial assurance for future investigation, long-term monitoring, or anticipated active remediation for current or reasonably anticipated uses.

References

- None.



Notes:

Purpose of Slide

- Discuss the nature of the site and how this can impact the remedy.

Key Points

- It is important that the nature of the site be considered during remedy selection.
- The location of the facility will impact how a remedy can be implemented; different considerations will be important in a densely residential area versus a rural area. In addition, the weather conditions will vary across the country from some areas where extreme heat or cold must be considered to areas where events such as hurricanes must be planned for.
- Operating status is also important:
  - Industrial facilities have unique issues because they do not want their operations interrupted. The remedies selected dictate the type of tasks that must be performed. Some tasks may be able to be performed during off-hours or during plant vacation or maintenance shutdowns. Non-operating facilities generally have more latitude and will probably not be affected by remedial activities, unless revitalization is underway.
  - Site security requirements can vary based on the type of facility and its operating status.
- Accessibility may be limited at some sites and this also can impact the remedy decision. The types of accessibility considerations that apply include: physical access, utilities, and right of way/ ownership considerations. We will look at each of these in the slides that follow.
- The type and distribution of contaminants and remediation waste generation and management issues also can impact remedy selection.
- The factors above can impact the selection of one remedy over another (this would fall under the balancing criteria of implementability) or it may impact aspects of a remedy such as the schedule or design. We will present some examples of how these factors can impact remedial choices and approaches.

References

- None.

Notes:

Purpose of Slide

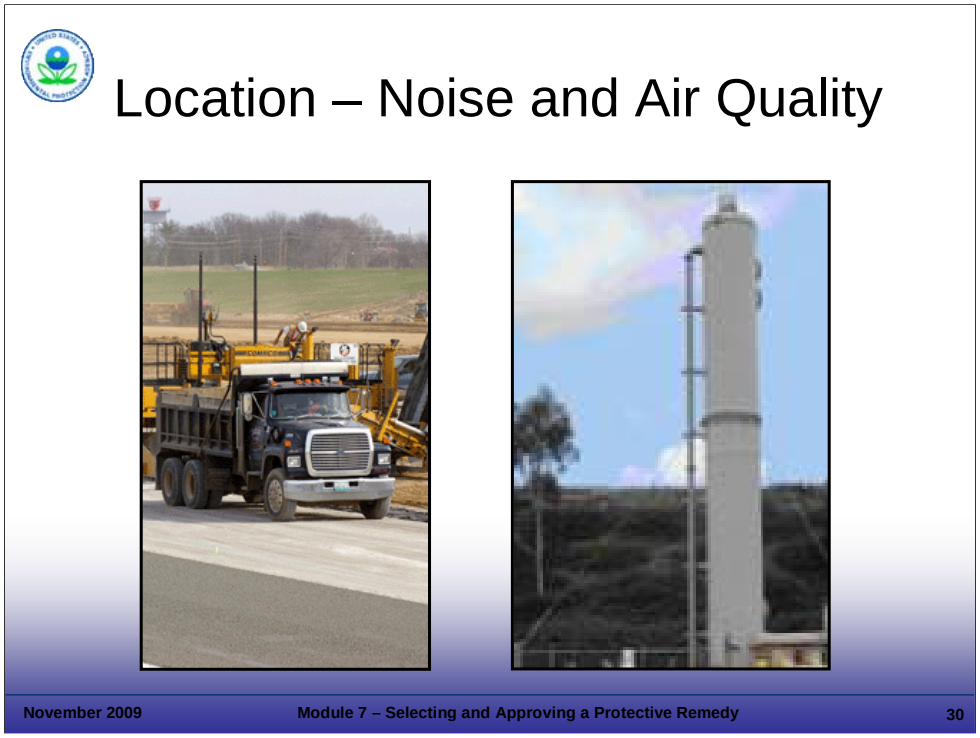
- Illustrate the types of locations where RCRA CA facilities may be present and discuss how location can impact the remedy decision.

Key Points

- The type of location will affect the remedy selection.
- Industrial locations are usually the least problematic unless the remediation will interfere with ongoing operations or if accessibility is limited due to health and safety concerns. Intrusive activities and those that are noisy, dusty, or have a similar nuisance impact will be more acceptable at an industrial facility than at a location that is residential.
- Residential (urban and suburban) and commercial locations pose the greatest challenge. It will be difficult to gain public acceptance for loud, disruptive operations. Air emissions, odors, and dust are other, less obvious, issues that must be addressed at such locations.
- In cities, interference with traffic may pose an issue. Imagine installing a groundwater monitoring well in the sidewalk of a major downtown business district and having to close a major road to do it. Night time drilling is an option.
- Ecologically sensitive areas pose special considerations and difficulties. For instance, a remedy that involves pumping (for example, dewatering for excavation or pump and treat systems) might have to be eliminated from consideration at a site with wetlands due to the negative ecological impacts of lowering water levels. Similarly, thermal treatment or chemical oxidation may also have to be eliminated at some sites because they can alter the temperature and chemistry of groundwater.
- The participants may wish to share input regarding how site location (the nature of the site) has impacted remedy selection at RCRA CA or other sites that they have been involved with.

References

- None.



