1.9 Environmental compliance personnel shall demonstrate a familiarity level knowledge of the principles and concepts of soil science.

Supporting Knowledge and/or Skills

a. List the different soil compositions and soil structures.

Soil with similar properties (composition) are grouped into soil classifications as follows:

- Alfisols are typically forest soils with clay translocations and deposition, and with high base status;
- Aridisols are soils existing in a dry climate where salts and carbonates may have accumulated;
- Entisols are recently formed soils with a limited development of horizons (layers);
- Histosols classify the soils in peat bogs and fens which may have high amounts of undecomposed organic matter;
- Inceptisols are young soils that possess few diagnostic features;
- Mollisols are temperate grasslands soils with a high organic matter content;
- Oxisols are highly weathered tropical soils;
- Spodosols are soils with substantial subsoil accumulation of humus and iron/aluminum oxides;
- Ultisols are soils with clay translocations and deposition, with low base status; and,
- Vertisols are swelling clay soils.[1]

Soil structure is a description of the grouping or aggregation of particles in soil and is important in determining its characteristics. Structure is strictly a field term descriptive of the gross, overall aggregation or arrangement of the primary soil separates. Four primary types of soil structure are recognized: platy, prismlike, blocklike, and spheroidal. The mechanics of structure formation are exceedingly complicated and rather obscure. The nature and origin of the parent material are important factors as are the physical and biochemical processes of soil formation, particularly those resulting in the synthesis of clay and humus. Climate is also a prime consideration.[1]

b. Define humus and explain its role in chemical reactions in the soil.

Humus is partially decomposed organic matter that is only slightly soluble in water. Humus coats sand, clay, and silt particles to form topsoils, by binding these particles and contributing to the soil's structure. Humus usually possesses a negative electrical charge and tends to attract positively charged nutrient ions - potassium (K^+), calcium (Ca^{2+}), and ammonia (NH_4^+).[1] Humus has a negative charge strong enough to counteract the leaching effect of rainwater as it passes through the topsoil layer, binding the nutrients in a location accessible to plant roots. Pesticides that form cations (positively charged ions) also bond with the humus layer in a process called adsorption, decreasing their concentration in solution (and ultimately the groundwater). In addition, humus limits the solubility of certain metal cations, attenuating the migration of these potentially harmful substances in surface and groundwater. For example, the solubility of radioactive cesium could be limited at a nuclear disposal site because of humus.

c. Define erosion (water and wind).

Soil erosion is the loss of topsoil, surface litter, and other soil components, primarily due to the actions of flowing water or wind. Loss of topsoil reduces surface fertility, which in turn reduces plant coverage and the ability of plants to hold the soil, accelerating the erosion process. Wind erosion is experienced where dry, bare soil exists (as in the Great Plains Dust Bowl experienced in the U.S. Midwest during the 1930s) and usually contributes to less soil loss than does water erosion. Three types of water erosion occur. Sheet erosion occurs when uniform sheets (or layers) of soil are washed away due to a wide flow of water. Rill erosion is produced when rapidly flowing surface waters form rivulets, cutting small channels into the soil. Gully erosion results when the rivulets of rapidly flowing surface water combine with subsequent rains (usually on steep, vegetation-poor slopes), cutting wider and deeper channels (gullies). Soil erosion is usually less severe in forests and rangelands than on croplands, but soil resources in these areas recover more slowly than those on croplands.

d. Describe the following processes and explain how water and soil interact in each:

- Infiltration and percolation
- Groundwater recharge
- Runoff
- Evapotranspiration
- Unsaturated flow

The flow of water through the environment is known as the hydrologic cycle. This cycle facilitates the dispersion of nutrients through the environment. The hydrologic cycle consists of evaporation, transpiration, condensation, precipitation, infiltration, percolation and runoff. Evaporation is the process of water being converted into water vapor and transpiration is the process of water being transported through a plant's parts to be evaporated into the atmosphere (also known as evapotranspiration). Condensation is the formation of water droplets from water vapor. Precipitation is the deposition of condensed water vapor as dew, rain, snow, sleet, or hail. Infiltration is the movement of water into the soil. Percolation is the downward flow of water through soils and permeable rock layers into groundwater (this process is known as groundwater recharge). Runoff is the surface flow of water that does not infiltrate into the soil. The flow of water through unsaturated soils occurs as a result of a gradient of total potential. Potential is the difference in energy of water in soil as apposed to free water. Total potential is the sum of gravitational potential, matric potential and osmotic potential. Gravitational potential is exerted by the acceleration of gravity. Matric potential results from surface tension and adhesion of water to the surface of the soil. Osmotic potential results from differences in dissolved concentrations of molecules and ions. Water moves from areas of high total potential to areas of lower total potential. Gravitational potential is usually the most significant factor making up the total potential and causing the unsaturated flow of water in soils; however, matric potential can also become significant. For example, water does not usually move from clay to sand even though the sand is drier. This is because the

higher adsorption properties of the clay result in a low matric potential. In drier soils, water is more strongly held at lower potentials and is mainly restricted to narrow pores, resulting in the water flowing more slowly in unsaturated soils compared to the rate of flow through saturated soils.[1]

e. Describe how soil characteristics, slope factors, and land cover conditions impact the detachment and transport processes of pollution.

Erosion and sediment transport occurs as a result of water flowing across the ground. This process does not take place until the rainfall intensity exceeds the infiltration rate of the soil. The size of the soil particles that are detached, or entrained, are a function of the velocity of the runoff water[2]. A soil's erodibility is a function of the degree of slope, the texture of the soil, where finer textured soils can be detached and transported by lower velocities of water, and the degree of surface roughness (cover condition class). At some point down slope when the velocity of the surface water decreases, sediment will be deposited with the larger aggregates deposited first and the smaller sized particles carried further downslope. The sorted deposition of different sizes is a function of reduced velocities. The density of vegetation and the amount of accumulated litter is a primary factor in increasing surface roughness, promoting infiltration and in reducing the velocity of water flowing across the surface. A high degree of surface roughness aids in preventing the detachment of soil particles, aids in slowing water and in promoting deposition.

The transport of pollutants through the soil is dependent on physical soil properties as well as to the soil's chemical properties, which determine its ability to retain (adsorb) the chemical constituents of the pollutants. Water solubility of the contaminant is a large determinant in the release and transport of the contaminant in surface and groundwater. Usually, highly soluble chemicals tend to have a low adsorption potential with regard to soils and sediments and tend to be quickly and easily distributed by the hydrologic system. Dissolved pollutants being transported by surface waters mostly travel the route that the surface water flows, which is dependent on slope (among other factors). Transport of pollutants into the groundwater is dependent on the rate of percolation. Pollutants that are strongly adsorbed to soil particles are transported at the rate of soil erosion (i.e. transported with the soil particle).

f. Discuss pollutant loading and the pollutant delivery ratio.

Pollutant loading describes the rate of transmission of pollutants to the environment, usually to a surface water body, such as a river or stream. Pollutant loading is often described in terms of mass of pollutant per unit time. A pollutant delivery ratio is used to calculate the loading of a particular pollutant. It can be described as the ratio of the gross amount of pollutant available per the amount delivered to a source. Pollutant delivery ratios are determined by using the Modified Universal Soil Loss Equation (MULSE) and sorptive partition coefficients for the pollutants of concern. The MULSE is an emperical model that is used to approximate the amount of surface soil eroded in a storm event of a

particular intensity. Sorption coefficients are required to project the amount of a pollutant transported in dissolved verses solid (sorbed) phases[3]. Pollutant loading is often used to determine the fate and transport of pollutants for Remedial Investigation/Feasibility Studies (RI/FS), RCRA Facility Investigations/Corrective Measures Studies (RFI/CMS), analyzing environmental impacts for NEPA evaluations, and for conducting both human health and environmental risk assessments.

g. Discuss the use of soil survey maps.

A general soil survey map is color–coded to distinguish the major soil associations (groupings) present in the area of consideration. A general soil survey map depicts factors on a larger scale and is not suitable for obtaining information required for soil management at an individual site, but allows the comparison of larger areas of land for general land use determinations. In addition to depiction of soil associations, general soil survey maps often include three dimensional representation showing relationships between soils, parent materials, and landscape position for the major soils included in the soil survey.

For information pertinent to a particular site, selection of the appropriate map for the specific site from the "Index to Map Sheets" in the soil survey is required. Each map unit description includes soil information for common uses, major limitations or hazards, and possible alternates to remedy these limitations or hazards. Soil surveys facilitate the development of resource plans, but as each soil area on the map may consist of several soil types, onsite investigation is required for intensive use planning[4].

h. Discuss the cation and anion exchange capacity of soils.

Cation exchange capacity (CEC) is defined as the ability of soil to sorb or hold cations and to exchange species of these ions in reversible chemical reactions. It is a quality important for both soil fertility-nutrition studies and for soil genesis. Thus, this type of data is widely used in soil classification considerations. However, its measurement is rather empirical, and several different analytical methods have been proposed. Despite the differences, CEC determinations yield numbers which are valuable in evaluating the capacity of soil to retain cations, its degree of weathering, and general chemical reactivity. The two types of CEC determinations that have been more widely employed are the ammonium saturation-displacement method commonly conducted at pH 7, and the summation method in which all exchangeable cation species are added. Some uses, inferences, and interpretations from CEC data are: (1) Inferences as to clay mineral species present in the soil; (2) Relative degree of weathering of the soil; (3) Agronomic and forest nutrition significance; (4) Engineering practice; and (5) Computing "percentage base saturation," a widely used pedologic and nutritional quality of soils[5].

Anion exchange deals with the reaction of phosphate ions with various metals such as soluble iron, aluminum, and manganese and with insoluble hydrous oxides of these elements, such as limonite and goethite. The compounds formed as a result of fixation by

iron and aluminum oxides are likely to be hydroxy phosphates. The large quantities of hydrous iron and aluminum oxides present in most soils make possible the fixation of tremendous total amounts of phosphorus by this means. Part of the phosphate that has reacted with iron and aluminum compounds and with silicate clays is subject to replacement by other anions. Such replacement is called anion exchange.[1]

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[1] Brady, Nyle C., *The Nature and Properties of Soils*, 8th ed., Macmillian Publishing Co., NY, 1974.

[2] Barfield, B.J., R.C. Warner, and C.T. Haan, *Applied Hydrology and Sedimentology for Disturbed Areas*, 1st ed, Oklahoma Technical Press, Stillwater, OK, 1981.

[3] Asante-Duah, D. Kofi, *Management of Contaminated Site Problems*, Lewis Publishers, Boca Raton, FL, 1974.

[4] *The Surface Down-- An Introduction to Soil Survey for Agronomic Use*, U.S. Department of Agriculture Soil Conservation Services, 1994.

[5] Buol, S.W., F.D. Hole, and R.J. McCracken, *Soil Genesis and Classification*, The Iowa State University Press, Ames, IA, 1973.

1.12 Environmental compliance personnel shall demonstrate a familiarity level knowledge of the basic principles and concepts of meteorology.

Supporting Knowledge and/or Skills

a. Discuss the properties of high pressure and low pressure systems and their impact on air pollution.

Air molecules are in constant motion, colliding with each other and objects in their paths. As the molecules collide, energy is transferred in the form of momentum. The momentum transferred is a function of the average kinetic energy of the molecules and is proportional to the absolute temperature. As the collision occurs, a force is exerted on a unit area of surface and is called air pressure.

An object on the earth's surface supports a vertical column of air which overlays it. This column of air exerts a force on the object equal to its weight. This force or atmospheric pressure is greatest near sea level ($1.013 \times 10^5 N/m^2$). Atmospheric pressure decreases with altitude because the weight of the overlying column of air decreases. Atmospheric density also decreases because the concentration of gaseous molecules per unit volume decreases. Thus, within the atmosphere there are high and low pressure air masses.

Large-scale horizontal air movements result from the differential heating (including cooling) of the earth's surface. Basically, this solar energy creates the large–scale pressure gradients. Air flow moves laterally from high pressure areas to low pressure areas; this pressure gradient creates local weather conditions (e.g., wind conditions, storm fronts, etc.). Classic air pollution episodes – most notably smog – occur when pressure systems allow air motion to stagnate: stagnant air is also known as light wind. Pollutant concentrations increase with light wind conditions. In periods of high winds of variable direction, pollutants are dispersed over greater lateral distances and pollutant concentrations are lower.[1]

b. Describe the following horizontal dispersion terms:

- Wind rose
- Pollution rose/plume meander

A wind rose is a graphical representation of wind direction frequency and speed for a set time period. Figure 1.12-1 is a wind rose that illustrates how data are plotted for eight primary and eight secondary compass directions.[1] The length of each spoke delineates the wind speed. The center of the wind rose presents the percentage of calms, with each concentric circle showing the wind speed in the depicted range.

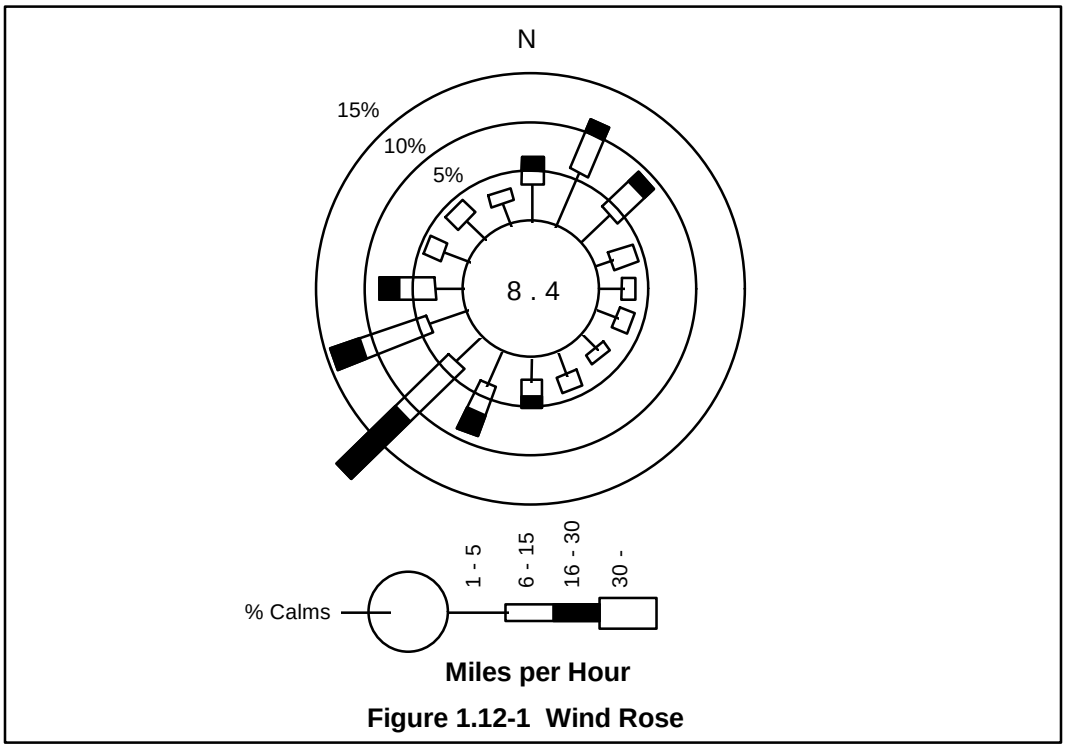


Figure 1.12-1 Wind Rose

A pollution rose/plume meander is a wind rose graphically showing pollutant dispersion data from point and area sources. Figure 1.12-2 shows a pollution rose for a carbon monoxide (CO) from an air monitoring location.[1]

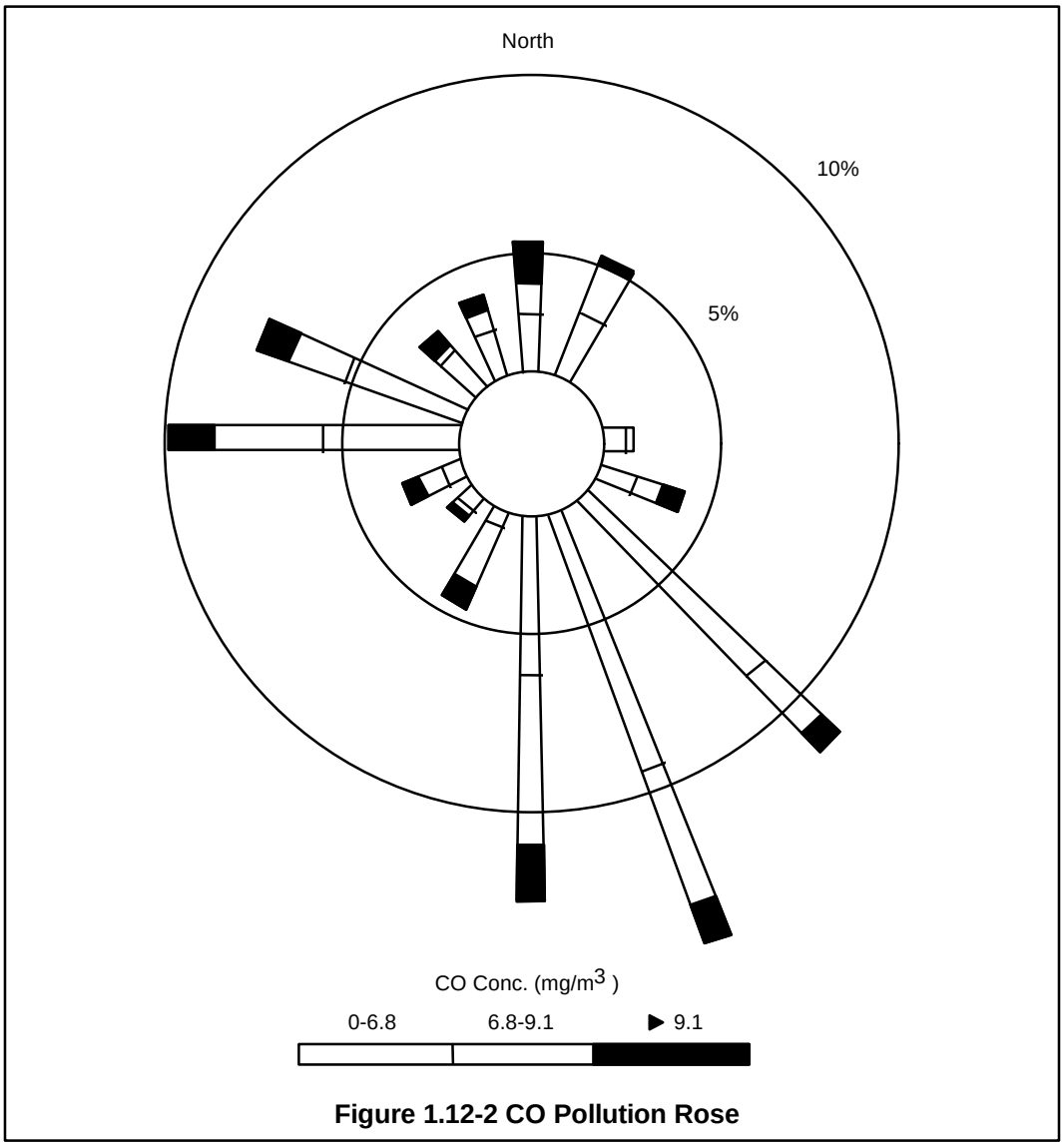


Figure 1.12-2 CO Pollution Rose

c. Describe the role of lapse rate in determining dispersion coefficients.

- Dry adiabatic lapse rate
- Prevailing lapse rate
- Neutral lapse rate
- Subadiabatic lapse rate
- Weak lapse rate
- Inversion
- Superadiabatic lapse rate

Lapse rate is the decrease in temperature due to increasing altitude. The lapse rate continues in the troposphere to an elevation of approximately 10 kilometers (km). The decrease in temperature with height is due to reduction of heating processes and radiative cooling of the air. The average normal lapse rate is -0.65°C/100m or -6.5° C/km.

The temperature values measured in a vertical column of air may vary widely with elevation. This measured temperature variance is called the lapse rate (or environmental lapse rate). These different lapse rate values characterize the stability of the atmosphere according to air motion and thus pollutant dispersion[1]. Stability then is the turbulence created by buoyant forces in the atmosphere and is related to the vertical temperature profile.[2] The atmosphere is considered stable when the lapse rate approximates a normal lapse rate (-0.65 °C/100m).