Notes:

Purpose of Slide

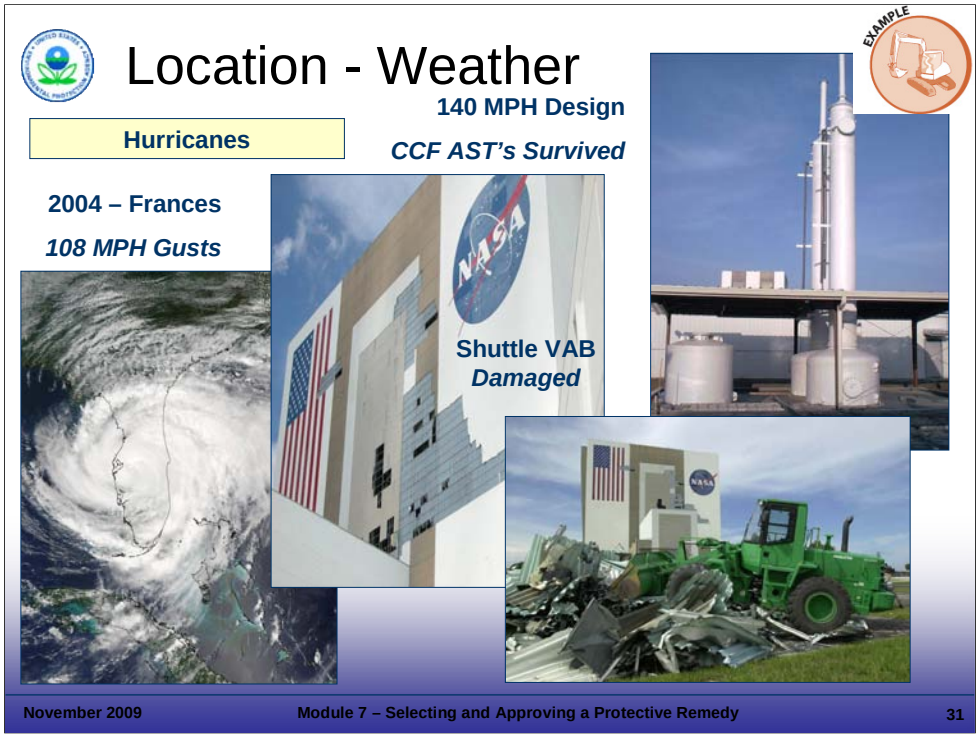
- Discuss how potential community impacts associated with noise and air quality can affect remedy selection.

Key Points

- A large excavation project or landfill cap could require heavy truck traffic for 12 hours a day for months. This situation would impact traffic safety and congestion, and may lead to selection of an alternative remedy.
- Noise can be a serious problem with process equipment. Blowers, compressors, and other rotating machinery can generate high pitched whines that carry long distances. These sounds would be especially noticeable at night. Other machinery can generate low frequency vibrations that are felt more than heard. These also can be objectionable. The photograph on the right is an air stripping tower installed on personal property to address contaminated groundwater that had migrated off-site.
- Earth moving and construction machinery can also generate these types of objectionable noises.

References

- None.



Notes:

Purpose of Slide

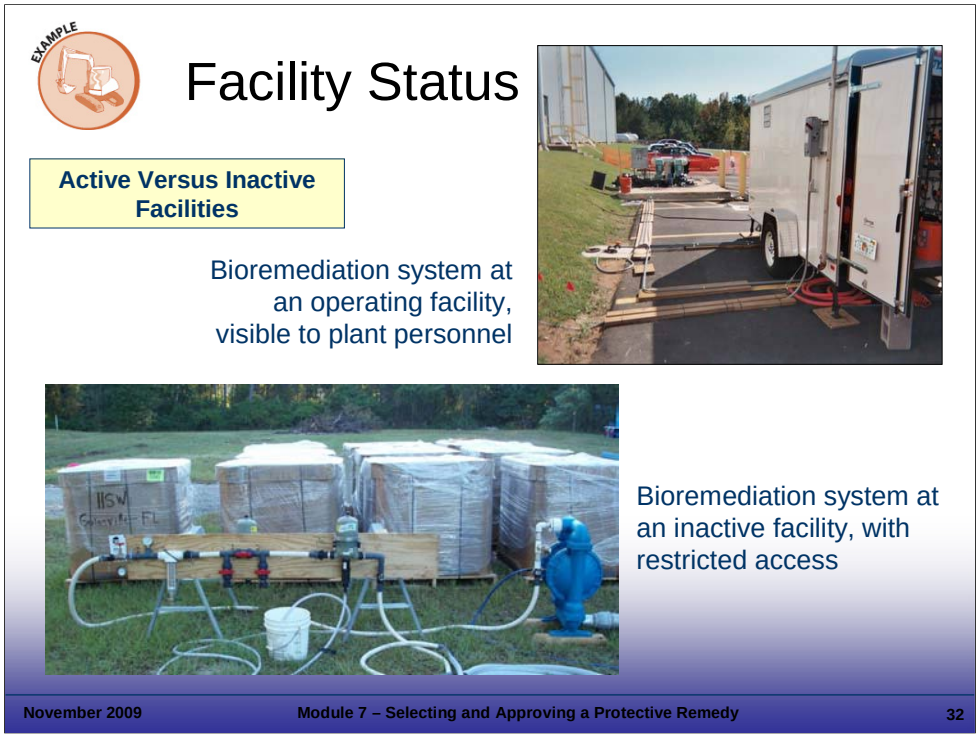
- Discuss design considerations to address the potential weather events, such as storm conditions (video clip included).

Key Points

- In coastal regions of the country, primarily the Gulf Coast, hurricanes have to be accommodated during design and implementation.
- In coastal Florida, the design wind load conditions for structures is 140 miles per hour (MPH). Further inland, the wind load criteria may drop to 110 MPH. Systems and buildings should be designed to withstand the force of these winds.
- In the photograph above (upper right), the dual aboveground storage tank (AST) system at the CCF facility at NASA Kennedy Space Center (KSC) was designed for a 140 MPH wind loading in a free-standing structure with no added bracing of guy wires. This level of effort required detailed design of the reinforced fiberglass ASTs, including shop samples and structural testing.
- In the same area at NASA KSC, the VAB building was severely damaged by Hurricane Frances in 2004 (108 MPH gusts), while the treatment system sustained no damage.
- Tropical storms (below 75 MPH) are common and can also cause severe damage.
- Hurricanes and tropical storms can drop large amounts of rain (up to 24-inches of rain in 24 hours).
- These wind and rain conditions can interrupt construction work, remediation system operations, and field work -- and can cause site shutdown and abandonment. Heavy rains associated with hurricanes also can affect groundwater conditions.
- Hurricanes can affect the Atlantic Coast all the way to Long Island and Cape Cod and heavy rains from such storms occur in the Appalachian and Blue Ridge mountains and into Pennsylvania and New York and cause major flooding issues.
- The bottom line is that potential weather conditions and storm events should be considered during remedy selection and design.

References

- None.



Notes:

Purpose of Slide

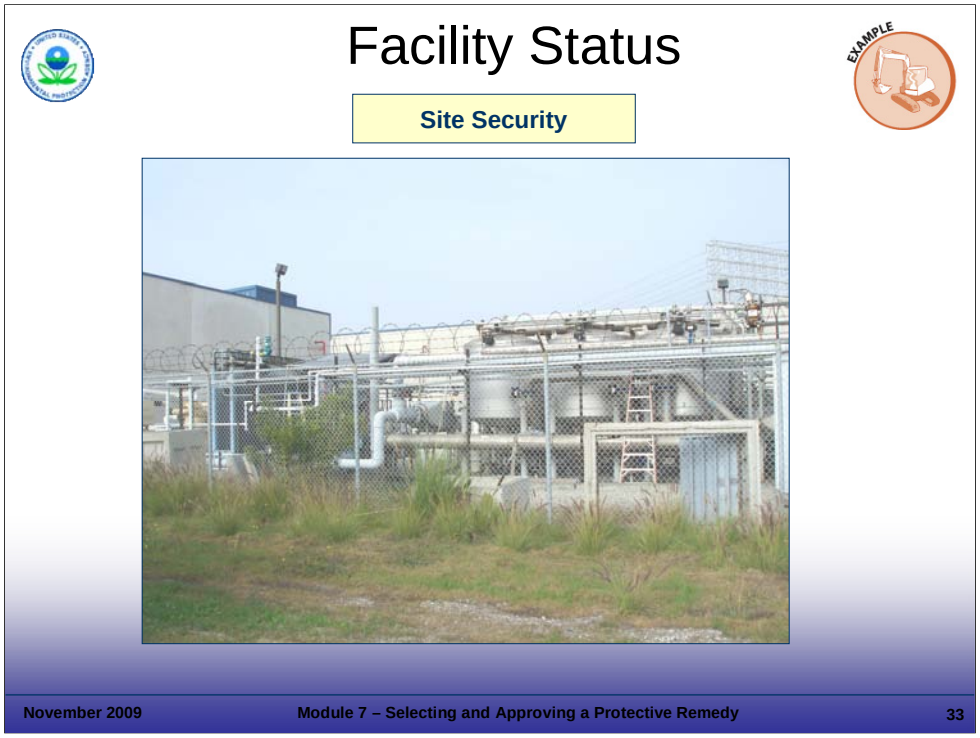
- Illustrate design and implementation considerations for active versus inactive facilities.

Key Points

- The photograph on the right is a bioremediation system installed in the parking lot of an active facility, near a sump where the original spill occurred. The system was designed to be as compact as possible (use few parking spaces); it is secure from a security and safety standpoint, and it is aesthetically acceptable.
- The photograph on the bottom shows a remediation system at an inactive facility with 24 hour security and no access to anyone other than remediation personnel. System design is more flexible from an aesthetic standpoint, since there is limited access to the site.

References

- None.



Notes:

Purpose of Slide

- Review site security considerations.

Key Points

- Many sites require security to protect the public and prevent damage and vandalism.
- This site is located in an industrial area undergoing revitalization.
- This remediation system is protected by a 10-foot chain link fence with razor ribbon to prevent intruders from coming into the site. Security lighting may also be required. As the area is developed, aesthetics will become important and it may be necessary to surround the site with a privacy fence.
- It is important to periodically review potential exposures as land uses change.

References

- None.