For warm, dry air being lifted vertically in dry air conditions, adiabatic expansion and cooling takes place. Under these conditions the lapse rate is called the **Dry Adiabatic Lapse Rate** and has a value of -1° C/100m or -10 °C/km.

The **prevailing lapse rate** is the term used to describe the consistent current atmospheric conditions at a given geographic location. This lapse rate is dependent upon various factors such as elevation, prevailing winds, moisture content, etc., and varies from location to location.

A **neutral or normal lapse rate** occurs when atmospheric conditions approach the adiabatic lapse rate (-0.65° C/100m). Neutrally stable air is warmer than surrounding atmosphere and rises, resulting in good dispersion of pollutants[1].

The **subadiabatic lapse rate** (≤ -1 °C/100m) is less than the dry adiabatic lapse rate[3]. Atmospheric conditions are considered stable under a subadiabatic atmosphere.

A **weak lapse rate**, or isothermal conditions, occurs when a warm parcel of air is released into an environment where the temperature remains constant with elevation. Under these atmospheric conditions the atmosphere is weakly stable and dispersion of pollutants is limited.

In an **inversion,** air parcel temperature is cooler than the surroundings, allowing the air to sink. Atmospheric conditions are very stable, with restricted vertical motion and resistance to change. Dispersion potential during inversion conditions is very poor[3]. An inversion represents unusually stable air and is particularly favorable for the entrapment of pollutants to the degree that heavy smog or highly toxic fog can develop. Local topography, such as in mountain valleys, can exacerbate inversion conditions by naturally trapping stable air. A frontal inversion results when rapidly moving warmer air masses move into air masses of lower temperature, passing over the cooler air mass and forcing it to remain at ground level[4].

Superadiabatic lapse rate (-2 °C/100m) occurs when unstable atmospheric conditions are such that warm air is cooling at a rate greater than the adiabatic lapse rate (-1 °C/100m) allowing air to rise rapidly. A superadiabatic lapse rate is excellent for vertical dispersion of pollutants.

d. Describe the classes of atmospheric stability, including inversions.

The classes of atmospheric stability are categorized into four types based on lapse rate:

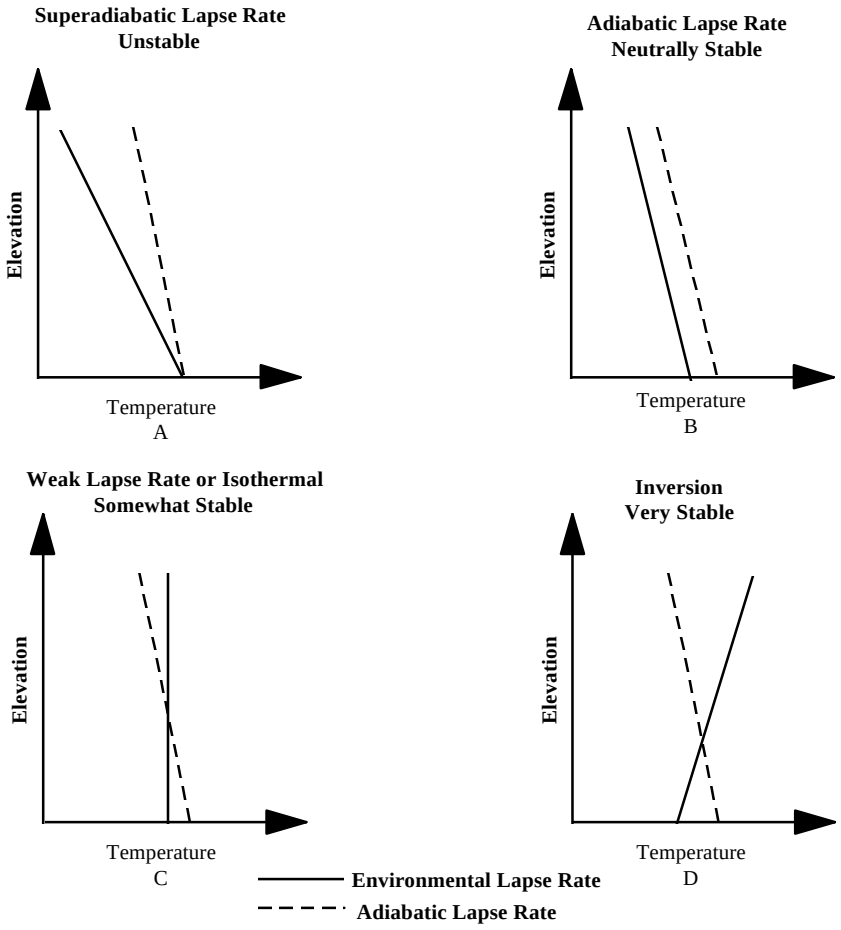
(1) Unstable or superadiabatic lapse rate;
(2) Neutrally stable or approximately the adiabatic lapse rate;
(3) Isothermal; and,
(4) Very stable or inversion conditions.

Figure 1.12-3 graphically illustrates the relationship between elevation and temperature for each atmospheric stability category[1]. The figure presents the Adiabatic Lapse Rate or Normal Lapse Rate (dashed line) by showing a constant slope throughout. The solid line represents the slope of the Environmental Lapse Rate that shows the relationship between the elevation and temperature of an air mass. As an air mass moves up and down the solid line, it is creating stable or unstable atmospheric conditions in relation to the surrounding air conditions.

The unstable or superadiabatic lapse rate and neutral stability or adiabatic lapse rate are discussed in Section 1.12(c). Isothermal stability is when atmospheric conditions are such that temperature remains constant with increasing elevation and a warm air mass would rise until it reaches equilibrium with the surrounding environment. Isothermal conditions are fairly stable and, therefore, are limited in the dispersion of pollutants[3].

Inversions occur under very stable atmospheric conditions. Under such conditions, atmospheric temperatures increase rather than decrease with increasing altitude, until a region of cooling is eventually reached. The inversion layer is the vertical distance in which this inversion of expected temperature ranges occurs. Inversion layers are located at ground level and in a variety of different atmospheric regions. Inversions limit vertical atmospheric mixing and will vary in altitude during the course of the day. The condition described above is the classic subsidence inversion. Advective inversions are formed when a warm air mass moves to cover a colder surface - as when warm air is forced over cooler mountains with the result of the warm air passing over the cooler air remaining stagnant on the lee side of the mountains. Radiation inversions (nocturnal inversions) occur due to loss of surface heat during the night as radiant energy stored in the ground is dissipated. As the surface temperature decreases, the air above the ground loses heat, producing a cooler air mass which remains stagnant. A frontal inversion results when rapidly moving warmer air masses move into air masses of lower temperature, passing over the cooler air mass and forcing it to remain at ground level[4].

Figure 1.12-3 Environmental Lapse Rates and Atmospheric Stability



Also important to air stability is the effect of density differences (See Figure 1.12-4). Air pressure – created by the kinetic energy of molecules colliding – elevation, and density of an air mass are all interrelated. In general, as an air mass moves to a higher elevation it has less air pressure or less kinetic energy, due to a decrease in the concentration of air particles. Moreover, as an air mass moves higher its density also decreases, subjecting the mass to wind movement. Therefore as an air mass at a high elevation cools, it drops in elevation, resulting in an increase increasing in density, increasing temperature and pressure. These changes which then creates stable or unstable conditions such as stagnation.

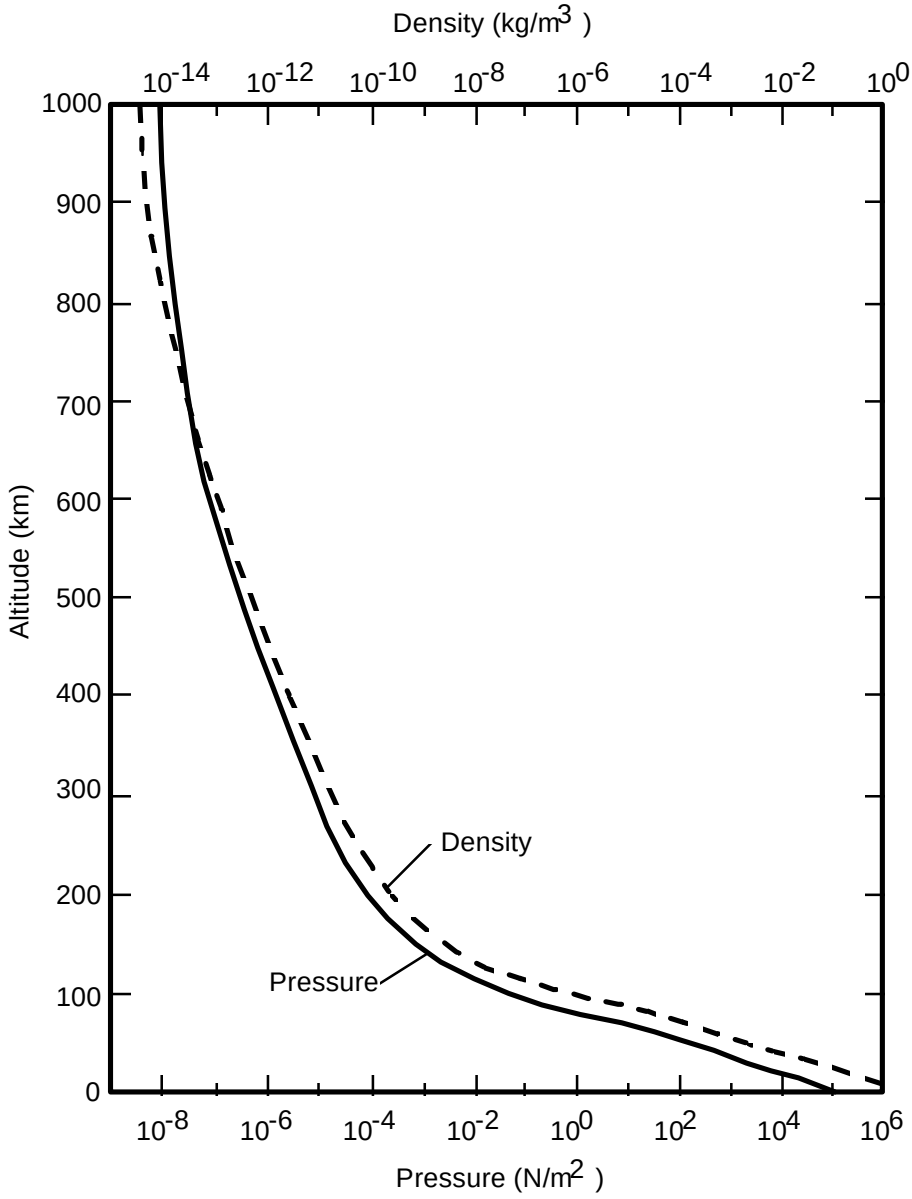


Figure 1.12-4 Atmospheric Density and Pressure Changes with Altitude

The **unstable or superadiabatic lapse rate** and **neutral stability or adiabatic lapse rate** are discussed above in Section 1.12(c). **Isothermal** stability is when atmospheric conditions are such that temperature remains constant with increasing elevation and a warm air mass would rise until it reaches equilibrium with the surrounding environment. Isothermal conditions are fairly stable and; therefore, are limited in the dispersion of pollutants.[3]

Inversions occur under very stable atmospheric conditions. Under such conditions, atmospheric temperatures increase rather than decrease with increasing altitude, until a region of cooling is eventually reached. The inversion layer is the vertical distance in which this inversion of expected temperature ranges occurs. Inversion layers are located at ground level and in a variety of different atmospheric regions. Inversions limit vertical atmospheric mixing and will vary in altitude during the course of the day. The condition described above is the classic subsidence inversion. Advective inversions are formed when a warm air mass moves to cover a colder surface –as when warm air is forced over cooler mountains with the result of the warm air passing over the cooler air remaining stagnant on the lee side of the mountains. Radiation inversions (nocturnal inversions) occur due to loss of surface heat during the night as radiant energy stored in the ground is dissipated. As the surface temperature decreases, the air above the ground loses heat, producing a cooler air mass which remains stagnant. A frontal inversion results when rapidly moving warmer air masses move into air masses of lower temperature, passing over the cooler air mass and forcing it to remain at ground level[4].

e. Describe information given by a wind rose and a pollution rose.

This is a demonstration skill and an individual will actually be performing the activity rather than acknowledging comprehension. Information for this topic is located in Section 1.12(b).

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[1] Godish, T., *Air Quality*, 2nd ed., Lewis Publishers, Inc., Chelsea, MI, 1991.
[2] Tuner, D. B., *Workbook of Atmospheric Dispersion Estimates*, Air Resource Field Research Office, Environmental Science Services Administration, U.S. Environmental Protection Agency, Research Triangle Park, NC, 1970.
[3] Wark, K. and Warner, C., *Air Pollution, It's Origin and Control*, 2 ed. Harper and Rowe, New York, NY,1981.
[4] Griffin, Roger D., *Principles of Air Quality Management*, Lewis, Boca Raton, FL, 1994.

1.13 Environmental compliance personnel shall demonstrate a familiarity level knowledge of the basic terms and concepts of environmental biology

Supporting Knowledge and/or Skills

a. Define the following terms:

- **Ecosystem**

  An ecosystem is a natural unit of living and non-living parts that interact to produce a system.[1] More simply, it is the sum of the plant community, animal community, and environment in a particular region or habitat. Organisms in an ecosystem are linked with each other and their physical environment through energetic interactions and material cycling.[2] An ecosystem can be considered on a large scale, such as a watershed ecosystem, or on a smaller scale, such as a stream ecosystem within that watershed, or even the ecosystem associated with a fallen log.

- **Habitat**

  A habitat is the place or niche within the physical environment where a species or population lives. A habitat includes living factors, such as plants and animals; and non-living factors, such as soil, climate, and light.

- **Species**

  A species is a categorical subdivision of a genus. Species generally resemble each other in appearance, behavior, chemical makeup and processes, and in genetic structure. A species is a group of morphologically and ecology similar organisms that (usually) can reproduce successfully only with each other.[1]

- **Pathways analysis**

  Pathways analysis examines the relationship between the exposure routes of chemicals from the chemical source through air, water, sediment, and soil to populations of living organisms. The three exposure routes considered in ecological risk assessment are: (1) ingestion; (2) dermal/surface contact; and (3) inhalation/respiration.[3] Selected major pathways through which chemicals reach a population include:

  source > air > animals > inhalation
  source > soil > plants > surface contact
  source > soil > animals > ingestion or dermal contact
  source > soil > plants > animals > ingestion

source > water > plants > animals > ingestion
source > water > animals > ingestion or dermal contact
source > sediment > animals > ingestion or dermal contact

- **Bioaccumulation**

  The net accumulation of a nonbiodegradable or a slowly biodegradable chemical by a living organism via all exposure routes[4]. Accumulation may often be present in a particular part or organ of the body. A biodegradable substance is capable of decomposing rapidly under natural conditions[5]. Biodegradable substances are generally not bioaccumulated.

- **Bioconcentration**

  The terms bioconcentration, bioaccumulation, and biomagnification may be confused if not understood carefully. Bioaccumulation is the net accumulation of a chemical by a living organism via all exposure routes. Bioconcentration is the net accumulation of a chemical by an aquatic organism directly from aqueous solution. Thus, bioconcentration is one route of exposure that may contribute to overall bioaccumulation in an organism. Finally, biomagnification is the tendency of some chemicals to accumulate to higher concentrations at higher levels in the food chain through dietary accumulation[4].

- **Biotoxicity**

  Biotoxicity is a measure of the effect a chemical can cause in an organism, and the amount of chemical necessary to produce the effect. Acute toxicity causes death or extreme physiological disorders to organisms shortly following exposure to the chemical. Chronic toxicity involves long-term effects of small doses of a chemical and their cumulative effects over time[3]. These effects may lead to death of the organism, or disruptions of vital functions such as reproduction.

  Biotoxicity is influenced by the organism (e.g., life stage, species, sex, etc.), the concentration of the substance, the duration of exposure, synergism with other chemicals, and environmental conditions.

- **Biodiversity**

  Biodiversity is the total of all living organisms and the communities and ecological complexes in which they occur, their variety and variability, and the interactions between them. Biodiversity is considered on a number of levels, including genetic diversity, species diversity, and community or ecosystem diversity. Decreases in biodiversity weaken an ecosystem, making it more susceptible to distress, both from natural and artificial sources.

b. Discuss how synergism makes it difficult to establish a cause/effect relationship between pollutants and disease.

Synergism is the interaction of individual chemicals to produce an effect greater than the sum of the independent effects of the individual chemicals.[1] In other words, two or more relatively harmless substances, that, once mixed become toxic, demonstrate synergism. For example, a laboratory study of the effect of a single chemical on an organism may underestimate the effects that will occur in the natural environment, where the organism may be simultaneously exposed to a multitude of other chemicals which may interact with the original chemical.

[1] Barbour, M.G., *Terrestrial Plant Ecology*, The Benjamin/Cummings Publishing Company, Inc., Menlo Park, CA, 1987.
[2] Smith, R.L., *Elements of Ecology*, HarperCollins Publishers Inc., New York, 1992.
[3] U.S. Environmental Protection Agency, *Risk Assessment Guidance for Superfund Volume II Environmental Evaluation Manual*, Interim Final, EPA/540/1-89/001, March 1989.
[4] Suter, G.W. II, *Ecological Risk Assessment*, Lewis Publishers, Chelsea, MI, 1993.
[5] U.S. Environmental Protection Agency, *Terms of Environment: Glossary, Abbreviations, and Acronyms*, EPA Office of the Administrator, Office of Communications, Education, and Public Affairs, EPA/175/B-94/015, April 1994.

1.14 Environmental compliance personnel shall demonstrate a familiarity level knowledge of the purpose and uses of environmental sampling and monitoring equipment.

Supporting Knowledge and/or Skills

a. Explain the reason for measuring emissions, meteorological factors and ambient air quality under the various operating conditions (e.g., routine or emergency).

The Clean Air Act (CAA) and State Implementation Plans (SIPs) require measurement of emissions from stationary sources to comply with permit conditions (40 CFR Part 50 Subpart F). Emissions monitoring is used to indicate either operational compliance or permit violation and the need for corrective action. Factors such as ambient air quality and meteorological conditions must be considered to properly evaluate measured emissions and to establish a pre-permit conditions baseline, because they may influence the established operational limits.

Wind direction, temperature, air pressure, relative humidity, and other meteorological conditions affect data collected on ambient air quality and emissions and help to establish pollutant dispersion patterns and determine the relative risk posed to populations in emergency conditions.

b. Describe the purpose and limitations of the following air quality measurement instruments:

- High volume particulate sampler
- Liquid bubbler
- Infrared spectrometer

High Volume Particulate Sampler

The high volume particulate sampler is used to collect organic compounds and associated particles with low vapor pressures from ambient air. These substances, which include volatile, semivolatile, and nonvolatile organic compounds, require filtration of large volumes of air to capture sufficient particles for analysis. Sorbent filtration media are used to collect the substances of interest. Because highly polar organic compounds may be difficult to separate from the filter matrix, these devices are not appropriate in all cases.

Several types of sorbent filtration media are used to collect particles, which are then separated and isolated for analysis. Solid sorbents are not compound-specific. Consequently, unwanted compounds are collected along with the target compound and must be separated prior to analysis.[1] Organic polymeric sorbents collect minimal amounts of water (which can affect sample quality) and are unable to capture highly volatile organic compounds and certain polar compounds.[1] Inorganic sorbents (silica gel, alumina, and molecular sieves) are more efficient collectors of polar compounds, but capture water

also, which accelerates their deactivation. Carbon sorbents are less reactive to water, are relatively nonpolar, and exhibit much stronger adsorption properties than organic sorbents, allowing efficient collection of volatile organic compounds (VOCs) such as vinyl chloride. Carbon sorbents, however, require the use of a solvent to displace the target contaminant from the sample filter matrix which may potentially influence the sample test results.[1]

Liquid Bubblers

Liquid bubblers are used to measure concentrations of oxidized sulfur compounds (SO_x) and ozone (O_3) in the atmosphere. These devices collect gases by bubbling ambient air through a liquid medium that dissolves the components of interest. Although bubblers are constructed to provide long-term reliability, they are not recommended for use in long-term monitoring in the United States because the liquid medium may evaporate or promote chemical speciation of the target compounds.[1]

Infrared Spectrometer

A nondispersive infrared (IR) spectrometer is commonly used to measure carbon monoxide (CO) concentrations and can be modified to analyze nitric and sulfuric acid concentrations. The device measures the attenuation of specific wavelengths of infrared light which is compared to a reference cell containing a known quantity of CO. Airborne instruments have a detection limit of approximately 50 ppb with a time resolution of 10 seconds.[1] Nitric acid can be detected to a level of 4 parts per billion (ppb) by using Fourier transform infrared spectroscopy. An IR-tunable diode laser spectroscope can detect nitric acid at a level of 100 parts per trillion (ppt). Using a technique termed IR-laser backscattering, sulfuric acid can be detected at concentrations of less than 1 g/m^3.

c. Describe the purpose and types of material collected by the following sampling media:

- High-efficiency glass fiber filter
- Activated charcoal cartridge
- Silica gel

High-efficiency glass fiber filters are used to collect nonvolatile and semivolatile organic and inorganic compounds during high volume air sampling. They are particularly useful for removing radioactive particles, such as plutonium, uranium, and americium, from effluent air, thus preventing their release to the environment.