Notes:

Purpose of Slide

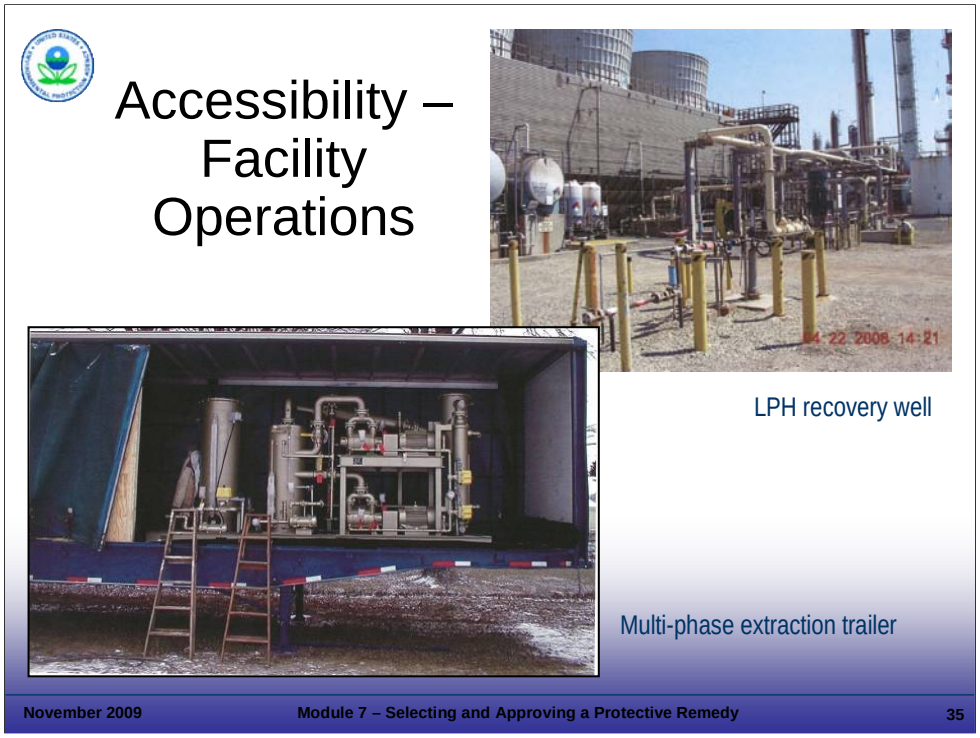
- Discuss Right of Way/Ownership issues.

Key Points

- This photograph shows rotasonic drilling at an angle to reach potential DNAPL contamination. The contaminants are along a rail right of way and access was not possible from the right of way.
- A similar case may arise when the adjoining property owner will not allow access to investigate.
- Notice the power lines in this photograph. Both above-ground and underground utilities are considered during remedy design and implementation.

References

- None.



Notes:

Purpose of Slide

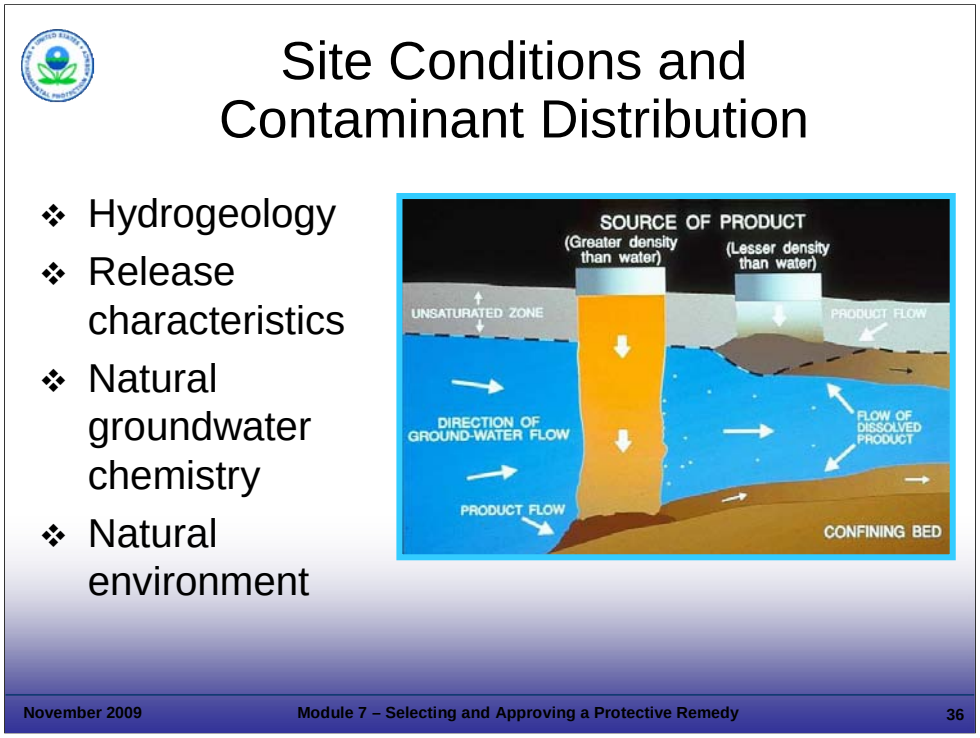
- Further discussion of remediation design considerations as they relate to accessibility and facility operations.

Key Points

- These photographs show ECs are protective of HH&E at operating facilities where there is limited access to portions of the facility.
- The multi-phase extraction trailer is at a chemical plant. The trailer is located outside the main part of the plant where it is safer and does not interfere with the operating facility.
- The light petroleum hydrocarbon (LPH) recovery well is placed outside the area of an operating facility where high pressure and high temperature equipment is present.

References

- None.