High Efficiency Particulate Air (HEPA) filters have the potential to remove 99.97% of the entrained particles from exhaust air streams. These filters, which are constructed of tiny glass fibers combined with a small amount of organic material added for strength and water repellency, are designed to be fire- and chemical-resistant. HEPA filters are commonly installed in banks of multiple filters, called filter plenums, in air exhaust systems.

An activated charcoal cartridge is used to filter and collect inorganic compounds and polar species of VOCs from air samples. Activated carbons, which have a very large surface-to-volume ratio, can be produced from various materials, including coal, coke, coconut char, charcoal, lignite, and bone char. These activated carbons vary in their adsorption capacities and affinity for different gases and vapors. Organic molecules of high molecular weight such as toluene, xylene, and benzene can be effectively removed by filtration systems utilizing activated charcoal or carbon. However, activated carbon systems are relatively ineffective in removing gaseous contaminants of low molecular weight such as HCHO and ethylene.

Silica gel also is used to capture polar VOCs from ambient air.[1] Silica gel is a clayey inorganic sorbent composed of highly porous crushed silica. Silica gels also captures water, which accelerates VOC deactivation.

d. Describe the purpose for measuring each of the following parameters during field surveys of water quality:

- Temperature
- Dissolved oxygen
- Conductivity
- pH

Temperature, dissolved oxygen, conductivity, and pH are general indicators of the health of a water body, including the ability to sustain aquatic life. These parameters also give an indication of the redox potential of a water body and are generally indicative of sample quality. The primary water quality parameters established under the Federal Water Pollution Control Act (FWPCA) of 1972 are biological oxygen demand (BOD), chemical oxygen demand (COD), solids, conductivity, pH, oil and grease, fecal coliforms, heavy metals, and select organic compounds. These parameters effectively define the criteria for water quality and are the parameters used to determine wastewater discharge permit compliance.[1]

Temperature is measured in the field. For ground water samples, temperature should be equilibrated over at least three casing volumes of water to assure that the measurement reflects that of the aquifer and is not influenced by water injected during drilling and well installation. Temperature affects pollutant solubilities and may indicate the release of contaminants (e.g., an increase in temperature may occur due to pollutant chemical reactions). Conductivity and pH are other temperature-dependent parameters.

Dissolved oxygen (DO) is measured in the field or lab. Because ground water is usually nearly oxygen-free (possessing dissolved ions in their most reduced state), the presence of dissolved oxygen in a ground water sample calls into question the sample collection

method also[1] and may indicate the presence of pollutants. DO affects the rates of chemical reactions and is an indirect measure of the effects of organic decomposition on surface water quality.

Conductivity, which is measured in the field, is an approximate measure of the total dissolved solids (TDS) content of a sample. For ground water samples, the value for conductivity should be stable over three well casing volumes to ensure proper sample representing of the aquifer. Conductivity also measures salinity and indicates the ability of a water body to carry electrical current and thus pollutants. Because the TDS concentration and conductivity of a sample may be pH- and temperature-dependent, conductivity should be measured along with pH and temperature.

The pH value, which is determined the field, is a measure of acidity or alkalinity. Values of pH less than 7 are considered acidic, values greater than 7 are considered basic, and those equal to 7 are considered neutral. Whenever possible, the pH of a sample should be measured in situ to document the original conditions of the aquifer or surface water. Because pH may change due to oxidation or other chemical reactions, pH measured in the laboratory may have little relation to the original conditions. The solubilities of many analytes are pH-dependent and their concentrations may change with variations in pH.

e. Discuss the factors that can affect readings and the preservation methods for the field measurements listed above.

At the moment of collection, the chemical and physical equilibrium of a sample may be altered, in some cases rendering the sample as nonrepresentative of existing water quality variations. For example, exposure of ground water samples to light can cause photochemical reactions and changes in temperature or pressure can cause temperature-dependent kinetic reactions or alter the concentrations of dissolved gases. Sample pH may also change as a result of disturbed equilibria.

Samples are vulnerable to reaction of dissolved constituents with the sample container, resulting in the loss of volatiles or the addition of extraneous compounds.[1] **Volatilization** can be minimized by containing the sample in a vessel with no air space. **Adsorption and absorption** can be minimized by using a container lined with the proper material for the substance being considered (e.g., plastic containers for solutions containing metals, glass containers for solutions containing oils, etc.). **Diffusion** can be minimized by containerizing the sample in Teflon-lined vessels. **Precipitation**, caused by a change in pH of the sample solution by reaction with the atmosphere, can be offset by the addition of nitric acid to the solution until the solution has a pH of less than 2. **Chemical changes** require the use of specific control procedures for specific compounds and are beyond the scope of this study guide. Refer to the analytical method suggested for the analyte of concern for recommended preservation techniques. **Photochemical changes** can be minimized by collecting samples in amber glass or opaque containers. **Microbiological**

degradation can be offset by controlling pH and temperature of the sample. Extreme pH (low or high) and low temperature can be effective, as can the addition of certain preservatives which kill and fix the organisms in the sample[1].

Immediately after a sample bottle has been filled, it must be preserved as specified by QAPP or analytical laboratory requirements. Preservation requirements vary, based on the sample matrix and the analyses being performed. For water samples, some analyses only require cooling to 4 degrees C, while others also require a chemical preservative such as nitric acid, sulfuric acid, hydrochloric acid, or sodium hydroxide. Enough acid or base is added to the sample bottle to either lower the pH to below 2, or raise the pH above 10. The chemicals used to preserve the sample must be of analytical (reagent) grade to avoid sample contamination.

f. Describe how trace toxic organics in water are assayed by gas chromatography.

In gas chromatography, a small sample is injected into a chromatographic column and carried through the column by a stream of inert carrier gas (commonly hydrogen or helium). Constituents are separated by differential attraction to the column packing materials and are retained in the column for different lengths of time (retention time) prior to passing the detector. A strip chart recorder is used to record the retention times, which are then compared to the retention times of a standard with known chemical composition. GC/ECD is very sensitive, highly selective against hydrocarbon background, and relatively inexpensive to operate.

An example of an assay of trace organics using gas chromatography (GC) is found in the EPA methods for analysis of pesticides in drinking water, which require the use of GC with the proper detector or in conjunction with mass spectroscopy (MS), and the use of compound-specific methods (EPA methods 507, 508, 515.1, 53.11, and 504[1]). Techniques common to these methods include sample collection, preservation and storage at 4°C, descriptions of required apparati and equipment; safe handling procedures for reagents, consumables, and standards; the use of two columns of different polarity; and instructions on the use of blank samples, internal standards, surrogate solutions, interferences, calibrations, standardization, and quality control[1].

EPA Method 505 for the analysis of organohalide pesticides and PCB products in water (by microextraction of GGECD) requires the following procedure:

- **Method summary** – 35 ml of sample is extracted with 2 ml of dichloromethane, 2 ul is injected into the GGECD (extraction and analysis time = 30-50 minutes).
- **GC columns used** – primary column = 0.32mm i.d. x 30m long, fused silica capillary column with DB-1; confirmatory columns = 0.32mm i.d. x 30m long, fused silica capillary columns with 1:1 mixed phase dimethylsilicone and polyethylene glycol (Durwax-DX3) or equivalent, or 0.32mm i.d. x 25m long 50:50 methyl-phenylsilicone (OV-17) or equivalent.

- **Method detection limits**– (MDLs) only for modern pesticides (ug/l) at: Arochlor = 0.075, Atrazine = 2.4, Metoxychlor = 0.96, and Simazine = 6.8.[1]

Samples are chromatographed using either packed or capillary columns and may be analyzed using either specific detectors or mass spectrometry.

g. Describe how heavy metals in water are measured using atomic absorption spectrophotometry.

Atomic absorption (AA) spectroscopy is the most widely used method of measurement of metals in water because it is highly sensitive, specific (only one metal can be tested at a time), and does not require preconcentration of the sample. Atoms absorb energy in the form of ultraviolet radiation and move to a higher energy, "excited" state. When such atoms revert back to their normal or "ground" state, the absorbed energy is lost in the form of radiation at specific wavelengths. Emitted spectra can be analyzed and related to the concentration of a given constituent.

The AA procedure requires that metal in the sample be converted into a gaseous state because free atoms are necessary for atomic absorption to occur. The conversion into a gas is achieved through aspiration of the metal solution into a flame, through use of a graphite furnace, or by chemical reduction in a solution followed by air bubbling. A gas stream combines with the vapor, forcing it into an $Ar-H_2$ flame, where the concentration of the substance is measured. As atomic spectra have distinct profiles in the range of 0.2 nm wide, a monochometer is introduced into the system to disperse unwanted lines. The resulting profiles are analyzed.

h. Describe how volatile organics are measured.

In air sampling for volatile organic compounds (VOCs), large volumes of air (20L) are forced through a solid sorbent material for adsorption of the compound to be examined. Separation of unwanted compounds from the target compound is made, followed by analysis of the sample through the use of gas chromatography.

The qualitative identification and quantitative determination of gaseous (volatile organic compounds VOCs) pollutant levels requires that acceptable chemical and physical analytical techniques be available. The acceptability of analytical techniques depends on their specificity, accuracy, precision and relative ease of use. The information in this section was modified from Godish (1979)[1].

A variety of chemical and physical techniques are used to determine concentrations of pollutant gases. Some of these are manual methods which require the collection of gases with subsequent analysis conducted in the laboratory. Most of those discussed below are utilized in continuous-flow, instantaneous-response instruments.

Wet chemistry. Wet chemical techniques are primarily used to determine concentrations of VOCs collected by bubblers or impingers. Most of the numerous wet chemical procedures available employ absorbing reagents to collect the desired gas or gases. The reagent/pollutant reaction product is analyzed in the laboratory and atmospheric concentrations are calculated. The most commonly used analytical principle is colorimetry -- that is, the formation of colored solutions whose light absorbance can be determined on spectrophotometric instruments. Wet chemical techniques are not as prevalent as they once were, but are still useful in the determination of various gases for which instrumental analysis is unavailable. Wet chemistry is also used for calibrating many instrument methods.

Chemiluminescence Chemiluminescence is the emission of light as a result of chemical reactions. It is used most commonly in continuous air monitoring instruments for determining O_3 and NO_x. In the analyzer, sampled air is introduced into a chamber with a reactant gas. Emitted light is sensed by a photomultiplier tube and amplified. Chemiluminescence methods have the advantage of high specificity and sensitivity, and they require no liquid chemicals.

Electrochemistry. Electrochemical analyzers are widely used to measure gases such as SO_2. In these analyzers, sampled air passes through an aqueous solution, where a chemical reaction between the pollutant and the reagent liberates electrons, creating a small current flow across an electrochemical cell. Current flow can be calibrated to indicate the concentration of pollutants being measured. A major drawback to such methods is the interference resulting from the reaction of the electrolyte with other contaminants in the air sample. This problem may be reduced by removing interferent gases before they reach the reaction chamber.

Infrared Analysis Non-dispersive infrared (NDIR) analysis is primarily used for the ambient monitoring of CO concentrations. The principle employed is the selective absorption of infrared energy by gases. Infrared analyzers generally consist of sample and reference cells with split- or dual-beam infrared sources. The absorption of infrared energy by gases such as CO results in differential heating and expansion between sample and reference cells, causing a diaphragm between them to move with a frequency related to the concentration of the absorbing gas. Because water interferes with CO analysis, sampled air must usually be dried prior to analysis.

Ultraviolet Absorption Depending on their molecular structure, chemical substances may absorb ultraviolet light energy to a significant degree. The selective absorption patterns can be used to identify some gases and their concentrations. Ultraviolet instruments are particularly sensitive to O_3.

Chromatography. In gas chromatography, molecules are adsorbed on a column of granular packing material. The collected gases are desorbed from the chromatographic column by heating. Because of differences in the strength of adsorption, each gas will be

released differentially as a function of time. Separated gases then pass through a detector where the relative concentration of each is determined. A variety of detectors are available, measuring concentration based on: 1) thermal conductivity, 2) differences in flame ionization due to the combustion of sample gases (flame ionization), and current flow between two electrodes caused by ionization of gases by radioactivity (electron capture). Because of the complexity of the equipment, gas chromatography is usually performed in a laboratory, although there are portable units available.

Photometry. In photometric analysis, the pollutant in sampled air absorbs some or all wavelengths from a light beam. In wavelength-selective instruments, pollutant concentration is usually measured by analyzing the beam at two different wavelengths in separate sample and reference cells.

[1] Godish, T., *Air Quality*, 2nd ed., Lewis Publishers, Chelsea, Michigan, 1991.

2. REGULATORY

2.1 Environmental compliance personnel shall demonstrate a working level knowledge of the Clean Air Act (CAA) and implementing regulations.

Supporting Knowledge and/or Skills

General Introduction to the Clean Air Act:

The Clean Air Act (CAA) establishes a regulatory framework for attaining and maintaining air quality standards (Table 2.1-1). The CAA was enacted in 1970 and amended in 1990. The purposes of the Act are:

- To protect and enhance the quality of the nation's air resources so as to promote the public health and welfare and the productive capacity of its population;
- To initiate and accelerate a national research and development program to achieve the prevention and control of air pollution;
- To provide technical and financial assistance to state and local governments in connection with the development and execution of the Air Pollution Prevention and Control Programs; and,
- To encourage and assist the development and operation of regional air pollution control programs.[1]

Table 2.1-1
Clean Air Act General Structure[2]

Title	Part and Section	Description
Title I	Air Pollution Prevention and Control	Divides all of the United States into areas treated as "attainment" or "non-attainment" for the purposes of application of various emission control strategies.
	Part A - Air Quality and Emissions Limitations	
	Section 107 Air Quality Control Regions	Divides the U.S. into attainment and nonattainment areas for contaminants.
	Section 108 Air Quality Criteria and Control Techniques	Describes the standards the EPA is to follow when listing air pollutants.
	Section 109 National Ambient Air Quality Standards (NAAQS)	Health-based primary and secondary NAAQS for criteria pollutants
	Section 110 State Implementation Plans (SIP)	Each state must submit a plan for the implementation, maintenance, and enforcement of national standards within its jurisdiction.
	Section 111 Standards of Performance for New Stationary Sources	Establishes New Source Performance Standards (NSPS) that are technology-based requirements on emissions from new or modified major stationary sources.
	Section 112 National Emission Standards for Hazardous Air Pollutants (HAPs) or (NESHAPs)	Establishes technology-based standards for 189 hazardous substances based on "maximum achievable control technology" or MACT.
	Part B - Ozone Protection (Replaced by Title VI)	See Title VI below.
	Part C - Prevention of Significant Deterioration of Air Quality	Requires states to limit emissions in non-attainment areas to prevent further degradation. Establishes preconstruction permitting requirements for new major sources in attainment areas using Best Available Control Technology (BACT).
	Part D - Plan Requirements for	In nonattainment areas new or modified

Table 2.1-1
Clean Air Act General Structure[2]

Title	Part and Section	Description
	Nonattainment Areas	sources must produce a "net" reduction of emissions by offsets or control technologies. Existing sources must use Reasonably Achievable Control Technology (RACT) to reduce emissions.
Title II	Emission Standards for Moving Sources	Establishes lower emission standards for automobiles and other vehicles. Also, contains new provisions for alternative fuels and use of "clean fuel" vehicles.
	Part A - Motor Vehicle Emission and Fuel Standards	Specific standards and procedures.
	Part B - Aircraft Emission Standards	Specific standards and procedures
Title III	General Provisions	Definitions, reports, funding, rulemaking, judicial review, citizen's suits.
Title IV	Noise Pollution and Acid Deposition Control	New standards for electric utilities regarding acid rain. Stringent standards for sulfur dioxide controls on new and existing plants. Creates market-based allowances for environmental solutions.
Title V	Operating Permits	Establishes universal Federal permit program for existing sources and implemented by each state. EPA can review state permits and veto for non-compliance.
Title VI	Stratospheric Ozone Protection	Phase out production and use of ozone-depleting substances. Authorizes EPA to ban nonessential products using the substance, to require labeling, and to regulate the replacement of those products with substitutes.

a. Discuss the application of the Clean Air Act to the Department of Energy or its facilities.

The Clean Air Act (CAA) applies not only to environmental activities at DOE facilities, but also to plant utilities, new sources (e.g., generators), and vehicle operation activities without exception, unless exempted by the President of the United States for reasons paramount to the country. The DOE must also comply with all Federal, state, interstate, and local requirements to the same extent as any non-government entity.[3]

b. Identify the National Ambient Air Quality Standards (primary and secondary) and the National Emission Standards for Hazardous Air Pollutants (NESHAP).

Section 109 of the CAA requires the EPA to promulgate primary and secondary national quality standards. The national standards are called National Ambient Air Quality Standards (NAAQS).

Primary NAAQS standards are based on the maximum concentration of a pollutant in ambient air that is protective of public health. The primary standards are also known as the criteria pollutants. The secondary standards define levels for protecting the public welfare (i.e., soils, vegetation, and wildlife). Both the primary and secondary standards are presented Table 2.1-2.

Table 2.1-2
National Ambient Air Quality Standards (NAAQS[4])

Pollutant	Averaging Time	Primary Standard	Secondary Standard	Measurement Method
Carbon monoxide (CO)	8 hr 1 hr	10 mg/m3 (9 ppm) 40 mg/m3 (35 ppm)	Same Same	Non-dispersive infrared spectroscopy
Nitrogen dioxide (NO_2)	Annual average	100 μg/m3	Same	Colorimetric using Saltzman method or equivalent
Sulfur dioxide (SO_2)	Annual average 24 hr 3 hr	80 μg/m3 (0.03 ppm) 365 μg/m3 (0.14 ppm)	 1300 μg/m3 (0.5 ppm)	Pararosaniline method or equivalent
Particulate Matter PM-10 (≤ 10 μm)	Annual arithmetic mean 24 hr	50 μg/m3 150 μg/m3	Same 50 μg/m3	Size-selective samplers
Hydrocarbons (corrected for methane)	3 hr (6-9 am)	160 μg/m3 (0.24 ppm)	Same	Flame ionization detector using gas chromatograph
Ozone (O3)	1 hr	235 μg/m3 (0.12 ppm)	Same	Chemiluminescent method or equivalent
Lead (Pb)	3 month average	1.5 μg/m3	Same	Atomic absorption

The National Emission Standards for Hazardous Air Pollutants (NESHAPs), or Hazardous Air Pollutants (HAPs), were established to regulate emissions based on protection of the public health or welfare. Public health or welfare is broadly interpreted and includes human health, soils, water, vegetation, economic well-being, weather, and other effects. The NESHAPs (noncriteria pollutants) are different than the NAAQS (criteria pollutants) even though both categories include toxic pollutants. Generally speaking, NAAQS pollutants are concentration specific and NESHAPs are industry/process specific pollutants, such as chrome plating, dry cleaning, coal burning utilities, etc. Examples of NESHAPS are asbestos, beryllium, mercury, inorganic arsenic, coke oven emission, vinyl chloride, benzene, and radionuclides. These pollutants are considered to be carcinogenic and mutagenic hazards.