Notes:

Purpose of Slide

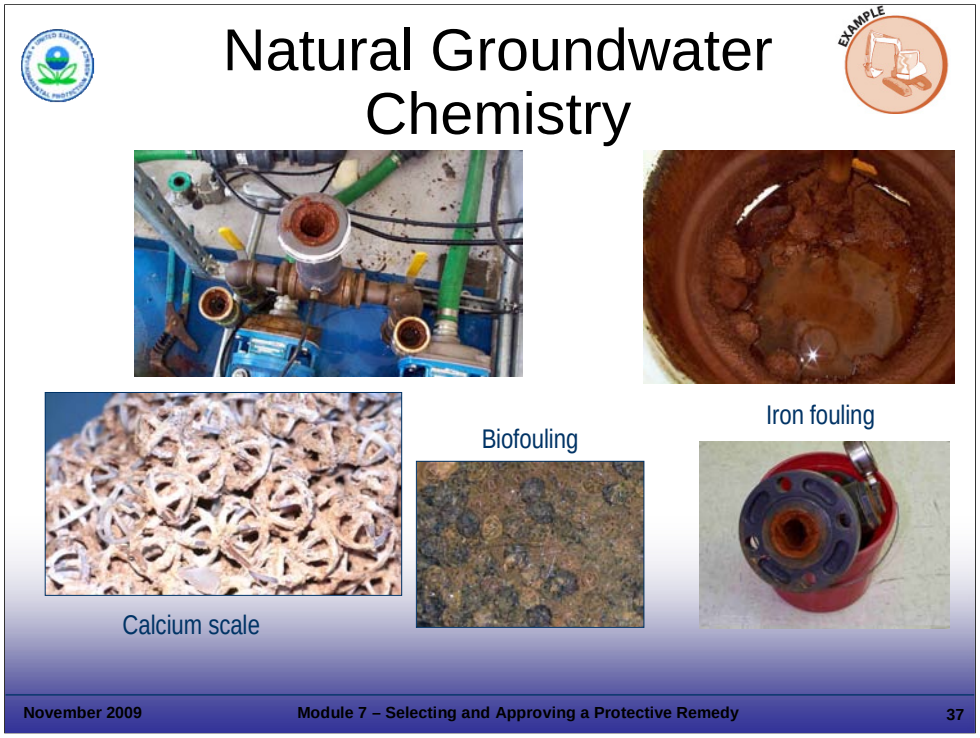
- Discuss site conditions and contaminant distribution and their potential impacts on the remedy.

Key Points

- Site conditions and contaminant type and distribution are the characteristics that we generally focus on during the characterization and remedy selection phase.
- However, the other topics we are discussing in this module can be equally important because they can make the difference between a remedy being implementable and not.
- The types of contaminants, media, type of release, and age of release, will all affect the remedial approach.
- Type of contaminant –
  - What was released? VOCs? Semi-volatile organic compounds (SVOCs)? Metals?
  - NAPL (product) or dissolved phase (like rinse water)? Solid waste? Floaters or sinkers?
- Release characteristics –
  - How was the material released? Through a spill or a slow leak over numerous years?
    - A spill generally spreads out over a wide area and percolates downward.
    - A long, slow release generally tends to cover a smaller area, but may migrate deeper.
  - Age of release – When was the material released?
    - Time affects degradation (what are we dealing with now) and dispersion (how far have the contaminants spread).
    - Some byproducts can provide clues to what natural processes are occurring on site.
- Natural groundwater chemistry can affect treatment options. Slide 44 shows problems associated with high iron content.

References

- None.



Notes:

Purpose of Slide

- Explain how the natural chemistry of the groundwater can affect treatment system design and cost. Anticipating issues is always preferred, but sometimes treatment problems do not show up until a system is running and modifications to design or maintenance become necessary.

Key Points

- This is an example of a site where a proven remedy – pump and treat groundwater contaminated with VOCs with air stripping technology – was implemented. Iron pretreatment was considered but eliminated in initial design due to high cost and some uncertainty of need, given the anticipated flow from multiple recovery wells with highly variable iron content combining as influent to the treatment system.
- The alternative to pretreatment was anticipating higher maintenance costs due to iron fouling at the air stripper. The operation and maintenance (O&M) plan and budget called for frequent cleaning and replacement of the packing material.
- However, iron oxidized at the collection pad due to aeration and affected system operation.
- The system was modified by replacing jet pumps. An air diaphragm pump was pilot tested at one of the treatment zones. It recovered groundwater at similar rates while lowering maintenance costs by reducing aeration and recirculation of the iron laden groundwater.
- Calcium scale can build up on air sparge packing material, and biofouling can also be a problem, depending on natural water chemistry.

References

- None.

Notes:

Purpose of Slide

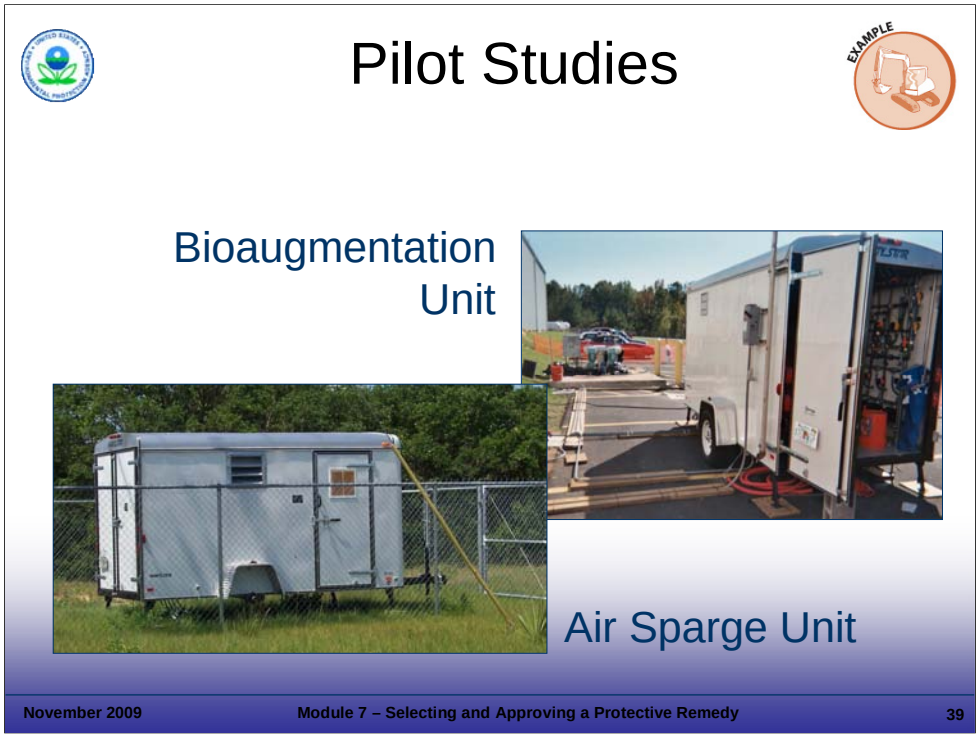
- Review how natural site conditions can affect remedy selection.

Key Points

- Physical site conditions can be problematic for some remedies. In this photograph, a large front end loader is being used to extract a bull dozer mired in mud. This incident occurred while workers were trying to clear a path to install a monitoring well.
- The presence of wetlands can impact remedy selection. For instance, thermal treatment may damage natural habitats and therefore, may be eliminated as a remediation option when wetlands are present.

References

- None.



Notes:

Purpose of Slide

- Discuss the concept of pilot studies to verify the feasibility/effectiveness of the selected technology(ies) to address site-specific conditions.

Key Points

- A pilot study is a focused, limited-scale test of a technology to determine its potential effectiveness under field conditions.
- Sometimes, a pilot study is preceded by a bench-scale test, which is a smaller lab-based test of the technology.
- Data from field observations are used to scale up the technology from the pilot-scale to the full-scale remedy.
- On some small sites, cleanup that is accomplished through a successful pilot study may actually turn out to be the final remedy.
- The unit shown on the left is a portable air sparge unit, originally used for a pilot study. At one site, this unit remediated groundwater to below MCLs in less than six months; it was used as a polishing step following pump and treat.
- The unit shown on the right is a bioaugmentation pilot trailer. Groundwater is extracted, amended with nutrients, and reinjected. Groundwater oxidation-reduction potential (ORP), pH, and temperature are read and logged electronically. The amended groundwater is then injected upgradient of the contaminant source area under gravity flow. After 12 months, contaminant mass in the source area was reduced by 97%, resulting in the elimination of a contaminated groundwater discharge to a stream and a change in remediation approach to monitoring only.
- In some cases, the pilot study will prove that a remedy is not effective and an alternative approach will be needed.

References

- None.

Notes:

Purpose of Slide

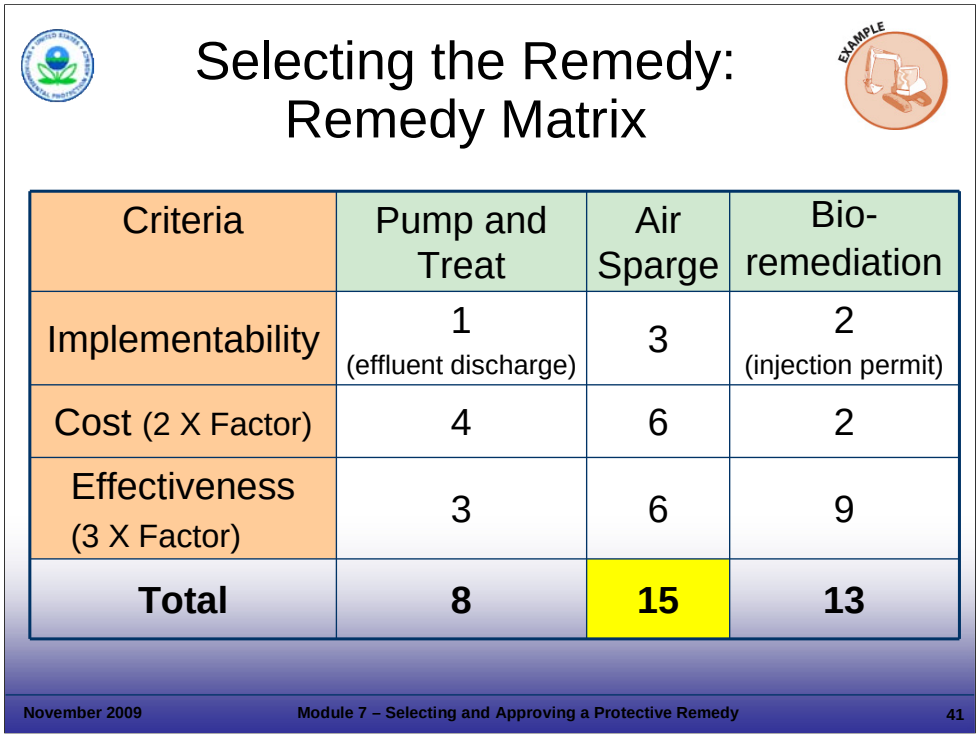
- Discuss the importance of addressing waste management issues early in the remedy selection process – point out that waste management is discussed in greater detail in Module 9, Managing Remediation Waste.