EPA has promulgated regulations specifically addressing asbestos emissions from manufacturing operations, building demolition/renovation operations, and waste disposal (40 CFR Part 61, Subpart M). The NESHAP standard does not set a numerical threshold for asbestos fiber emissions; instead, it requires persons conducting operations, to notify EPA and to follow certain procedures relating to the stripping and removing of asbestos materials, and to adopt specific work practices to prevent the release of asbestos fibers into the air. Disposal of asbestos at a landfill requires double bagging of the material prior to disposal. Almost all states have enacted some type of asbestos-related legislation. Therefore, each DOE facility will be subject to these state specific standards regarding asbestos. State laws may include: accreditation plans for the training and certification of inspectors, abatement project designers, contractors, workers and others involved in asbestos work; performance standards; disposal methods; measures for building permits for demolition or renovation; and the liability of abatement project contractors, including fines for improper removal.

Under the 1990 CAA Amendments, Congress listed 189 toxic air pollutants (40 CFR Part 61 and 63). These pollutants are known to be, or reasonably anticipated to be, carcinogenic, mutagenic, teratogenic, neurotoxic, cause reproductive dysfunctions, or are acutely or chronically toxic[4]. By the year 2000, the objective is a 90% average reduction in toxics and 95% for particulate matter. These standards apply to any major source as defined by the CAA. To comply with the NAAQS and NESHAPs standards, a major source must apply Maximum Achievable Control Technology (MACT) to the regulated source.

c. Describe the requirements for permitting, monitoring and reporting prescribed in the regulations that implement Title V of the Clean Air Act.

The New Source Performance Standards (NSPS) set minimum nationwide emission limitations for classes of facilities. The NSPS are set at levels that reflect the degree of control achievable through the application of the best system of continuous emission reduction that has been adequately demonstrated for that category of sources. The NSPS

must take into consideration the cost of achieving such emissions reduction, any non-air quality health and environmental impacts, and energy requirements.

The facility classes of most interest to DOE are those applicable to fossil-fuel-fired steam generators for which construction was begun after August 17, 1971 (40 CFR Part 60, Subpart D), and electric utility steam generating units for which construction was begun after September 18, 1978 [40 CFR Part 60, Subpart D (a)].

Any air pollutant-emitting modification or new facility planned will require a permit under the CAA. Requirements exist for applications, permits and requirements for mathematical modeling, field measurements, and associated engineering aspects. Title V requires each state to develop, implement and administer a comprehensive Operating Permit Program for pollution sources. EPA reviews and approves programs and has authority to review and approve individual permits[5]. Any modification or new facility will undergo a New Source Review (NSR) permitting process.

Title V requires major sources, having the potential to emit over 100 tons/year of any pollutant, and any other source required to comply with the CAA. Permits must include:

- Emission limitations and standards relevant to the source;
- Monitoring, recordkeeping, and reporting requirements;
- Severability clause which ensures applicability of the rest of the permit if any portion is challenged;
- Statement that allows for modification, revocation, reopening, reissuance, or termination of a permit for cause;
- Fee schedule;
- Compliance requirements (including certification, testing, monitoring, reporting recordkeeping requirements, inspection and entry requirements, schedule of compliance, and provisions for reporting); and,
- Statement declaring terms and conditions of the permit that are not required under the CAA and that are not Federally-enforceable.

The NSR process is likely to become a critical path item for any project, especially if one year of ambient air quality data is required for a construction permit.

New Source Review and Permitting

The NSR is a process to evaluate an application for a Federal, state, and local "permit to construct" from the air quality regulatory agency with jurisdiction. A NSR application is required for a new source with the potential to emit 100 tons/year or for major existing plants modifications that will increase emissions significantly (i.e., 40 tons per year of sulfur dioxide or any other primary criteria pollutant).[5] Which requirements apply are dependent upon the source's location. Sources located in an attainment area (regions which meet or attain national standards) are subject to the Prevention of Significa

Deterioration (PSD) program [Section 2.1(d)]. Sources located in nonattainment areas must comply with the nonattainment permit program.

Nonattainment Area Permitting

New major sources, having the potential to emit over 100 tons/year of a nonattainment pollutant with lower thresholds for more serious pollutants or modified existing sources in nonattainment areas, must receive a pre-construction nonattainment permit. Permits must include Table 2.1-3 conditions:

- Requirement that such sources achieve the Lowest Achievable Emissions Rate (LAER) based on the most stringent SIP limitation or on an actual limit achieved in practice by the same or similar industrial category;
- Offsets are also included in permits. The source is required to offset its potential to emit nonattainment pollutants by securing emissions reductions from other facilities in the area. Offsets must be achieved at greater than a one-to-one ratio;
- Source must also be able to certify that all of its sources are in compliance with all applicable air quality requirements; and
- Sources must certify that the benefits of the source will outweigh its social and environmental costs.[5]

Table 2.1-3
Nonattainment Area Permit Conditions

- Net reduction of emissions and reasonable further progress
- Lowest Achievable Emissions Rate (LAER) emissions limitations
- All other sources in compliance with air quality requirements
- Non-interference with SIP requirements
- Analysis of alternatives

Permit Application Requirements

Every major air pollution source is required submit a permit application within one year after the date that EPA approves the state permit program. For most existing major sources, applications will be due on or before November 15, 1995, assuming that EPA authorizes the state to administer the program by the statutory deadline. Figure 2.1-1 presents the permit approval process. Note the process may take up to 18 months.

Each state develops its own standard permit application form. However, the form must include the following information requirements at a minimum:

- General company information, including facility name and address, owner's name and agent, and the facility contact person;
- A description of the facility's processes and products, along with the facility's SIC code;
- An inventory of the emission of all regulated air pollutants and air pollutants for which the facility is classified as a major source;
- A description of all emission points;
- Emission rates;
- A description of fuels and how they are used, as well as a description of raw materials used;
- A description of all air pollution control and compliance monitoring devices or activities;
- A description of any operating limitations or restrictions on work practices that affect emissions of regulated air pollutants;
- A description of all applicable state and Federal air pollution control requirements, including those promulgated at the time of application that will become effective during the term of the permit;
- A compliance plan for all sources within the facility regulated under the permit program;
- A certification of compliance with all applicable requirements and a schedule for submission of a least annual compliance certifications during the permit term; and,
- A description of methods used to determine compliance, including monitoring, recordkeeping, reporting, and testing methods.

States are allowed to exempt insignificant activities or emission units (e.g., based on size, emission levels, or production rate) from permit application information requirements. However, the application must contain a list identifying the activities or units that are exempt.

The permit application must include a compliance plan. If the source is not in compliance, the plan must describe how the source will be brought into compliance. The plan must include a schedule of measures that will be taken, along with enforceable milestones. At least every six months, the facility must submit a certified report describing its progress in meeting the terms of the compliance plan. Even sources that are in compliance must submit a plan, but this plan need on make a statement that the source will continue to comply. Currently, compliant sources do not need to submit progress reports.

Sources that are subject to compliance with acid rain standards will have to also submit a national uniform permit, required by EPA.

Monitoring and Recordkeeping Requirements (40 CFR Parts 60 & 61)

Monitoring and recordkeeping requirements are industry specific. For example, a glass manufacturer may have different monitoring requirements than a copper smelter. In

addition, new sources have different standards than existing sources. Thus, it is imperative that monitoring and recordkeeping requirements be researched according to source specific conditions. The following is a general overview:

- Existing Sources

  Monitoring must be performed according to industry specific standards. Regulators may require a performance evaluation of monitoring equipment at any time and the operator must send within 60 days a written report of the results. The owner must inform the regulators in writing, of the date of the performance test, 30 days before the test. Each different effluent that is subject to a standard must be monitored separately and at each point of release, even if the contaminants are emitted through a common waste stream. The owner must reduce the monitoring data prior to submittal to the regulators, excluding down times, calibration checks, zero span adjustments, etc. The regulators may alter monitoring requirements based on using alternate monitoring techniques or due to dispute of the results of monitoring data.

  Records of all monitoring data, monitoring systems calibration checks, and malfunctioning of monitoring equipment shall be maintained for a minimum of 2 years. If the particular industry is required to perform continuous monitoring, the amount of data that must kept can be substantial. In reality, monitoring data should be kept permanently for owner protection. Records must be made available to the regulators at any time, upon request.

- New Sources

  Monitoring must be performed according to industry specific standards. For new sources, most industrial categories require installation of a continuous emission monitoring system (CEMS). All CEMS equipment must be in place prior to performance testing and must meet manufacturers written specifications for operation. The owner may also be required to comply with opacity standards. If so, the source must install a continuous opacity monitoring system (COMS) and conduct a performance evaluation. Evaluation of the COMS must be sent to the regulators 10 days before any performance testing of a facility's emission control systems. The owner must provide a written report to the regulators within 60 days of completion of a performance evaluation. Monitoring systems must be checked daily during operation. A CEMS must measure emissions on a cycle (sampling, analyzing, and data recording) for each 15-minute period. CEMS must be installed so as to properly measure process parameters. A CEMS must be installed that will monitor each pollutant at each point of release, even if the pollutant is combined with other pollutants in a single waste stream. Opacity measurement data must be reduced to 6-minute averages and for COMS to 1-hour averages for reporting. Within the 6-minute period there must be 36 or more data points recorded.

Breakdowns, calibration checks, and zero and span adjustments are not to be included in the averages. All units must be consistent.

The regulators may approve alternatives to monitoring systems based on data included in a written application. Such alterations may include: location of the equipment; pollutant conversion methods; procedures for performing daily checks of zero and span calibrations; alternatives to American Society for Testing and Materials (ASTM) methods; alternative CEMS; alternative monitoring requirements for combined effluents; alternatives to relative accuracy for performance tests; and alternatives to the reference method tests for determining accuracy of CEMS.

Records must be kept of any startup, shutdown, or malfunction in the operation of the facility, air pollution control equipment, or any period in which the CEMS is inoperative. Facilities with a CEMS must submit a performance report semi-annually, except when more frequent reporting is requested by the regulators. All reports must be postmarked by the 30th day following the end of each calendar half. Records of all monitoring data, monitoring systems calibration checks, and malfunctioning of monitoring equipment shall be maintained for a minimum of 2 years. In reality, monitoring data should be kept permanently for owner protection. Records must be made available to the regulators at any time, upon request.

d. Describe the Prevention of Significant Deterioration (PSD) regarding the requirements established by the Clean Air Act.

Section 161 of the CAA establishes PSD requirements (Table 2.1-4). Areas where NAAQS standards are met are designated attaining, and major facilities in these areas will be subject to PSD requirements. Basically, in the NSR permit, the source is allowed to consume some or part of an incremental deterioration in ambient air quality in the attainment area.

The attainment areas of the country are subdivided into three classes of land use with different allowable increments for each pollutant.[5] In Class I, little deterioration of air quality is allowed and, therefore, Class I increments are small. Class II and Class III areas have progressively larger increments, allowing for a slight amount of industrial growth. Most attaining areas are classified as Class II.

To receive an approved PSD permit, a new major facility must achieve emission limits based on Best Available Control Technology (BACT). BACT is the maximum level of reduction of emissions possible based on technology, while considering economic, energy, and other factors. BACT is applied to the criteria pollutants, NESHAPs, and HAPs.[5]

Table 2.1-4

PSD Construction Requirements[6]

- Permit issued;
- Review of permit conducted;
- Required analysis of permit performed;
- Public comment on permit completed;
- Demonstration that emissions will not exceed increment, NAAQS, or other applicable requirements completed;
- Special Class I provisions complied with;
- Analysis of impacts of related growth completed; and,
- Agreement to conduct monitoring to assess impact of emissions signed.

e. Discuss the modeling requirements for monitoring and close calculation air dispersion in the National Emissions Standards for Hazardous Air Pollutant, Standards for Radionuclides.

To determine compliance with the standards (effective dose equivalent of 10 mrem/year to any member of the public), radionuclide emissions shall be determined using EPA approved sampling procedures, computer models (CAP-88 or AIRDOS-PC or COMPLY, as appropriate).[7]

Environmental measurements of radionuclide air concentrations at critical receptor locations may be used as an alternative to air dispersion calculations in demonstrating compliance with the standard if the owner or operator meets the identified criteria.[7] The critical receptor is usually defined as the maximally exposed member of the public at any offsite point where there is a residence, school, business or office exposed to all sources of emissions in the facility. However, the regulators may re-define the critical receptor to be a more sensitive species or location. The identified criteria are the activity levels of radionuclides found by sampling or by modeling that clearly show compliance with the standard for that particular radionuclide pollutant.

The radionuclides that must be monitored for are based on a broad definition in the CAA. In 40 CFR Part 61.91 (c), radionuclide is defined as "a type of atom which spontaneously undergoes radioactive decay." Due to this broad definition, the regulators can require DOE to monitor for about any type of radionuclide at a site. In fact, the regulation applies to any DOE facility that emits any radionuclide other than radon-222 and radon-220 into the air.

f. Identify the major sources and emission limitations per the Clean Air Act, Title V.

The CAA defines major sources in attainment and nonattainment areas. In attainment areas a major source has the potential to emit 100 tons/year of criteria pollutants and/or

250 tons/year of NESHAPs. In a nonattainment area, a major source has the potential to emit over 100 tons/year of any nonattainment pollutant.

Emission limitations are based on permit requirements which incorporate BACT, LAER, and Reasonably Achievable Control Technology (RACT) technology requirements. Section 2.1(k) of this document summarizes technology requirements and their applicability.

g. Discuss the New Source Performance Standards (40 CFR 60).

Due to the high cost associated with retrofitting an existing facility, the CAA amendments require new sources to comply with higher requirements for technical performance. New sources; therefore, are subject to higher, more stringent level of control than existing sources.[2]

Section 111 of the CAA authorizes EPA to establish New Source Performance Standards (NSPS). Based on industry categories, the NSPS are federal technology-based requirements on emissions from new or modified stationary sources of pollution.[8] Types of facilities (by type of process and size) to which the standards apply are found in 40 CFR 60. Examples of facilities identified in 40 CFR 52.21 include fossil fuel-fired steam generators, incinerators, citric and sulfuric acid plants, asphalt concrete plants, and petroleum refineries.

h. Discuss the potential liabilities of the Department of Energy and its contractors inherent in the enforcement of environmental regulations (i.e., compliance orders, enforcement actions, fines and penalties, and provisions for civil suits).

The 1990 CAA Amendments significantly strengthened the EPA's enforcement authority under the CAA and increased civil and criminal penalties for violations.[2] Given the 1990 Amendments, the DOE and its contractors may be fined, penalized, or sued for violations.

For civil penalties, the 1990 Amendments allow the EPA to bring administrative enforcement actions against violators without going through the Department of Justice (DoJ). Similar to the Clean Water Act, the CAA authorizes the EPA to impose administrative penalties of up to $200,000 (or more, if the EPA and the DoJ agree that stiffer penalties are warranted). This process allows EPA to avoid having to coordinate with DoJ first and enable EPA to attempt to reach agreements with violators before litigating.[2]

The 1990 Amendments also provide authority to EPA to use field citations for minor violations. These field "tickets" can be as high as $5,000 per day per violation. Violators may pay the fee or request a hearing.[2]

Private citizens may sue (citizen suit provision) for violations of the CAA. Further, the CAA now provides authorization to EPA to pay a bounty of up to $10,000 to anyone who provides information that results in a conviction of civil penalty.[2]

Criminal liability can be imposed on any person (e.g., individual, corporation, partnership) who knowingly violates the CAA. Fines of up to $250,000 per day per violation and up to five years in jail may be levied. Corporations may be fined up to $500,000 per violation. Recordkeeping crimes have also been expanded to include making false statements, failing to file or maintain records or reports as required. Individuals may be fined up to $250,000 and two years in jail: corporations may be fined up to $500,000. This is particularly important given that permittees must certify annually to permit compliance. Knowing failure to pay fee is a criminal act and is punishable by fines of $100,000 and one year for individuals and $500,000 for corporations. Criminal penalties may also be levied against persons who knowingly or negligently release air toxics which place another person in imminent danger. Knowingly releasing pollutants could result in $250,000 per day and up to 15 years in prison for individuals and $1,000,000 for corporations. Negligently releasing pollutants may result in fines of $100,000 and up to one year in jail for individuals and $200,000 for corporations.[2]

In addition to increasing fines and penalties, per requirements in the Pollution Prosecution Act of 1990, the EPA has increased its ability to enforce these statutory requirements by adding trained criminal investigators to its staff.[2]

i. Discuss the National Emissions Standards for Hazardous Air Pollutants air emission limits.

NESHAP air emissions limits apply to major sources (10 tons/year for any on HAP and 25 tons/year for any combination of HAPs). Air emissions limits are established by permit and are based on Maximum Achievable Control Technology (MACT) requirements. Section 2.1(k) summarizes MACT requirements.

j. Describe the Clean Air Act, Title V, Stratospheric Ozone Protection criteria.

Title VI of the CAA requires phasing-out the production and consumption of ozone-depleting substances. Regarding products which contain ozone-depleting substances, it authorizes EPA to ban products determined to be non-essential; requires labeling; and regulates replacements with substitutes.[8]

k. Discuss the requirements for control technologies specified in the Clean Air Act and the purpose and function of various air pollutant abatement technologies.
Section 2.1(l) below for a discussion of the classes of air pollutant abatement/control technologies and Section 2.1(m) for a discussion of various pollution abatement equipment/technologies.

l. Describe the four basic classes of air pollutant abatement/control technologies specified in the Clean Air Act.

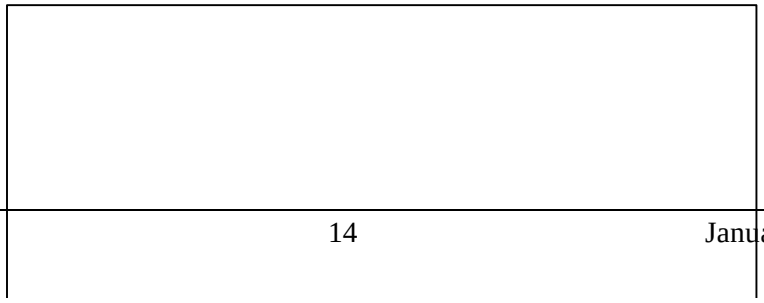
The four classes of air pollutant abatement/control technologies are:

(1) Maximum Achievable Control Technology (MACT) - This category of technology is intended to result in the maximum degree of emission reduction that is achievable. MACT requires that new sources must be at least as stringent as the best emission level achieved in practice by the best controlled source in the source category (for new source MACT standards) or the best performing group of sources (for existing source MACT standards)[3].
(2) Lowest Achievable Emissions Rate (LAER) - LAER is the most stringent emission limitation contained in any State Implementation Plan (SIP) or that is achieved in practice by the same or similar source category, whichever is more stringent.[2]
(3) Best Available Control Technology (BACT) - BACT (considered on a case-by-case basis) is the maximum level of reduction of emissions possible based on technology, while taking into consideration economic, energy, and other related factors. BACT must be at least as stringent as any New Source Performance Standard (NSPS) applicable to the source category[2].
(4) Reasonably Achievable Control Technology (RACT) - RACT is technology that will result in the maximum degree of emission control that is reasonably achievable considering feasibility issues such as technology and economics[6]

m. Describe, in general, the purpose and function of various pollution abatement equipment/technologies.

- Cyclones
- Baghouse
- Electrostatic precipitator
- Thermal oxidizer
- Scrubber
- Adsorption

Cyclones are used to remove particulate from a waste gas stream. Particles can be removed from a waste gas stream by creating cyclonic air flow. Figure 2.1-1 shows a common cyclone. Waste gas enters an inlet near the top of a cylindrical body. Centrifugal forces created by the spiraling waste stream push the particles against the walls of the cyclone, where they concentrate and swirl downward to a hopper for removal.[4]



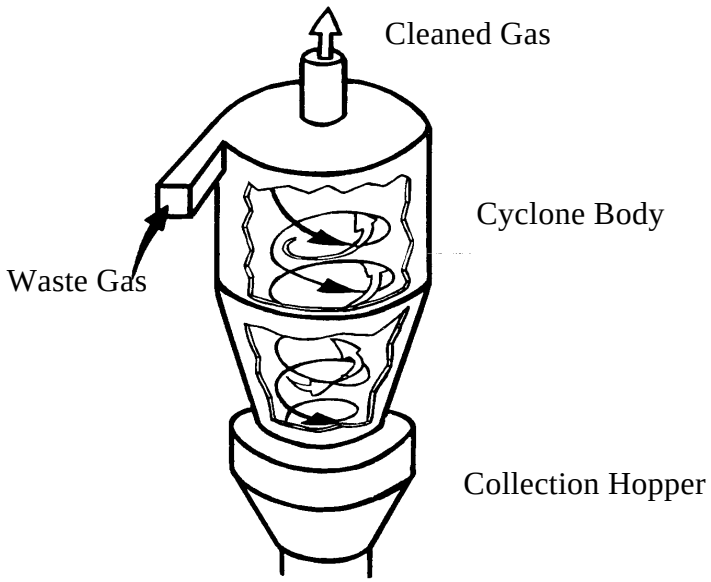


Figure 2.1-1 Common Cyclone Dust Collector.

Baghouses are used to control dust emissions from a variety of industrial sources. Within a baghouse there is a filter fabric collection system consisting of multiple suspend tubular or flat collecting bags. The filter fabric can be made of many materials. Figure 2.1-1 shows a typical baghouse configuration. The waste gas enters from the side and flows downward to a hopper, where flow is reversed upward into an array of bags. Large particles drop out as air direction is reversed and smaller particles are collected on the inside of the filter bags. Bags are cleaned and reused as feasible.[4]

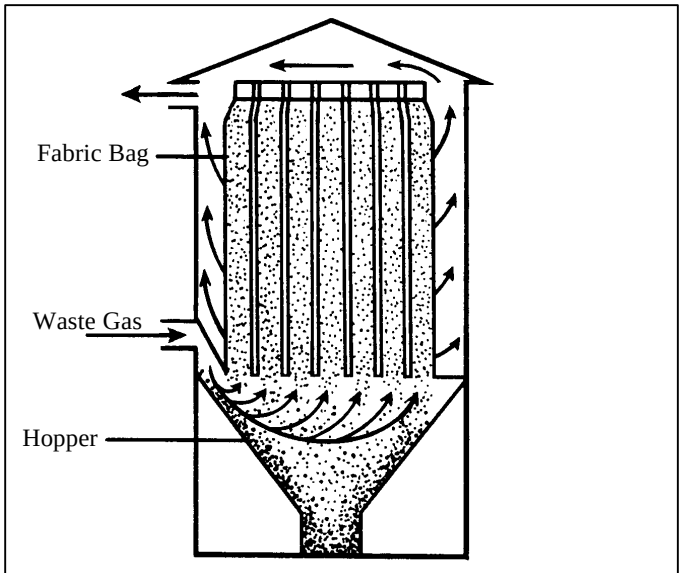


Figure 2.1-2 Baghouse Fabric Filter Dust Collection System

Electrostatic precipitators remove solid and/or liquid particles from waste gas by electrically charging particles which are then collected on opposite charged plates. Figure 2.1-3 presents a schematic showing how the waste gas particles are charged, using a high voltage, direct current corona and subsequently collected on the lower electrode.[4]

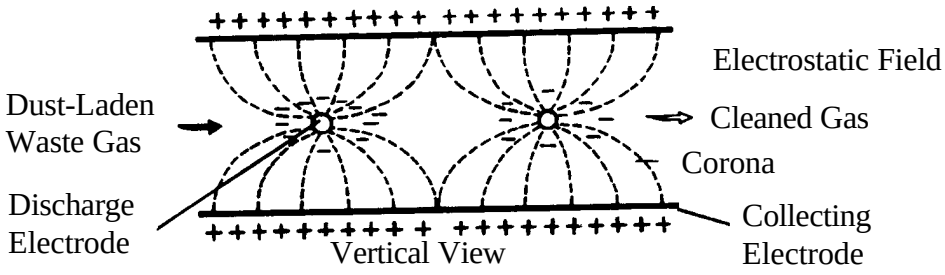


Figure 2.1-3 Discharge and Collection Electrodes in Electrostatic Precipitator

A thermal oxidizer (basically an incinerator) uses a combustion process for the control of waste gases. Thermal oxidizers are used for the treatment of waste gases that have a combustible concentration below the lower explosive limit of the pollutant. Waste gases are heated to high temperatures and combusted. The efficiency of the combustion can be controlled by adjusting the reaction time, optimization of retention time, and the degree of turbulence in mixing the reacting gases.[4] Figure 2.1-4 presents a typical thermal incinerator configuration.

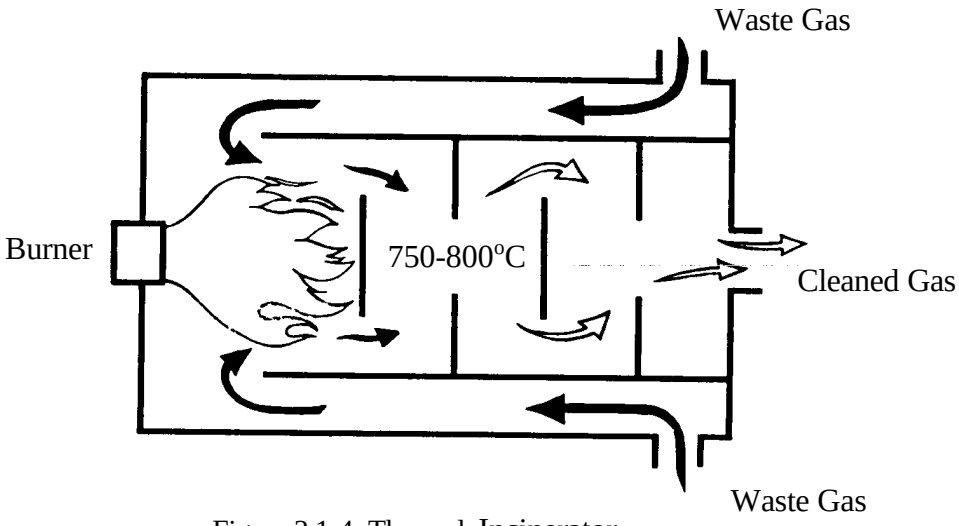


Figure 2.1-4 Thermal Incinerator

Control systems which employ liquid media to remove gases are called **scrubbers.**[4] Scrubbers remove gasses by chemical absorption in a medium that may be a liquid or a liquid-solid slurry. Water is the most common medium used due to low cost, but other chemical reagents may be added to increase absorption capacity.

Different than the method used for scrubbers, some contaminants can be removed from waste gases by their physical **adsorption** to solid surfaces.[4] The solid collecting media is called an adsorbent. Adsorption is a reversible process, thereby recovering the adsorbent and therefore is widely used for solvent recovery in various industrial processes (i.e., dry cleaning, degreasing, etc.). Adsorption has limited use in air pollution problems and is mainly used to control malodors.[4]

[1] Hackman, F., et. al., edited by Rothenberg, E., et. al, *Clean Air Act -- Separating the Old and New Versions*, 1st ed., RTM Communications, Inc., Alexandria, VA, 1991.
[2] Sullivan, T. F. P., *Environmental Law Handbook*, 12th ed., Government Institutes, Inc., Rockville, MD, 1993.
[3] 42 U.S.C.A. Sections 7418, Clean Air Act, Control of Pollution from Federal Facilities, Subsection 118.
[4] Godish, T., *Air Quality*, 2nd ed., Lewis Publishers, Inc., Chelsea,MI, 1991.
[5] ENSR, *Clean Air Act, Regulatory Overview*, 1988.
[6] Spensley, J. W., *The Clean Air Act: Summary of Key Provisions*, Holme, Roberts, and Owen, LLC, Unpublished handout for a University of Denver graduate course, Denver, CO, 1995.
[7] 40 Code of Federal Regulations (CFR) 61.93(a)
[8] Garret, T. L. and S. D. Winner, *A Clean Air Act Primer: Part I*, *Environmental Law Reporter*, 22 ELR 10159-10189, March 1992.

2.2 Environmental compliance personnel shall demonstrate a working level knowledge of the following laws and regulations as related to the environmental medium of water:

- Clean Water Act (CWA)
- Safe Drinking Water Act (SDWA)
- Resource Conservation andRecovery Act (RCRA) (groundwater Provisions)
- National Groundwater Protection Policy (NGPP)
- Oil Pollution Act (OPA)
- Rivers and Harbors Act (RHA)

a. Discuss the application of the above laws and regulations to the Department of Energy and its facilities.(DOE) and its facilities.

This section addresses the major Federal environmental regulations affecting water resources. Although Federal facilities are in many ways a unique entity when viewed in comparison to private industry, all Federal facilities, including DOE, must comply with the regulations discussed herein. For example, RCRA regulated facilities with an operating permit are required to meet the corrective action provisions of RCRA. In addition, all facilities that are discharging to waters of the U.S. are subject to NPDES permit requirements under the CWA. Thus, when reading this section, one should automatically assume that the laws and regulations discussed apply to all DOE facilities.

Environmental law with respect to water has a complex interrelationship between Federal and state roles. The state role in implementing Federal law will be of significance to DOE facilities, since all Federal facilities are subject to state requirements. Since state laws will vary, it is beyond the scope of this document to provide descriptions of each state program implemented under the Federal Acts. Thus, while the information presented on Federal Regulations provides the foundational knowledge for environmental laws, it is imperative that environmental staff at a DOE facility become familiar with the particular state programs.

<u>Clean Water Act (CWA)</u>

The CWA (Federal Water Pollution Control Act) was promulgated in 1972 with major revisions in 1977 and 1987. The aim of the CWA is to restore and maintain the chemical, physical, and biological integrity of the Nation's water. To achieve this, two national goals were established: (1) eliminating the discharge of pollutants into navigable waters; and (2) achieving an interim water quality level that would protect fish, shellfish, and wildlife while providing for recreation in and on the water wherever attainable. Major provisions of the Clean Water Act that address these goals and pertain to DOE facilities are as follows:

- Water Quality Standards;
- Effluent Technology-based Standards on an industry-by-industry basis;
- Establishment of the National Pollutant Discharge Elimination System (NPDES) program;
- Provisions for toxic chemical and oil spills; and,
- Section 404 Permitting for Dredge/Fill Activities in "waters of the U.S.".

Each of these components is discussed in more detail throughout Section 2.2. Table 2.2-1 provides a convenient reference of the major components of the Clean Water Act that apply to DOE facilities. Most, if not all DOE facilities are likely to have one or more of the activities listed in this table. The environmental staff at a DOE site should be knowledgeable in the Clean Water Act sections that apply to the particular site. For example, if the DOE site contains fuel tanks, then the environmental staff should be knowledgeable in Section 311 of the CWA.

Table 2.2-1 includes reference to Section 313 of the CWA. This reference is worthy of special attention as it applies directly to DOE facilities. As per Section 313, no entity of the Federal government is exempt from the CWA except by the President of the United States, but in no cases are they exempt from Section 306 or 307 of the CWA. In addition, under Section 313(b)(1), the Environmental Protection Agency (EPA) must cooperate with Federal facilities to identify situations where alternative treatment processes and techniques (including recycle/reuse) may be implemented.

Table 2.2-1
Major Components of Clean Water Act

Activity	CWA Reference	Description
Point Source Discharges	402(a)(1)	Direct, point source discharges must be covered by an NPDES permit. Indirect discharges (discharges to a POTW)[a] must adhere to the Pretreatment Regulations, a segment of the NPDES program. The NPDES permit(s) set sets discharge limitations that are protective of water quality standards.
Dredge and Fill	Sect. 404 CWA	Permit must be obtained from the Army Corps of Engineers prior to discharge of any dredged or fill material into a "Water of the U.S.". The Army Corps, in conjunction with EPA, issues permits following consideration of public interests. See also RHA.
Potential for Releases of Oil and Hazardous Substances	Section 311	Regulates the discharge of oil to surface waters, establishes penalties and a National Contingency Plan for oil cleanup activities. See also OPA.

Sewage Sludge	Section 405	CWA directs EPA to develop technical standards for municipal sludge use and disposal and to incorporate them into NPDES permits (40 CFR Part 503).
Storm Water Discharges	Section 402(p)	Point Source Storm Water discharges (municipal and those associated with industrial activities) are subject to NPDES permitting requirements set forth in 40 CFR 122.
Federal Facilities Program	Section 313	Reinforces applicability of CWA to Federal facilities and specifies cooperation of EPA with Federal facilities in identifying opportunities for implementin alternative treatment technologies.
[a] Publicly Owned Treatment Works		

Safe Drinking Water Act (SDWA)

The SDWA was passed in 1974. The act has two purposes. First, is to ensure that the water that comes from the tap in the United States is fit to drink. Second, is to prevent the contamination of groundwater, which serves as the principal source of drinking water for 50% of the general population and 96% of the rural population[1]. SDWA regulates public water systems which include community and non-community water supply systems. Included in this regulation are National Primary Drinking Water Standards and Secondary Drinking Water Standards, which are maximum levels of pollutants established to protect the public health and welfare. The Safe Drinking Water Act of 1974 mandated that EPA must set Primary and Secondary Drinking Water Standards. EPA was slow in developing these standards and had problems with their enforceability within the states. The SDWA amendments of 1986 strengthened the original Act by requiring EPA to set National Primary Drinking Water Standards for 83 contaminants in 3 years and for 25 additional contaminants each year thereafter

The SDWA bans the use of lead piping and contains provisions for treatment when elevated levels of lead and copper are found in drinking water. Groundwater protection is provided through the SDWA mandates of the Underground Injection Control Program, as well as Critical Aquifer (sole source) protection programs. Other aspects addressed by the SDWA include conditions for public notification, filtration requirements, and monitoring specifications for various pollutants.The SDWA is organized as follows:

Table 2.2-2
Major Components of the Safe Drinking Water Act

Part	Title	Purpose
A	Definitions	Definitions of terms used in the act.
B	Public Water System	Presents the National Primary and Secondary drinking water standards, enforcement actions, exemptions, variances, ban on lead pipes, solder, and flux.
C	Protection of Underground Sources of Drinking Water	Presents regulations for States, State enforcement responsibility, enforcement program, regulation of underground injections, sole source aquifer program, State wellhead protection program.
D	Emergency Powers	Authorizes action against imminent and substantial endangerment to health and associated penalties.
E	General Provisions	Addresses treatment chemical supplies, reasearch, training, grants for States, special project grants and guaranteed loans, sets up the National Drinking Water Advisory Council, and provides for citizen's civil suits Also addresses Indian Tribe compliance.
F	Additional requirements to regulate the Safety of Drinking Water	Addresses water coolers using lead-lined tanks, lead contamination in school drinking water, and Federal assistance to States for correcting lead contamination in school drinking water.

The most recent amendments to the SDWA were signed by the President on August 6, 1996. The 1996 amendments address (1) stronger approaches to preventing contamination through state programs; (2) consumer notification; (3) regulatory improvements (better science, prioritization, and risk assessment), including the elimination of the requirement to regulate 25 contaminants every 3 years; and, (4) state revolving funds (Federal facilities are not eligible). Some of these provisions may indirectly affect DOE to the extent that they may have an impact on state programs and the development of Maximum Contaminant Levels (MCLs). One specific provision in which this relationship is clear is the requirement for states to develop an operator certification program. Further discussion of SDWA and regulations may be found in Sections 2.2(e), (f), (g), (i), (j), and (k).

Resource Conservation and Recovery Act (RCRA) (Groundwater Provisions)

RCRA addresses the protection of groundwater from contamination of hazardous wastes in 40 CFR Parts 264 Subpart F and 265 Subpart F. Part 265 applies to Treatment Storage and Disposal (TSD) facilities operating under "interim" status and is intended to minimize the potential for environmental and public health threats. Interim facilities are essentially awaiting EPA permits. Part 264 regulates permitted TSDs, and are more specific than Part 265 requirements. Part 264 also differs from Part 265 in that it includes provisions for corrective actions. Further discussion of RCRA groundwater provisions are found under Sections 2.2 (l) and (m).

- The protection of groundwater under RCRA is also addressed in Subtitle I concerning Underground Storage Tanks (USTs). The aim of UST regulations is to prevent groundwater contamination resulting from UST systems corroding and leaking, or spills from tanks caused by overflow or during emptying. UST regulations address existing tanks in terms of correcting existing problems and address new tanks by setting standards in order to prevent recurrence of past problems. The UST programs are administered on a state level, however the state program must incorporate the technical standards and corrective action requirements outlined in 40 CFR Part 280. The environmental staff at a DOE site should be familiar with existing state regulations because these may be more stringent than the Federal regulations. A discussion of the Federal Regulations is provided in Section 2.3(n).

National Groundwater Protection Policy

The National Groundwater Protection Policy (NGPP) is a broadly written EPA policy. The policy is detailed in the EPA document entitled "Protecting the Nation's Groundwater: an EPA Strategy." The EPA established the NGPP in 1991 with the intent to write a broad, guidance policy that composites all of the environmental laws addressing groundwater protection. The policy is not enforceable and does not list standards, rather it sets forth EPA's strategy in directing the protection of the Nation's groundwater.

The EPA's current strategy for regulating groundwater is for states to develop comprehensive programs tailored to meet the particular state's needs. Many, but not all, states have developed such programs. Examples of states which have comprehensive groundwater protection laws include Nebraska, Kansas, and California. Some aspects of groundwater protection are currently addressed in the Resource Conservation and Recovery Act (RCRA) and the Safe Drinking Water Act (SDWA); however, there is currently no comprehensive Federal groundwater protection legislation.[1]

Oil Pollution Act (OPA)

OPA addresses liability for oil spills and safety measures for vessels and facilities. The OPA imposes strict liability, with limits, for a list of damages resulting from an oil spill into surface waters (subject to exceptions as delineated in the OPA). In addition, it designates a $1 billion supplemental compensation fund for oil spills. Title IV of the OPA amends Section 311 of the CWA, by enabling Federal oversight of oil spill clean up operations. Title IV also addresses shipping and navigation safety, including a requirement for vessels and facility operators to develop response plans and a requirement for replacement of single hull tankers with double hulls vessels. Furthermore, the Oil Pollution Act increases civil and criminal penalties for causing spills and for violating marine safety and environmental protection laws.

The Oil Pollution Act applies to any potential for discharges of oil to navigable waterways, thus inland facilities are subject to regulations as well as vessels. Any bulk storage of fuel or petroleum is likely to be regulated as a result of the Oil Pollution Act. Specific regulations related to the Oil Pollution Act can be found in the most recent 40 CFR Parts 109 through 117. See Section 2.2(q) for a discussion of these regulations.

Rivers and Harbors Act (RHA)

RHA (1899) was originally intended to regulate surface waters with respect to navigation; however, it became a means to regulate discharges to water. The portions of the Rivers and Harbors Act most relevant to DOE facilities are Sections 9, 10, and 13. Section 9 of the Rivers and Harbors Act requires Congressional approval of the construction of any bridge, dam, dike, or causeway over or in a navigable water of the U.S. (U.S.C.A. Section 402). Section 10 of the Rivers and Harbors Act prohibits the unauthorized obstruction or alteration of any navigable water of the U.S. without a permit. This includes the excavation from or depositing of material in navigable waters. Section 13 prohibits the "discharge of any refuse of any kind or description" into navigable waters (33 U.S.C.A. Section 407), excluding refuse "flowing from streets and sewers in a liquid state". The CWA supersedes the Rivers and Harbors Act with respect to discharges to water. Furthermore, the authority of the Department of the Army in issuing permits under Section 13 has been superseded by the Environmental Protection Agency and NPDES delegated states under Sections 402 and 405 of the CWA. Section 2.2(c) contains further discussion of the Rivers and Harbors Act and CWA Section 404 permitting.

b. Describe the water quality criteria and stream use classification identified in the Clean Water Act.

(Note: stream use classification is not a term used in the clean water act. Designated uses or use classifications may be what was intended.)

Water Quality Criteria and Designated Uses are components of Water Quality Standards that are mandated in the Clean Water Act. Section 303 of the Clean Water Act requires states to develop Water Quality Standards. Water Quality Criteria, Designated Uses (stream use classifications), and Antidegradation (a classifications related topic) are defined in the following sections, and the interrelationship of these concepts are discussed under Water Quality Standards. Although it is a separate component of the CWA, Technology-based Effluent Standards play a similar role in permitting and are briefly described at the end of this subsection.