Key Points

- Understanding the volume and nature of wastes that may be generated from each remediation option is important, given that waste management issues can limit available options. For example, if soil contains hazardous waste, excavation and off-site disposal may be cost prohibitive. Air emissions limitations may eliminate certain treatment options or mean that off-gas treatment may be necessary. Handling of treated effluent is a common challenge for groundwater pump and treat systems.
- RCRA regulations that address the handling and disposal of waste can affect the selection of remedies or specific designs, particularly to minimize the generation of hazardous waste during remediation.
- Air emissions from treatment technologies may be subject to the Maximum Achievable Control Technology (MACT) Rule for Site Remediation – The MACT final rule (40 CFR Part 63, subpart GGGGG) was published on October 8, 2003. It establishes national emission standards for hazardous air pollutants from site remediation activities. The rule covers remediation of contaminated environmental media, such as soils, groundwater or surface water. The affected sources subject to control are: process vents, remediation material management units, and equipment leaks. Currently, the final rule exempts emissions from site remediation when covered under CERCLA or RCRA CA programs (but this exemption has been challenged in court). The rule does not provide an exemption of cleanups conducted under alternative authorities, such as state voluntary programs. Even with the current exemption, the MACT applies to all cleanups not performed under a permit or 3008(h) order.
- Effluent disposal can be an issue – what do you do with treated groundwater? Options and considerations include:
  - Surface water discharge – National Pollution Discharge Elimination System (NPDES) permit
  - Exfiltration gallery – shallow disposal
  - Underground injection well – Underground Injection Control (UIC) permit required
  - Publicly-Owned Treatment Works (POTW) – may be cost prohibitive: (1) Is a pipeline required?, (2) Is a connection available nearby?
  - Permitted industrial pre-treatment facility – are the waste stream and process compatible?
- Some remediation wastes (soil, sludge) may have to be transported by truck for disposal to a non-hazardous or hazardous waste facility.

References

- Federal Register (FR). 2003. 40 Code of Federal Regulations (CFR) Part 63. National Emission Standards for Hazardous Air Pollutants; Site Remediation. Final Rule. 68 FR No. 195. October 8.
- EPA. Office of Air and Radiation Web Site. Includes link to the Proposed Rule from 2002 (http://www.epa.gov/ttn/oarpg/t3/meta/m6058.html).
- National Petrochemical and Refiners Association (NPRA) Website. Information on Site Remediation MACT and link to Final Rule Promulgated on October. Accessed On-line at: http://npra.org/issues/environment/?zoom_highlight=MACT.



Criteria	Pump and Treat	Air Sparge	Bio-remediation
Implementability	1 (effluent discharge)	3	2 (injection permit)
Cost (2 X Factor)	4	6	2
Effectiveness (3 X Factor)	3	6	9
Total	**8**	**15**	**13**

Notes:

Purpose of Slide

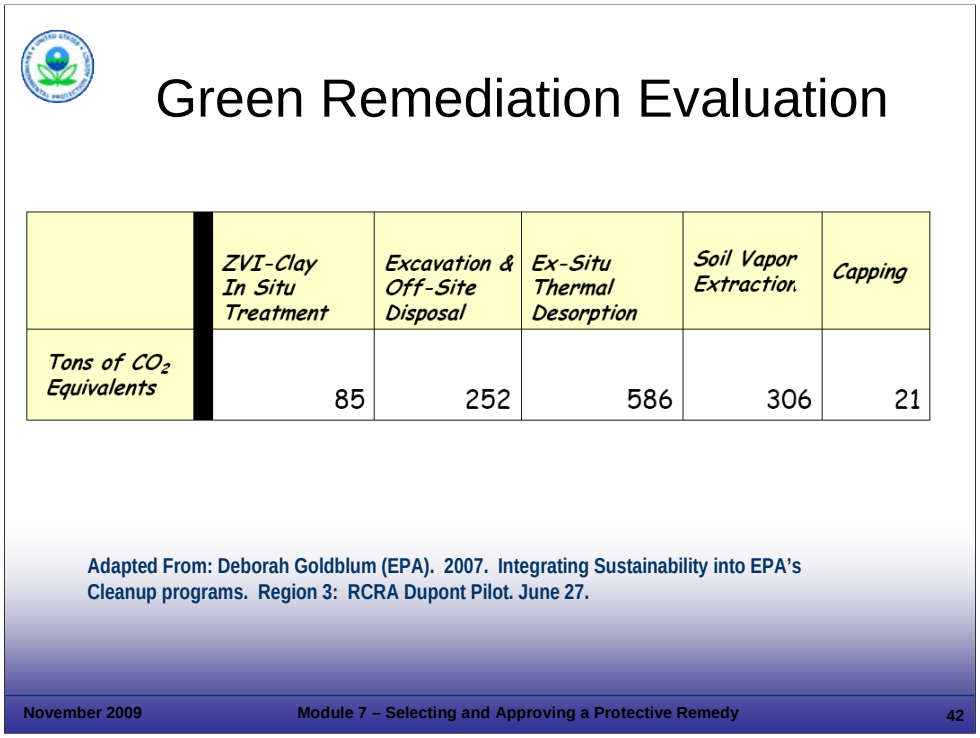
- Show the utility of a matrix to compare and select remedies. Also point out that the threshold and balancing criteria are useful in evaluating options because they address both policy and field considerations important for selecting a remedy.