Water Quality Criteria

Water Quality Criteria are scientifically derived ambient limits which are developed by EPA for pollutants of concern. These are recommended levels which are not to be exceeded in a body of water in order to protect aquatic life and human health.[3] Water Quality Criteria (WQC) apply within a receiving water, but are often used as the basis for developing limitations in National Pollutant Discharge Elimination System (NPDES) permits. EPA has published recommended water quality criteria in a document referred to as the "Gold Book".[4] Updated information on water quality criteria is published in Federal Register Notices. Water Quality Criteria are most often thought of as being numeric, (e.g., 50 ug/L), however, they may also be narrative. For example; "All waters must, at all times and flows, be free from substances that are toxic to humans or aquatic life".[5]

Designated Uses (Stream Use Classifications)

The Clean Water Act mandates that states must classify waters within its boundaries in terms of their existing uses and their potential to support uses. The states' designated uses must at a minimum meet the requirements as defined under the Clean Water Act (CWA) Sections 101(a), 101(a)(2), and 303(c), in that they must address propagation of fish, shellfish, wildlife, and recreational uses (i.e., the "fishable/swimmable" goal of the CWA).[6] States must also consider the use and value of the waters for human consumption. States may designate more specific uses. For example, a state may have use categories of "warm water fish species" and "cold water fish species," to address the designated use of propagation of fish.

In order for the state to have a designated use that does not support the "fishable/ swimmable" goal of the CWA, the state must conduct a use attainability analysis. The use attainability analysis is a demonstration that the "fishable/swimmable" goals cannot be met when effluent limits under CWA Section 301(b)(1)(A) and (B) and Section 306 are implemented for point source discharges and when cost effective and reasonable best management practices are implemented for non-point sources. Regulations governing when states may remove uses or establish subcategories are found in 40 CFR 131.10 et. seq.

Antidegradation Policy

The purpose of an antidegradation policy is to ensure that existing quality of water bodies is not lowered, even when lowering of that quality will still support the uses classified by the state. In the adoption of antidegradation requirements under the CWA (40 CFR 131.12), three tiers of protection have been established. Tier I [40 CFR 131.12(a)(1)] protects existing water quality and uses, and the water quality necessary to maintain these uses. Establishing an existing use requires demonstrating that this use has occurred since November 28, 1975, or that the waters are capable of this use regardless of whether or not this use was made of the water body in the past. Tier II [40 CFR 131.12(a)(2)] is established to protect waters whose quality is better than necessary to meet the "fishable/swimmable" goals under the CWA. Tier II designated waters require an extensive antidegradation review before standards can be relaxed—but in no case may the standards be relaxed to a point where an established use of the waterbody is impacted. Tier III designates outstanding national resource waters where no degradation is allowed. Tier III designation protects the highest quality U.S.waters and waters of exceptional ecological significance.

Water Quality Standards

Section 303 of the CWA requires states to develop and implement Water Quality Standards. A Water Quality Standard (WQS) is a law or regulation that consists of the beneficial designated use(s) of a waterbody, the numeric and narrative water quality criteria that are necessary to protect the use or uses of that particular waterbody, and an antidegradation statement. Thus, the WQS has three components:

- Numeric or narrative water quality criteria;
- Designated use; and,
- Antidegradation statement.

The term WQS is commonly used when referring to a state's WQC that has been adopted into a standard, thus the terms Water Quality Criteria and Water Quality Standard are easily confused.The two terms may be distinguished as follows:

- Water quality criteria are elements of state water quality standards, expressed as constituent concentrations, levels, or narrative statements, representing a quality of water that supports a particular use. When criteria are met, water quality will generally protect the designated use.

- Water quality standards are provisions of state or Federal law which consist of a designated use or uses for the waters of the United States and water quality criteria for such waters based upon such uses. Water quality standards are to protect the public health or welfare, enhance the quality of water and serve the purposes of the Clean Water Act.

The EPA regularly (usually triennially) reviews a state's water quality standards and may require the states to make modifications. The state then resubmits the "officially adopted" standards to EPA which may reflect modifications required by EPA. At this point, if EPA determines that the standards do not comply with the Clean Water Act, EPA may promulgate water quality standards for the state. It should be noted that Indian Tribes, upon specific demonstration to EPA, may be treated as a state and may develop WQS in the same manner as states. The environmental staff at a DOE site should retain a current list of water quality standards either by periodically reviewing Federal Register notices, or by contacting the EPA Region.

In developing a Water Quality Standard, a state may use the EPA criteria discussed above or it may develop its own criteria to reflect local prevailing conditions. Table 2.2-3 is an example of a Water Quality Standard taken from the Colorado Water Quality Standards. In this example, the criteria for arsenic is 50 ug/l and the designated uses are listed. The antidegradation statement is elsewhere in the regulations. In addition, when numerical values to protect a designated use cannot be derived, the state may establish a narrative standard. In doing so, the state must specify how that standard is to be implemented. Standards usually are applied in the receiving water; however, a state may have an "effluent standard" which is applied to a point of discharge[6].

Table 2.2-3
Example of Water Quality Standard (paraphrased from the Colorado Water Quality Standards)

Stream Segment	Stream Use Classification	Standards for Total Recoverable Arsenic
Mainstream and all tributaries to Woman and Walnut Creeks from sources to Standley Lake and Great Western Reservoir except for specific listings in Segment 5.	Aquatic Life Warm 2 Recreation 2 Water Supply Agriculture	50 ug/L

The system by which states apply standards will vary; however, some general methods are common. For example, most states will have developed a set of criteria which apply to most waters of the state. Then, where there are unusual conditions, the state may develop more customized or "site specific standards" for one or more parameters. Such was the case at the DOE Rocky Flats site; whereby, the state developed site specific standards for radionuclides in two of the receiving waters. The DOE participated in the standards process through hearings and petitions to the Colorado Water Quality Control Board. As an example, the site specific standards for radionuclides are provided in Table 2.2-4. These standards are presented for example purposes only and are not necessarily the current standards.

Table 2.2-4
Site Specific Water Quality Standards developed for the DOE Rocky Flats Environmental Technology Site

Radionuclide	Woman Creek (pCi/L)	Walnut Creek (pCi/L)
Gross Alpha	7.00	11.00
Gross Beta	5.00	19.00
Plutonium	0.15	0.15
Americium	0.15	0.15
Tritium	500.00	500.00
Uranium	5.00	10.00

Technology-based Effluent Standards

Section 301 of the CWA sets forth the requirement for EPA to develop technology-based standards on an industry-by-industry basis. Technology-based standards refer to standards that reflect pollutant concentrations in wastewater which are achieved assuming a certain level of treatment. In developing these standards, EPA collects data using industry surveys. The resulting standards which are promulgated are referred to as "effluent guidelines". The effluent guidelines may be found in the most current 40 CFR 401-471. There are no effluent guidelines that directly apply to DOE facilities; however, in some instances, the permitting authority may "borrow" technology-based effluent standards as a basis for a permit limit. This may be done particularly if the permit writer determines that a permit limit is necessary to protect the health of the receiving water and the basis of the effluent guideline also applies to the particular DOE activity. For example, if a DOE facility conducts an operation that results in the potential for asbestos to enter the wastewater discharge, and there are no applicable water quality standards for asbestos, then the permit for this facility may contain an effluent limit for asbestos that is based on the "Effluent Guidelines and Standards for the Asbestos Manufacturing Point Source Category". Such an action must be justified in the permit's fact sheet.

c. Discuss the Clean Water Act permitting requirements including monitoring and reporting. Include in the discussion, National Pollutant Discharge Elimination System Program and the Rivers and Harbors Act Dredge/Fill material permits.

The Clean Water Act sets forth permitting requirements in two main areas: the National Pollutant Discharge Elimination System (NPDES) and Section 404 which addresses dredge/fill activities. The NPDES program is administered by EPA. Section 404 is administered by the Army Corps of Engineers in conjunction with EPA.

National Pollutant Discharge Elimination System (NPDES)

The CWA prohibits the discharge of pollutants through point sources, to "Waters of the U.S."“ waters of the U.S.”, without an NPDES permit. This includes wastewater and point source discharges of storm waters. This section focuses on wastewater discharges. As previously mentioned, the NPDES program is administered overall by EPA; however, EPA delegates authority to states, who meet certain requirements, to implement the NPDES program components. NPDES program components are as follows:

- Federal Facilities
- Wastewater Discharges
- Pretreatment Program
- Sludge Permitting
- Storm Water [discussed under 2.2 (o)]
- General Permits

The EPA may grant a state NPDES authority for any one or more of these components. A description of the applicability of the NPDES program to DOE sites, the permitting process and monitoring and reporting, which applies to the overall program is described below, followed by a description of each of the NPDES program components as they relate to the permitting process.

- NPDES Program as it Applies to DOE Sites

  Any point source discharge from a DOE site is subject to an NPDES permit. The NPDES permit will address pollutants which may be present in that discharge due to activities at the site or site conditions. The implementing regulations (40 CFR Part 122), contain a wide encompassing definition of “pollutants”, however, the definition excludes radionuclides which are regulated under the Atomic Energy Act. Since many DOE sites contain radioactive materials, it is important to distinguish the applicability of the CWA NPDES program versus the AEA concerning radionuclides. This distinction follows:

  ◊ The CWA applies to naturally occurring and accelerator-produced radioisotopes. In addition, Section 301(f) of the CWA prohibits the discharge of any radiological warfare agent or high-level radioactive waste into the navigable waters.

  ◊ The AEA regulates **source, byproduct**, or **special nuclear materials**

  Source materials include: (1) uranium, thorium, or any other material which the Atomic Energy Commission finds is essential to the production of special nuclear material pursuant to the provisions of Sect. 61 (of the AEA); or, (2) ores containing one or more of the foregoing materials, in

such concentration as the Commission may by regulation determine from time to time. **Byproduct material** includes: (1) any radioactive material (except special nuclear material) yielded in or made radioactive by exposure incident to the process of producing or utilizing special nuclear material; and, (2) the tailings or wastes produced by the extraction or concentration of uranium or thorium from any ore processed primarily for its source material content. **Special nuclear material** includes: (1) plutonium, uranium enriched in the isotope 233 or in the isotope 235, and any other material which the Commission, pursuant to the provisions of Section 51, finds is capable of releasing substantial quantities of atomic energy and is in the interest of the common defense and security, but does not include source material; or, (2) any material artificially enriched by any of the foregoing, but does not include source material[7].

- Permit Development Process

Prior to discharging through a point source to a water of the U.S., one must apply for and obtain an NPDES permit. The permit is valid for 5 years. A person already possessing an NPDES permit must submit an application for renewal at least 180 days prior to the permit expiration date. The application forms and requirements for the renewal are generally the same as for new permits. The application consists of several EPA forms and accompanying data that the forms request. These form numbers and their applicability are provided in Table 2.2-5.

Table 2.2-5
EPA Forms Comprising NPDES Permits

Form Number	Applicability
1	Requests general information such as the name of the facility, location, mailing address, contact person, etc. Accompanies all other NPDES applications.
Form A and Short Form A	Applicable to POTWs. Form A applies to major dischargers; Short Form A applies to minor dischargers.
2B	Applies to concentrated animal feeding operations or aquatic animal production facilities.
2C	Applies to industrial dischargers. This is where the applicant provides analytical data on the wastewater.
2D	Applies to new manufacturing, mining and commercial discharges.
2E	Applies to new or existing industrial dischargers which do not discharge process wastewater.
2F	Applies to new or existing municipal and industrial discharges which are required to apply for storm water permits

Form 2C has the most widespread applicability and is perhaps the most complex, as this is where monitoring results are reported. Upon receipt of the application, the permitting authority will review the application for completeness. They will notify the applicant regarding additional information required. The next step is development of a Draft Permit.

The Draft Permit is accompanied by a Fact Sheet or Rationale, which is made available to the permittee. The Fact Sheet should contain justification for the effluent limits, monitoring requirements, and special conditions in the permit. The permittee should carefully review the Facts Sheet to ensure that the permit writer used recent and correct information in developing limits. Upon issuance of the draft permit, public notice is provided and a public hearing may be scheduled,; whereby, the permitting authority receives comments. The permit writer addresses these comments by making any necessary modifications to the draft permit prior to it becoming final.
The NPDES permit includes the following sections:

- **Cover Page**–Lists the facility name Page –Lists the facility name, location, and outfalls and receiving water covered by the permit, the effective dates, a statement authorizing discharge(s), and the signature of the permitting authority;
- **Effluent Limitations**– Numeric and narrative limits for each parameter are described. Sometimes this section contains requirements for monitoring without a permit limit;
- **Monitoring Requirements**– Frequency, type of sample and methods for analyses are described in this section. If methods are not specified, then the permittee must use EPA approved methods which are outlined in 40 CFR Part 136;
- **Standard Conditions**– Include references to state or Federal Statutes and reflect requirements that are common to all permits issued by the permitting authority; and,
- **Special Conditions**– Contains requirements that do not fit under the other sections. Examples include special studies to be conducted or compliance schedules, and requirements for best management practices.

Monitoring and Reporting

The Monitoring and Reporting section of the permit will specify frequency, sample types and analytical methods. In the absence of direction in the permit, analytical requirements (including sample techniques) must adhere to methods outlined in 40 CFR Part 136. In conducting monitoring, the permittee is required to maintain records that include the following items of information:

- Date, exact place, and time of sampling or measurement;
- Individual(s)s who performed the sampling or measurement;
- Individuals(s) who performed the analyses;
- Analytical techniques or methods used; and,
- Results of the analyses.

The permittee must also keep records on instrument calibration, maintenance, and original strip chart recordings.[8] All these records must be kept for a minimum of 3 years. Records on sludge use and disposal, regulated under 40 CFR Part 503, must be kept for 5 years.

The permittee is required to report the results of monitoring using the Discharge Monitoring Report (DMR) form developed by EPA.The required frequency for submitting the DMR is specified in the permit.If the permittee monitors at a frequency greater than specified in the permit, these results must be included in calculations and reported on the DMR.
In addition to monthly reporting, there may be instances specified under standards conditions, where spills, upsets, and bypasses must be reported. These generally reflect the requirements of 40 CFR 122.41 which are summarized in Table 2.2-6.

Table 2.2-6
Conditions which Require Notification as per NPDES Regulations Outlined in 40 CFR 122.41

Instances Which Must Be Reported	Method of Report
Advanced notice of planned changes to facility that may result in noncompliance	Orally within 24 hours and written submission within 5 days
Any unanticipated bypass	Orally within 24 hours and written submission within 5 days
Any upset which exceeds any effluent limitations in the permit	Orally within 24 hours and written submission within 5 days
Violation of a Maximum Daily Limit for any of the pollutants listed by the Director in the permit to be reported	Orally within 24 hours and written submission within 5 days
All other instances of noncompliance	At time of DMR submittal
If permittee becomes aware of omission of facts or information in permit application.	"Promptly"

The written submission must contain a description of the noncompliance and its cause; the period of noncompliance, including exact dates and times, and if the noncompliance has not been corrected; the anticipated time it is expected to continue; and steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance.

- Special Segments of the NPDES Program

  ◊ Federal Facilities

  In order for states to exercise NPDES authority over Federal facilities, they must obtain special authorization. Federal facilities include DOE facilities and other installations which are owned and operated by the U.S. government. Permits are issued to Federal facilities similar to any other individual permit, except additional requirements may be included to reflect CWA Section 313. This section requires EPA to cooperate with Federal facilities in implementing innovative treatment processes.

  ◊ Pretreatment

  Pretreatment refers to an industry partially treating its wastewater prior to discharging it to the POTW. The purpose of pretreatment is to prevent toxic chemicals from interfering with a POTW's biological treatment systems and to prevent toxics pass-through. Industries which discharge to a POTW are referred to as "indirect dischargers", and are not required to obtain an NPDES permit. EPA does regulate indirect dischargers; however, regulation is through the Pretreatment Program. The requirements under the NPDES pretreatment program are outlined in 40 CFR Part 403. These regulations require POTWs receiving industrial effluent ensure that indirect discharges do not cause toxic interference and pass through. The POTW must also ensure that the wastewater received from the indirect discharger meets effluent guidelines and pretreatment standards which are found in 40 CFR Parts 400-424. Note that the POTW bears the responsibility for meeting the pretreatment regulations.

- Storm Water Program

  ◊ The storm water portion of the NPDES program is addressed under 2.2 (o).

  ◊ Sludge Permits

  EPA originally regulated sludge under 40 CFR Part 257. In 1993, 40 CFR Part 503 regulations became effective. Part 503 regulations stipulate land disposal methods for sludge, including treatment and land application rates. As per 40 CFR 122.21, if a facility has an existing NPDES permit, it must include sludge monitoring in its next application for renewal. If a facility has no existing permit, it must submit monitoring data in accordance with 40 CFR Parts 122, 123, and 501.

◊ General Permit

A general permit is a single permit , containing a set of requirements, that is issued to several dischargers in lieu of individual permits. States must have special authorization from EPA in order to have General Permit Authority. General permits cover a geographic area, with boundaries that may coincide with:

- Designated planning areas;
- Sewer districts;
- City, county, or state boundaries;
- State highway systems;
- Standard metropolitan statistical areas; and,
- Urban areas.

As will be discussed under 2.2 (o), general permits are used in Storm Water Permitting. Other types of discharges for which general permits are issued include categories of point sources that have similar operations, and similar wastewater characteristics. Additional requirements for general permits are found in 40 CFR 122.28.

Section 404 Permits (Rivers and Harbors Act)

Activities that involve dredge and fill of navigable waterways were originally regulated by Sections 9 and 10 of the Rivers and Harbors Act of 1899. The Clean Water Act Section 404 supersedes these regulations with respect to dredge and fill. A description of the 404 permitting program, including regulatory authority and applicability, is provided below followed by a discussion of types of permits issued.

- CWA Section 404 Permitting Program

Permitting for dredge and fill of navigable waterways is under the jurisdiction of the Army Corps of Engineers in conjunction with EPA. The Army Corps District or Division Engineer develops and issues permits. These are reviewed by the EPA. Section 404 of the CWA establishes the authority for the Army Corps to issue permits following "public interest review" for the discharge of dredge/fill material into waters of the U.S. at disposal sites specified in EPA Guidelines [(CWA Section 404(b)(1)]. While these are guidelines, EPA has the authority to veto a permit if granting of the permit would result in unacceptable adverse effects on municipal water supplies, shellfish beds and fishery areas, wildlife, or recreational areas. (See 40 CFR Part 230). Where there is a potential applicability of other regulations that protect resources, the Army must also consult with other agencies such as the United States Fish and Wildlife Service or the National Marine Fisheries Service.

The term "dredge and fill" encompasses a variety of activities, as specified by 33 CFR 323.2, including:

"...the addition of dredge material to a site; the runoff or overflow from a contained land or water disposal area; and, any addition, including any redeposit, of dredged material, including excavated material, into waters of the U.S. which is incidental to any activity, including mechanized landclearing, ditching, a channelization, or other excavation".

Because of the wide encompassing definition, it can be assumed that most major activities on waters or wetlands would fall under the jurisdiction of CWA 404 Permits. However, there are clarifications of excluded activities and exemptions in CWA Section 404(f)(1) and (2), 33 CFR 323.2, 323.3, and 40 CFR 232.4. In proposing any activity which may affect a "water of the U.S.", these references should be consulted as well as the District Army Corps of Engineers.
The term "waters of the U.S." is another critical definition concerning 404 Permits. An entire section of regulations is devoted to this definition (40 CFR Part 328). In general, "waters of the U.S." includes "navigable waters of the U.S." and also other hydrologic conditions. Wetlands are included in the definition if their destruction has the potential for affecting interstate commerce. Under Section 404 of the CWA, the definition of wetlands cites three characteristics: wetland vegetation, hydra soils, and hydrology (flooding/soil saturation). Anyone attempting to define or delineate a wetland should consult these regulations and the Army Corps District Engineer.

- Types of Permits Issued Under CWA Section 404

  The Army Corps of Engineers issues two types of permits: General and Individual. General permits, authorized by CWA Section 404(e),. They are issued for a specific category or categories of permits on a specific geographical basis and for activities expected to have only minimal impacts. When that geographical basis is nationwide, they are referred to as Nationwide Permits. Nationwide Permits are issued through publication in the Federal Register and are codified in 33 CFR Part 330. Examples of Nationwide Permits include Cranberry Production Activities and Boat Ramps.

  Individual permits are issued on a case-by-case basis by Army Corps District or Division Engineers. The regulatory approach and general policies set forth by the Army Corps in issuing permits are found in 33 CFR 320. These policies emphasize consideration of the public interests, including careful consideration of wetlands and water quality, historic, cultural, scenic, and recreational resources. Several other considerations are included in the general policies as well as reference to EPA Guidelines (40 CFR Part 230) and should be consulted when proposing an activity subject to CWA 404 permits.

In addition to the regulations discussed above, associated regulations governing activities requiring Section 404 permits are as follows:

- 40 CFR 225 – Ocean Dumping
- 33 CFR 321 – Dams or Dikes
- 33 CFR 322 – Activities that alter or modify the course, condition, location, or capacity of a navigable water of the United States "water of the U.S."; and construction of artificial islands, installations, and other devices on the outer continental shelf
- 33 CFR 323 – Discharges of dredged or fill material into "waters of the United States of the U.S."
- 33 CFR 324 – Activities involving the transportation of dredged material for the purpose of disposal in ocean waters.

d. Discuss the reporting requirements identified in the Clean Water Act.

Reporting requirements resulting from the CWA mainly stem from the NPDES program. Reporting requirements under the NPDES program were discussed previously in Section 2.2 (c). In addition to NPDES, the CWA contains a provision in Section 311 to immediately report the discharge of oil or a hazardous substance to the United States Government [CWA Section 311(b)(5)]. This section generally applies to spills rather than permitted discharges. Stemming from Section 311 are regulations for determining reportable quantities for hazardous substances outlined in 40 CFR 117. This regulation stipulates the quantity in pounds for numerous hazardous substances, would trigger the reporting requirement.

e. Discuss the standards for maximum contaminant levels (primary and secondary) contained in the Safe Drinking Water Act.

Primary and Secondary Maximum Contaminant Levels (MCLs) are the means by which EPA sets limits on pollutants in drinking water in order to ensure the public health and welfare. Primary standards address contaminants that may affect public health; for example, bacteria or benzene (carcinogen). Prior to the 1986 amendments, EPA developed "interim" standards and Recommended Maximum Contaminant Levels (RMCLs). The 1986 amendments dropped the "interim" status: all interim standards became National Primary Drinking Water Standards. In addition, the amendments changed RMCLS to Maximum Contaminant Level Goals (MCLGs). The 1996 amendments replace the requirement for regulating 25 new contaminants every three years with the option for EPA to review 5 contaminants every 5 years. Furthermore, EPA is given discretion over whether or not to regulate the contaminant following the review. EPA must base such a decision according to criteria (1) that the contaminant would adversely affect human health, (2) that there is a high probability of frequent occurrence at significant levels; and, (3) that the regulation would represent a meaningful opportunity for health risk reduction[9]. The definitions of MCL and MCLG are as follows:

MCL Maximum permissible level of a contaminant in water which is delivered to the free flowing outlet of the ultimate user of a public water system, except in the case of turbidity where the maximum permissible level is measured at the point of entry to the distribution system. Contaminants added to the water under circumstances controlled by the user, except those resulting from corrosion of piping and plumbing caused by water quality, are excluded from this definition.

MCLG Maximum level of a contaminant in drinking water at which no known or anticipated adverse effect on the health of persons would occur, and which allows an adequate margin of safety. MCLGs are non-enforceable health goals.

As an example the MCLs for radionuclides are presented in Table 2.2-7.

Table 2.2-7
Primary Drinking Water Standards (MCLs) for Radionuclides

Radionuclide	MCL[10]
Beta particle and photon activity	4 mrem/yr*
Gross alpha particle activity	15 pCi/L
Radium 226/228	5 pCi/L
*"Rem" means the unit of dose equivalent from ionizing radiation to the total body of any internal organ system. A "millirem (mrem)" is a 1/1000 of a rem. PicoCurie (pCi) means the quantity of radioactive material producing 2.22 nuclear transformations per minute.	

Note that MCLs are requirements, whereas, MCLGs are nonenforceable goals. In some instances it may not be technically or economically feasible to determine how much of a contaminant is present in drinking water (i.e., the contaminant may be harmful at levels which are below the most sensitive detection limits.)[1] In this case, EPA may adopt a treatment technique in lieu of an MCL/MCLG as a National Primary Drinking Water Standard. For example, public water systems must certify adherence to certain dosing restrictions in order to protect against elevated levels of acrylamide and epichlorhydrin.[11]

When EPA develops an MCL and MCLG for a given contaminant, the standards are published in the Federal Register for public review. Public hearings may be held during which EPA receives comments from the scientific community and the general public. EPA attempts to address these comments and then final National Primary Drinking Water Standards are promulgated. The 1996 amendments have added provisions for EPA to conduct a cost-benefit analysis in the development of MCLs. A complete list of the

Primary Drinking Water Standards as well as the sampling and analytical method requirements may be found in the most current edition of 40 CFR Part 141.

National Secondary Drinking Water Standards

Secondary Drinking Water Standards are designed to protect the public welfare by addressing aesthetic properties of drinking water (e.g., odor). Secondary Drinking Water Standards are nonenforceable; however, states may adopt these standards into regulation. A complete list of Secondary Drinking Water Standards may be found in the most current 40 CFR Part 143.

f. Describe the provisions for notification to consumers as outlined by the Safe Drinking Water Act.

Regulations for public notification are designed to ensure that the public has the opportunity to make informed decisions about drinking water problems. The regulations concerning notification to consumers is specified in 40 CFR 141.32 for Violations of MCLs and 40 CFR 141.85 concerning elevated levels of lead.

- Notification for Violation of MCLs

  Table 2.2-8 summarizes the notifications required. For each type of condition requiring notification, the owner/operator must conduct an initial notification and follow-up notifications for as long as the violation or condition exists. In addition to the conditions described in Table 2.2-8, the owner/operator must provide these notices to all new billing units or new hookups prior to beginning the service.

  When an owner operator issues a notification, specific requirements to adhere to are outlined in 40 CFR 141.32(d). The notice must explain the violation, any potential adverse health effects, the population at risk, the steps that the public water system is taking to correct the problem, the necessity for seeking alternate water supplies (if any), and any preventive measures the consumer should take until the violation is corrected. The notice must include a telephone number to contact as a source of additional information. Where appropriate, the notice must be multilingual. In describing the potential adverse health effects, the notice must contain language that is provided in 40 CFR 141.32(e).

Table 2.2-8
Notification Requirements for Owners/Operators of Public Water Systems

Conditions Requiring Notification	Required Notifications	Method of Notification
Violations of the MCL, which pose an acute risk to human health, include: • Nitrate • Total coliform, when fecal or E. coli are present • Occurrence of a waterborne disease outbreak in an unfiltered system • Any violations determined by the state as posing acute risk	(1) Within 24 hours (2) Within 14 days (3) Within 45 days (4) Once every 3 mos. for as long as violation continues	Give copy of notice to radio and television stations serving the area served by the public water system; Daily newspaper or weekly newspaper (if no daily); or Mail or hand delivery Mail or hand delivery
Violations of the MCL, which pose an acute risk to human health, include: • Nitrate • Total coliform, when fecal or E. coli are present • Occurrence of a waterborne disease outbreak in an unfiltered system • Any violations determined by the state as posing acute risk	(1) Within 72 hours (2) Within 14 days (3) Within 45 days (4) Once every 3 mos. for as long as violation continues	Give copy of notice to radio and television stations serving the area served by the public water system; Daily newspaper or weekly newspaper (if no daily); or Mail or hand delivery Mail or hand delivery
Violation of MCL, treatment technique (that is a primary standard), or failure to comply with a schedule prescribed pursuant to a variance or exemption.	(1) Within 14 days (2) Within 45 days (3) Once every 3 mos. for as long as violation continues	Daily newspaper or weekly newspaper (if no daily) Mail or hand delivery Mail or hand delivery

Table 2.2-8
Notification Requirements for Owners/Operators of Public Water Systems

Conditions Requiring Notification	Required Notifications	Method of Notification
Violation of MCL, treatment technique (that is a primary standard), or failure to comply with a schedule prescribed pursuant to a variance or exemption.	(1) Within 14 days	Daily newspaper or weekly newspaper (if no daily)
	(2) Within 45 days	Mail or hand delivery
	(3) Once every 3 mos. for as long as violation continues	Mail or hand delivery
The owner operator meets any one of the following conditions: • Fails to perform monitoring • Fails to comply with test procedures • Subject to a variance • Subject to an exemption	(1) Within 3 months of violation or granting of variance or exemption	Daily newspaper, weekly newspaper if no daily exists; **or** Hand delivery or posting (when no daily or weekly newspaper or for non-community water systems)
	(2) Once every 3 months for as long as violation exists or variance / exemption remains in effect. Posting is continuous.	Mail, hand delivery or posting
Minor violations as defined by state	Once per year	Unspecified

- Notifications for Elevated Levels of Lead

  In addition to notifying consumers of violations of the MCL, the owner/operator is required, within 60 days, to provide "public education" materials when concentrations of lead exceed 0.015 mg/L. The public education program includes written materials and broadcast materials. The exact language and content of the education materials is provided in 40 CFR 141.85. Basically the materials describe the health effects of lead and steps the consumer can take to reduce exposure to lead. Written materials must be inserted in water bills and provided to newspapers, and delivered to schools, city and county health departments, hospitals, clinics, some doctors offices, Women, Infants, and Children (WIC) and Head Start programs, and local welfare agencies. Notification must be repeated every 6 months for as long as the action level is exceeded. For non-community, non-transient water systems, the owner/operator must post informational posters in public places or the common area of each building served, and must deliver

informational pamphlets to each person served by the water system. Notification by non-transient, non-community water systems must be repeated once a year for as long as the action level is exceeded.

g. Discuss the Safe Drinking Water Act Underground Injection Control Program.

Section 1422 of the SDWA requires EPA to identify states that need Underground Injection Control Programs to protect drinking water sources. This section also sets forth a requirement for EPA to develop an Underground Injection Control (UIC) Program. The overall program is administered by states; however, in the absence of an approved state program, EPA administers the program. Underground Injection Control regulations apply to well injection which is defined as follows:

> "...the subsurface emplacement of fluids through a bored, drilled or driven well, or through a dug well, where the depth of the dug well is greater than the largest surface dimension".

Types of activities covered by UIC program are described as follows [40 CFR 144.1(g)(1)].:

- Any injection well located on a drilling platform inside the state's territorial waters;
- Any dug hole or well that is deeper than its largest surface dimension, where the principal function of the hole is emplacement of fluids;
- Any septic tank or cesspool used by generators or hazardous waste, or by owners or operators of hazardous waste management facilities, to dispose of fluids containing hazardous waste; and,
- Any septic tank, cesspool, or the well used by a multiple dwelling, community, or regional system for the injection of wastes.

Not included are wells located outside the state's territorial waters, single family waste disposal systems, and nonresidential sanitary waste disposal systems with a capacity to serve fewer than 20 people per day. The UIC program regulates activities by grouping them into five categories or classes of wells:

Class I – Injection of hazardous wastes into the lowermost formations, containing within one-quarter mile of the well bore, an underground source of drinking water; containing drinking water.
Class II – Injection of fluids associated with natural gas storage operations, or conventional oil or natural gas production.
Class III – Injection for the extraction of minerals.
Class IV – Injection of hazardous wastes directly into an underground source of drinking water. These are now prohibited.
Class V – Other types of injection wells. These are to be assessed by EPA at a later date. Future regulations governing these may ensue.

Within the UIC program, well injection may be authorized by permit or by rule. Authorization by rule is restricted to Class I, II (except for enhanced recovery and hydrocarbon storage) and III wells. Authorization by rule expires either when a permit is issued or 5 years after the approval or promulgation of the UIC program (either state or EPA). Permits may be issued as area permits, which are permits covering a specific geographic area and meet other requirements (e.g., a single owner/operator). Area permits are not issued for injection of hazardous wastes. Emergency permits may also be issued under certain circumstances (e.g., when there is an imminent danger to persons).

Requirement for Authorization by Rule is outlined in 40 CFR 144 Subpart C. For Authorization by Rule, owners/operators must provide "inventory information", such as lists of wells and the depth of the formation into which the well is injecting. Authorization by Rule stipulates operating requirements including monitoring and closure requirements which are provided in Subpart C.

Subpart D of 40 CFR 144 addresses Authorization by Permit. Permits for Class I wells are effective for up to 10 years. Class II and III permits are reviewed every 5 years, whereby; whereby they may be modified, revoked, reissued, terminated, or have a minor modification made. Permits may contain construction requirements, corrective actions, operation requirements, (e.g., maximum injection volumes and/or pressures), monitoring and reporting requirements, and any compliance schedule. The permits contain standard conditions that outline information that is the same among all permits issued (e.g., signatory requirements). Furthermore, under the UIC program, owners and operators of injection wells are required to demonstrate the financial ability for closure of the wells (i.e., plugging and abandonment). The specific requirements for financial demonstrations are outlined 40 CFR Subpart F.

h. Describe the standard methods for the examination of water and wastewater.

As the title states, Standard Methods for the Examination of Water and Wastewater (Standard Methods) contains analytical methods of analyses that are appropriate for analyzing natural waters and wastewater.Each method outlines step-by-step instructions for performing the analyses and includes information on quality control. Within the scientific community, these methods are commonly accepted as the standard test procedures. With respect to environmental regulations,; however, not all the test methods in Standard Methods are acceptable. With respect to wastewater permitting, 40 CFR Part 136 specifies which of the methods and which edition of Standard Methods are acceptable for compliance monitoring for various pollutants. Currently, the 16th and 17th editions contains most EPA approved methods. In addition, NPDES permits may contain specific references to Standard Methods. Regulations implementing the Safe Drinking Water Act National Primary Drinking Water Standards also specify acceptable methods, which include Standard Methods tests, and specific techniques to use when conducting the analyses.[12] The other major protocol incorporated by reference in 40 CFR Part 136 is "Methods of Chemical Analysis of Water and Wastes".

i. Discuss the Safe Drinking Water Act permitting requirements.

The Safe Drinking Water Act requires permits under the Underground Injection Control Program. Several other components of the SDWA and its implementing regulations require information that is to be submitted to and by states, but does not constitute "permitting". States, on the other hand, may establish permitting programs for public water systems, thus one should contact the appropriate state agency regarding permits for public water systems.

j. Describe the aquifer protection (sole source) regulations of the Safe Drinking Water Act.

Section 1424(e) of the Safe Drinking Water Act outlines requirements to identify drinking water supplies that depend on a single aquifer (sole source). When an aquifer is designated as a sole source, no Federal activity or activity receiving Federal financial assistance may be conducted that the EPA Regional Administrator determines may contaminate the aquifer and result in a significant hazard to the public health. Once identified, critical Aquifer Protection Areas are established to prevent groundwater contamination. The criteria for Critical Aquifer Protection Areas are as follows:

- All or part of an area which was designated as a sole or principal source aquifer prior to June 19, 1986 and for which an areawide groundwater quality protection plan was approved under Section 208 of the CWA.
- All or part of a major recharge area to a sole or principle source aquifer, designated before June 19, 1988, for which:
    - ◊ The sole or principle source aquifer is particularly vulnerable to contamination due to hydrogeologic characteristics;
    - ◊ Contamination is reasonable or likely to occur unless a program to reduce or prevent such contamination is implemented; and,
    - ◊ In the absence of any program to reduce or prevent contamination, reasonably foreseeable contamination would result in significant costs resulting from using alternate drinking water supplies as well as economic costs, and social costs.

Any person, group, or community, may petition for an aquifer to be designated as a sole source. The Regional Administrator reviews these petitions and makes a final determination of whether or not the aquifer is a sole source.

k. Discuss the cross-connection identification/elimination and backflow prevention regulations described in the Safe Drinking Water Act.

The Safe Drinking Water Act does not address cross-connection identification/elimination and backflow prevention. These requirements are implemented on a state and local level.

In addition, the Occupational Safety and Health Administration prohibits cross-connections unless they are equipped with backflow prevention devices.[11] State and local regulations are subject to wide variation among and within states and a description of these is beyond the scope of this document. Nonetheless, cross-connection control and backflow prevention are important in order to ensure safe drinking water, thus some discussion is provided.

Cross-connections and backflow are situations where non-potable water, due to plumbing characteristics, has the potential for coming into contact with potable water. If the non-potable water contains chemical or microbiological constituents which are harmful to human health, then the persons served by the water supply are at risk. Cross-connections may be defined as an actual or potential physical link between the potable water supply and any other source or sources that may be considered nonpotable. The cross-connection may be "a direct arrangement of piping line that allows the potable water supply to be connected to a line that contains a contaminant[13]". Backflow is "the reversal of flow in a piping system that is counter to the normal direction of flow". Backflow may consist of backpressure (pressure greater than the supply pressure) or backsiphonage (pressure becomes less than atmospheric pressure, thus creating a siphon or vacuum in the system).[14] Cross-connections are commonplace at institutions, large commercial and industrial facilities. Backflow prevention may be achieved through several devices. Information on these devices may be found by contacting the American Water Works Association.

An essential step in cross-connection control and backflow prevention is formation of a strong program which not only addresses the physical devices, but identification, inventory, and inspection of cross-connections. This may be a state or local requirement as well as a practical approach to ensuring safe drinking water. The Oak Ridge National Laboratory (ORNL) has such a program in place. The ORNL's cross-connection control program is directed by a committee that evaluate of the potable and nonpotable water systems at the facility. The committee functions include locating and identifying all potable water cross connections and providing recommendations for corrective actions. In addition, the committee oversees new installations of backflow prevention devices, maintenance of existing devices, labeling of potable and process lines, and responding to complaints and concerns. In addition, personnel trained in backflow prevention routinely inspect the devices to ensure that they meet local laws and accepted standards. The results of the survey and the inspections are entered into a data base system.[11]

For information on state and local laws concerning cross-connections and backflow prevention, contact state drinking water agencies and construction/plumbing agencies. In addition, the following manuals address cross connections and backflow prevention practices.

- "Recommended Practice for Backflow Prevention and Cross Connection Control". Available for a fee from American Water Works Association, 1-800-926-7337.

- "Cross Connection Control Manual", Hendrickson, Howard D., U.S. Environmental Protection Agency, Office of Drinking Water.

l. Describe the groundwater protection requirements applicable to interim status Resource Conservation and Recovery Act's (RCRA) facilities in RCRA's implementing regulations, Subpart F of 40 CFR 265.

The purpose of RCRA Subpart F of 40 CFR 265 is to assess the impact on groundwater of Hazardous Waste Treatment, Storage, and Disposal Facilities operating under interim status Interim status refers to existing facilities waiting for an operating permit. More specifically, these are facilities who were in existence on Nov. 19, 1980 (or brought under Subtitle C regulation due to an amendment) who meet certain conditions. Subpart F applies only to those owner/operators of a surface impoundment, landfill, land treatment facility, and some waste piles used to manage hazardous waste.

The major elements of the Subpart F regulations are as follows:

- Development and installation of a monitoring system,
- Background monitoring,
- Routine monitoring and evaluation,
- Conducting assessments,
- Reporting requirements, and,
- Reporting requirements.

Each of these elements is discussed below:

- Development and Installation of a Monitoring System

  The owner/operator of a surface impoundment must develop a monitoring system which consists of 4 wells. One well must be placed upgradient and should reflect groundwater not influenced by the waste management unit. Three wells must be placed downgradient, such that they intercept any waste migrating from the unit. If properly located, comparison of up and downgradient conditions should indicate if there is contamination.

- Background Monitoring

  Background monitoring must be conducted for one year to establish the basis for comparing all future data. Parameters to monitor include: Drinking water parameters, groundwater quality parameters, and groundwater contamination parameters. Background monitoring must be conducted and reported on a quarterly basis.

- Routine Monitoring and Evaluation

  The purpose of routine monitoring and evaluation is to examine groundwater for elevated levels of indicator constituents. Routine monitoring includes semiannual monitoring for groundwater contamination indicator parameters; and annual monitoring for groundwater quality indicator parameters. Drinking water parameters are not included in routine monitoring. The results of routine monitoring are examined statistically (compared with background monitoring). If an elevation (or decrease in pH) occurs, the owner/operator must notify the Regional Administrator within 7 days. In addition, the owner/operator must implement an assessment program. Reports on routine monitoring must be submitted annually along with well elevations and changes in background level. Monitoring must continue for the life of the facility unless it is a land disposal facility, in which case it must be monitored for up to 30 years after the facility has closed. At this time, the owner/operator may discontinue the assessment.

- Assessment

  When contamination is suspected, the owner/operator must implement a groundwater assessment program to determine what is contaminating the groundwater, the extent of contamination, and the rate of the contaminant migration. Within 15 days, the owner /operator must submit a report to the Regional Administrator. If assessment shows no contamination, then the owner/operator may resume monitoring for the indicator parameters. If the assessment does show contamination, then the owner/operator must continue assessing the extent of groundwater contamination quarterly until the facility is closed or further monitoring is required as a result of the permitting process. If the facility was already closed, no more assessment is required.