Key Points

- Feasibility studies are not required under RCRA CA, but facilities often evaluate multiple technologies for site cleanups. One effective way to select a remedy from a number of alternatives is to develop a matrix of remedial options, evaluation criteria, and associated weighting factors for the evaluation criteria. The speaker will describe the rows and columns shown on this slide. The scale used for each item ranges from 1 for low score to 3 for high score; these scores are then weighted as shown on the table.
- Weighting factors are established to represent the importance of a criterion to a facility. For instance, in this example, the facility considers effectiveness to be the most important criterion and it is weighted by a factor of 3.
- In the example shown, the technology selected for implementation would be air sparging based on the selection criteria and weighting factors applied.
- This screening approach can be implemented before complete characterization of the facility is accomplished. For instance, air sparge could be tentatively selected as the most appropriate remedy based on current information, with a subsequent pilot test used to evaluate the implementability of the remedy (for example, adequate radius of influence). Based on pilot test results, air sparge might remain as the final remedy or another remedy may be more deemed more appropriate. In this case, air sparge was appropriate for one part of the site and bioaugmentation was used for another part of the site.
- It is not always necessary to prepare a CMS containing detailed evaluations and descriptions of various remedial alternatives considered for the facility. The CMS or equivalent document need only present the selected remedial alternative and the basis for its selection. This streamlined approach is more efficient and cost effective than presenting the full range of technologies considered.

References

- None.



Notes:

Purpose of Slide

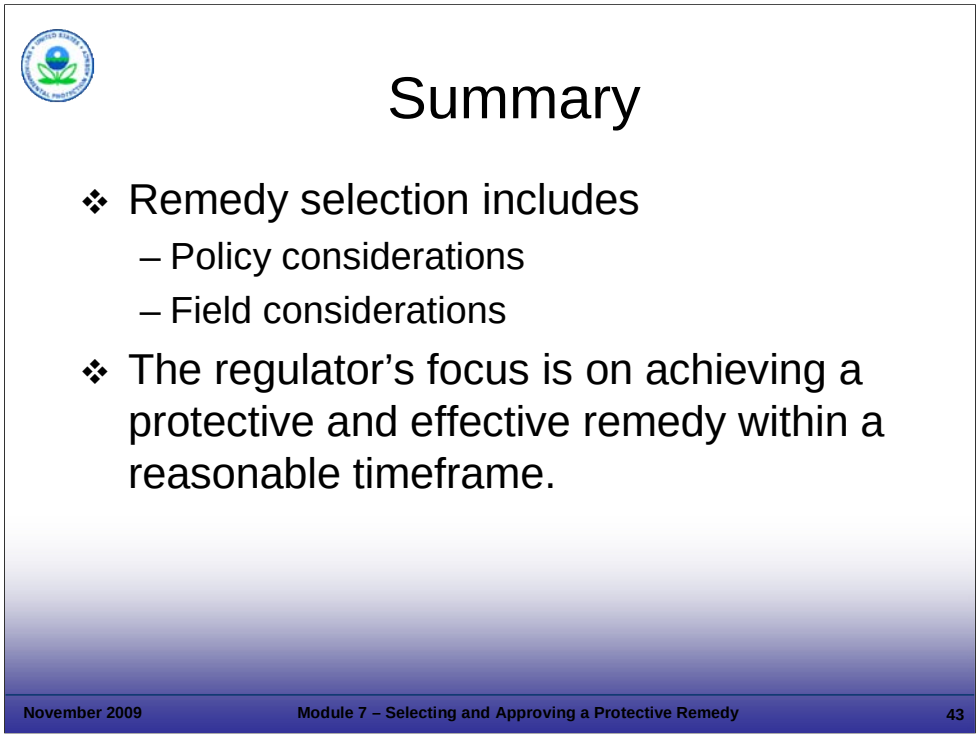
- Present a potential additional row in a broader remediation technology matrix to address green remediation - in this case, carbon dioxide (CO_2) emissions from a variety of alternative remedies under consideration are compared.

Key Points

- This is from an EPA Region 3 pilot study, which focused on integrating sustainability into cleanups and identified sustainability goals, performance measures, and implementation options.
- Sustainability performance measures included consideration of greenhouse gases produced, resources consumed (land, soil, water), and energy consumed.
- This table shows the greenhouse gas emissions calculated based on implementation of five remedial options (ZVI is zero valent iron). In addition to the threshold and balancing criteria, this type of information can be used in the evaluation and selection of a remedy.

References

- EPA. 2007. Integrating Sustainability into EPA's Cleanup Programs. Region 3 RCRA DuPont Pilot. Author Deborah Goldblum. June 27.



Notes:

Purpose of Slide

- Summarize the key points of this module.

Key Points

- The participants will have reviewed and learned about a variety of considerations for selecting remedies and achieving a Remedy Decision.
  - Only some of these considerations are technical (related to hydrogeology, chemistry, and transport of contaminants); policy considerations are also important.
  - It is important to remember that field considerations, such as access and right of way, also can impact remedy selection and implementation.
- We have discussed the importance of a results-based approach and the application of the flexibility allowed under the RCRA CA program to select protective remedies that will meet cleanup criteria in reasonable timeframes based on current and reasonably anticipated uses.

References

- None.