  It should be noted that all or part of thegroundwater requirements may be waived if the owner/operator demonstrates that there is low potential for migration of hazardous wastes from the facility. The owner/operator may receive special permission for an alternate monitoring system if the one specified in the requirements is not capable of yielding unbiased samples.

- Reporting Requirements

  Reporting requirements are addressed under 40 CFR Part 265.94. The owner/operator must keep records of monitoring analyses including groundwater elevation throughout the active life of the facility and post-closure period. Reports must also be submitted the first year when initial background concentrations are being established for the facility. Quarterly sampling results must be submitted within 15 days after completing sampling. Annual reports must include concentrations or values of parameters listed in 40 CFR Part 265.92(b)(3) and

separately identify any significant differences from initial background found in upgradient wells. If contamination to groundwater occurs during operations, then the annual report must address rate of migration of hazardous waste constituents. This information must be submitted no later than March 1 following each calendar year.

m. Describe the groundwater protection requirements applicable to permitted Resource Conservation and Recovery Act (RCRA) facilities in RCRA's implementing regulations, Subpart F of 40 CFR 264 and in the facility's permit.

Part 264 Technical Requirements are more extensive than requirements for facilities operating under interim status in that Part 264:

- Requires an owner/operator to take corrective action if groundwater contamination is detected and, and,
- Compels the owner and operators of the different waste management methods to design their management units to prevent the release of hazardous wastes.

Permit writers base their permits on information obtained while operating under Part 264 Standards. Permits will include specific requirements based on Best Engineering Judgment (BEJ).

The Subpart F requirements of Part 264 apply to permitted Treatment, Storage and Disposal facilities which have surface impoundments, waste piles, land treatment units and landfills. Subpart F requires the owner/operator to clean up any groundwater contamination. Subpart F has three programs:

- Detection monitoring;
- Compliance monitoring; and,
- Corrective action.

Detection monitoring includes background monitoring and semi-annual monitoring for indicator parameters. The permit specifies the point at which **compliance monitoring** is conducted, as well as the indicator parameters and constituents that must be monitored. "This point is located at the edge of the waste management area, best envisioned as an imaginary line on the outer limit of one or a group of disposal units[15]. If the monitoring system detects leakage of contaminant, then the owner/operator must commence a compliance monitoring program and establish groundwater protection standards.

The permit contains limits for parameters that are selected from Appendix VII of Part 264 and are determined to originate from the TSD. The assigned limits may be background levels, levels listed in Table I of Part 264.94, or Alternate Concentration Limits (ACLs) established by the Regional Administrator.

The owner/operator must initiate **corrective actions** if any statistically significant increase in levels for a permitted parameter occurs. Specific corrective actions are outlined in the facilities permit. The owner/operator may remove the wastes from the groundwater or treat the groundwater in place.

n. Discuss the potential liabilities of the Department and its contractors inherent in the enforcement of environmental regulations (i.e., compliance orders, enforcement actions, fines and penalties, and provisions for civil suits).

Potential Liabilities of DOE– Compliance orders are usually issued against DOE, not its contractors, although states prefer to have the contractor named in the orders. DOE prefers not having the contractors named in the orders due to the change-over of contractors. Enforcement actions have been brought against both DOE and its contractors for environmental regulatory violations. Fines and penalties are usually negotiated between DOE and the states or EPA. Civil suits can be brought against DOE.

Potential Liabilities of DOE Contractors– Compliance orders are usually issued against DOE, not its contractors, although states prefer to have the contractor named in the orders. DOE has traditionally preferred not having the contractors named in the orders due to the change-over of contractors. Enforcement actions have been brought against both DOE and its contractors for environmental regulatory violations. Fines and penalties can be assessed against a DOE contractor outside of the negotiated ones between DOE and the states or EPA. Civil suits can be brought against DOE contractors.(Table 2.2-9)

Table 2.2-9
Potential Liabilities of DOE Contractors

STATUTE	CIVIL LIABILITIES	CRIMINAL LIABILITIES
Clean Water Act (CWA) [16]	Up to $25,000 per day for each day of violation	Negligent violations: $25,000 per day, or 1 year in prison, or both. Knowing violations: $5,000-$5,000-$50,000 per day, or 3 years in prison, or both Knowing endangerment: $250,000, or 15 years in prison, or both
Clean Air Act (CAA)	$200,000 or more without going through the Department of Justice Field "tickets" = $5,000 per day per violation	Individual Negligent = up to 1 year + $100,000 Knowing = 5 years + $250,000 per day per violation Knowing Endangerment = up to 15 years + $250,000 per day

		Falsificationof records = 2 years + up to $250,000 Corporation Negligent = up to 1 year + $200,000 Knowing Endangerment = up to 15 years + $1 million per day Falsification of records = 2 years + up to $500,000
Clean Air Act (CAA)	Up to $25,000 per day for each day of violation	Negligent = 1 year Knowing = 5 years + $$ Knowing Endangerment = 15 years + $1M Falsification = 2 years
Pollution Prevention Act of 1990 (PPA)	None (voluntaryprogram)	None (voluntaryprogram)
Pollution Prevention Act of 1990 (PPA)	None (voluntary program)	None (voluntary program)
Pollution Prevention Act of 1990 (PPA)	None (voluntary program)	None (voluntary program)
Resource Conservation Recovery Act (RCRA)	Up to $25,000 per day for each day of violation	Negligent Violations: $50,000 per day, for each day of violation and/or 5 years in prison Knowing endangerment: $500,000 per violation Knowing endangerment: $250,000 and/or 15 years in prison for an individual and $1,000,000 for a corporation
Safe Drinking Water Act (SDWA)	Up to $25,000 per day for each day of violation	$25,000 per day for each day of violation, and/or 3 years in prison

Federal Agency Liability– Per the Federal Facilities Compliance Act (FFCA), Federal facilities do not have sovereign immunity from state enforcement of state environmental laws under the solid and hazardous waste provisions of the Solid Waste Disposal Act (SWDA). Additionally, Federal facilities are obligated to pay fines and penalties assessed by the states.

Federal Employee Liability– Federal employees can be personally liable for both civil and criminal penalties imposed under the solid and hazardous waste provisions of the SWDA.

Civil Penalties– The Act exempts personal liability of agents, employees, or officers of the United States for any civil penalty under any Federal, state, interstate, or local solid or hazardous waste law with respect to any act or omission within the scope of the official duties of the agent, employee, or officer. However, Federal agencies are now liable for civil penalties and fines.

Criminal Penalties– The Act states, "an agent, employee, or officer of the United States shall be subject to any criminal sanction (including, but not limited to, any fine or imprisonment) under any Federal or state solid or hazardous waste law, but no department, agency, or instrumentality of the executive, legislative, or judicial branch of the Federal Government shall be subject to any such sanction".

o. Discuss the storm water management aspects of the National Pollutant Discharge Elimination System (NPDES).

The National Pollutant Discharge Elimination System (NPDES) specifies the permitting system under the Clean Water Act (CWA) for discharging effluents into bodies of surface water (Section 402). Section 405 of the CWA establishes deadlines, priorities, and permit requirements for storm water discharges from industrial sources and from municipal separate storm sewer systems servicing populations of a certain size, or if the source is determined to significantly contribute to noncompliance of regulated waters.

Activities Requiring a Permit.

Regulated industrial discharges of storm waters include those "directly related to manufacturing, processing, or raw materials storage areas" but do not include discharges associated with "parking lots and administrative and employee buildings." In other words, the storm water conveyance is collecting storm water that has come from areas where specific activities identified by EPA occur. These specific activities covered can be more accurately identified by Standard Industrial Codes (SIC) codes. The SIC codes subject to storm water permits as well as other situations which affect coverage/exemption, are identified in 40 CFR 122.26(b)(14)i through (xi). It should be noted that construction activities that result in a disturbance of over 5 acres are subject to storm water regulations.

Types of Permits

Permits may be issued by the state, if it has the appropriate NPDES authority, or by EPA. States with NPDES storm water authority are free to issue their own version of permits (provided they meet Federal requirements) or they may adopt EPA's permits. There are four types of storm water permits issued by EPA:

(1) Baseline General Permit for Storm Water Discharges Associated with Industrial Activity;
(2) Activity; (2) Baseline General Permit for Storm Water Discharges From Construction Sites;
(3) Individual Permit; and,
(4) Sites; (3) Individual Permit; and, (4) Multisector General Permit for Storm Water Discharges Associated with Industrial Activity.

- Baseline General Permit for Storm Water Discharges Associated With Industrial Activity (Baseline/Industrial)

  In order to be covered by the Baseline/Industrial, the discharger must meet the requirements of being a storm water discharge associated with industrial activity. Other exclusions are listed in 40 CFR I.B.3. For coverage under the Baseline/Industrial, the discharger is required to submit a Notice of Intent (NOI), for which EPA has developed a special form. The NOI requirements include the preparation (without submission) of a pollution prevention plan. Other general information is required, such as the receiving water, location of outfalls, existing NPDES permit information. The NOI must also include an indication of whether existing quantitative data exists; but no monitoring must be submitted with the NOI.

  The Baseline/Industrial requirements are divided into categories of industries. (e.g., Primary Metals Industries, Animal Handling/Meat Packing). Each category has a specific set of monitoring requirements. The only category with actual limits is (facilities with) Coal Pile Runoff.Either semi-annual or annual monitoring is required depending on the category. Information on eligibility, NOI requirements, permit conditions, monitoring requirements, and pollution prevention plans can be found in FederalRegister Notice September 25, 1992, vol. 57, no. 187, pp. 44438-44470).

- Individual Permits For Storm Water Discharges Associated With Industrial Activity (Individual Permits).

  Individual permits for storm water discharges associated with industrial activity are issued either: (1) when the EPA director determines they are required or (2) when the applicant requests such a permit . Exclusions of the general permit may be eligible for an individual permit. These permits are issued on a case-by-case basis. Most of the time the contents of these permits are standard for an industry (i.e., several steam electric plants may have the same monitoring requirements and limits). This is because several states have developed model permits for groups of industries based on information received during the group application process (group applications are no longer available). To apply for an individual permit, the

applicant must submit extensive information, including monitoring data from representative storm events.

- Baseline General Permits For Storm Water Discharges Associated With Construction Activity (Baseline/Construction)

  The Baseline/Construction Permit covers discharges of storm water associated with construction activity that result in a disturbance to 5 or more acres of land. The NOI requirements are essentially the same as for the Baseline/Industrial permit, except that the discharger must provide construction start and end dates, acres disturbed, and must certify that the pollution prevention plan is in accordance with state and local erosion/sedimentation requirements. The Baseline/Construction Permit does not require monitoring; however, the permittee is required to submit signed copies of the NOI to state or local agencies which may require erosion and sedimentation plans.

- Multisector General Permit for Storm Water Discharges Associated with Industrial Activity (Multisector General Permit)

  The Multisector General Permit was proposed in 1993 after receipt and processing of Group Applications for Discharges associated with Industrial Activity. The monitoring associated with the Group Applications formed the basis for the Multisector General Permit, thus this permit is more specifically tailored to industrial categories than the General Permit/Industrial. The NOI submission requirements are essentially the same as for Baseline/Industrial Permits. Storm Water Discharges associated with Industrial Activity are eligible to file an NOI under this permit if:

  (1) EPA is the permit issuing authority (i.e., the state does not have the appropriate NPDES authority);or,
  (2) The state has permit issuing authority and has adopted the Multisector General Permit.

  Not all states having permit issuing authority have adopted the Multisector General Permit. For example, Colorado does not issue Multisector Permits.

  The Multisector General Permit sets forth conditions for 29 industrial categories. The Multisector General Permit differs from the General Permit Industrial primarily in the monitoring requirements and the pollution prevention plan requirements as these are industry specific.

p. Describe the radiological liquid effluent requirements established in DOE Order 5400.5, Radiation Protection of the Public and the Environment, and 10 CFR 834, Radiation Protection of the Public and Environment.

10 CFR 834, Radiation Protection of the Public and Environment, has not yet been promulgated in 10 CFR. 10 CFR are regulations relating to radiation protection standards. Part 834 will replace DOE 5400.5, Radiation Protection of the Public and the Environment. The radiological liquid effluent requirements should be very similar in both documents.

10 CFR 834 sets dose limits for members of the public (on-site or off-site) similar to the primary radiation protection standards established in DOE Order 5400.5. The CFR also mandates the applicable limits of EPA and state regulations, and additional controls on the release of liquid wastes are adopted to reduce the potential for radiological contamination of natural resources such as land, ground and surface water, and ecosystems.

Standards for liquid effluent discharges are driven by ALARA (as low as reasonably achievable (ALARA) to minimize contamination in the environment to the extent practicable. This regulation adopts the "best available technology" (BAT) as the appropriate level of treatment for liquid wastes containing radioactive material and provides that the BAT be phased in at the earliest practicable time. Technical and economic considerations are included in determining the BAT. Based on cost and benefit considerations, radioactive waste streams that contain radionuclide concentrations below the derived concentration guide (DCG) reference values, at the point of discharge to a surface waterway, normally will not require treatment to further reduce the concentration. BAT treatment is provided to protect groundwater and to prevent radionuclide buildup in soil.

Demonstrations of compliance with the effluent requirements of this regulation generally will be based upon calculations that make use of information obtained from monitoring and surveillance programs. The ability to detect, quantify, and adequately respond to unplanned releases of radioactive material to the environment also rely on in-place effluent monitoring, monitoring of environmental transport and diffusion conditions, and assessment capabilities. Monitoring will enable DOE to develop useful data and to collect and analyze pertinent information on unplanned releases in a timely manner. It is the intent of DOE that the monitoring and surveillance programs for DOE activities, facilities, and locations be of high quality. Although some differences result from specific site or specific activity conditions, uniformity in the methods and performance criteria used in obtaining the information is desirable.

q. Explain the spill prevention and control requirements of the Clean Water Act (40 CFR 109-114)

Regulations concerning the discharge of oil into water can be found in 40 CFR 109 through 117. While the provisions for Spill Prevention Control and Countermeasure requirements (SPCC) are mainly addressed in Part 112, Part 110 contains associated definitions and the prohibition of oil discharges. In general, under 40 CFR 110, no person may discharge oil into navigable waters that may affect natural resources or in any quantity that may cause a violation of a water quality standard or cause a sheen or a sludge or emulsion.

SPCC requirements were implemented as a result of the CWA Section 311(j)(c) and are found in 40 CFR 112. The SPCC requirements address non-transportation-related on-shore and off-shore facilities. In relation to most DOE facilities, this will include inland bulk fuel storage tanks. As per 40 CFR 112.1(c), Federal facilities, departments, agencies and instrumentalities, including the DOE, are subject to all these regulations with the exception of 40 CFR 112.6 which addresses civil penalties. Activities which are exempt from SPCC requirements include:

- Onshore and offshore facilities which, due to their location, could not reasonably be expected to discharge oil into or upon the navigable waters of the United States or adjoining shore-lines;
- Equipment or operations of vessels or transportation related onshore and offshore facilities which are subject to authority and control of the Department of Transportation; and,
- Facilities for which the underground buried storage capacity of the facility is 42,000 gallons or less of oil or oil product and the above ground storage capacity of the facility is 1,320 gallons or less of oil or oil product, provided no single above ground container has a capacity in excess of 660 gal.

Facilities which are covered by this regulation are required to submit a spill prevention control and countermeasures plan. The purpose of the plan is to prevent oil and hazardous substances from reaching surface waters in the event of a spill. SPCC plans identify instances where the installation of equipment or practices will achieve this objective. The time frame for preparation is generally within 6 months of initial operation. The SPCC plan must then be fully implemented within 1 year of initial operation. A copy of the SPCC plan must be kept on site. Furthermore, a Registered Professional Engineer must certify that the SPCC plan is in accordance with good engineering practices.

Guidelines for information to be addressed in SPCC plans is specified in 40 CFR 112.7. These specifications are very detailed and are dependent upon the type of facility and the activities at the facility. In general the plan should:

(1) Address corrective actions for previous spills. If there is reasonable potential for spills, include a prediction of the direction, rate, flow, and quantity of oil or hazardous substance which would result from failures;
(2) Address provisions for containment and/or diversionary structures or equipment (e.g., dikes, weirs, curbing) that prevents oil from reaching navigable waters;
(3) Include a demonstration of why installation of equipment (as described in #1 above) is impractical; and,
(4) Include a discussion of conformance to any applicable state regulations regarding spill control measures and specific techniques listed under 40 CFR 112.7(e).

Because SPCC plans include numerous, industry specific details, one should consult 40 CFR 112.7(e) for more information.

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[1] Sullivan, T.F.P., *Environmental Law Handbook*, 12th ed., Government Institute Inc., Rockville, MD, 1993.
[2] 33 CFR 320.2.
[3] Environmental Protection Agency, Office of Water, *Technical Support Document for Water Quality-based Toxics Control*, March 1991. EPA/505/2-90-001. PB91-127415. Environmental Protection Agency (EPA), Office of Water, EPA/505/2-90-001, Pub. 91-127415, March 1991
[4] Environmental Protection Agency, *Water Quality Standards Handbook:* Second Edition ("Gold Book"), dated 1986, with revisions August 1994.
[5] Environmental Protection Agency, Office of Water, 1987, *Training Manual for NPDES Permit Writers*, EPA, Office of Water, 1987.
[6] Ibid.
[7] 40 CFR 122.41(j) Treatment techniques for acrylamide and epichlorohydrin. *Environmental Guidance Program Reference, Clean Water Act* (excluding Section 404), Environmental Services Division, Oak Ridge National Laboratory, ORNL/M-628, TN, 1989.
[8] 40 CFR Part 136 and 40 CFR 122.41(j).
[9] The Safe Drinking Water Act, Amendments of 1996, Office of Water Regulations and Legislation, http://www.epa.gov/OGWDW/SDWAthem.html#1.
[10] *Is Your Drinking Water Safe?*, EPA, Office of Water, EPA 570/9-91-005, September 1991.
[11] *Treatment Techniques for Acrylamide and Epichlorohydrin*, 40 CFR 141.111.
[12] *Standard Methods for the Examination of Water and Wastes"* American Public Health Association, American Water Works Association, Water Pollution Control Federation, 16th ed., 1985.
[13] Moore, Rebecca M., *Cross Connection Control of the Potable Water Lines at Oak Ridge National Laboratory*, Oak Ridge National Laboratory, ORNL/TM-13010, TN, April 1996.
[14] Asay, Stuart F., P.E. , Publisher and Editor, *Drinking Water and Backflow Prevention*, http://www.dwbp-online.com/DWBPTERM.
[15] *USEPA RCRA Orientation Manual*, EPA, Office of Solid Waste, EPA/530-SW-86-001, 1986.
[16] Under CWA Section 313, a Federal employee/entity may be exempted by the President of the United States, but in no cases exempt from CWA Sections 306 and 307.

2.3 Environmental compliance personnel shall demonstrate a working level knowledge of the following laws, regulations, and Department of Energy (DOE) Orders, as related to Environmental Waste Management:

- Resource Conservation and Recovery Act (RCRA)
- Hazardous Materials Transportation Act (HMTA)
- DOE Order 5820.2A, Radioactive Waste Management
- Toxic Substances Control Act (TSCA)

Supporting Knowledge and/or Skills

a. Discuss the application of the above regulations to the Department of Energy and its facilities.

Resource Conservation and Recovery Act (RCRA) This act (42 U.S.C.§ 6901 et seq., as amended) also known as the Solid Waste Disposal Act, governs the management of solid and hazardous waste, and is under the direction of the U.S. EPA. RCRA is divided into numerous Subtitles, of which three are of specific interest:

- Subtitle C – Hazardous Waste Management
- Subtitle D – State or Regional Solid Waste Plans
- Subtitle I – Regulation of Underground Storage Tanks

Of interest in this section is Subtitle C – Hazardous Waste Management. RCRA applies to all DOE facilities that manage wastes; i.e., that generate, store, treat, or dispose of wastes on-site. DOE facilities are subject to all of the associated regulations for hazardous waste, 40 CFR Parts 260 through 270, except for the financial requirements.

EPA has not listed asbestos-containing material as hazardous waste under the RCRA; however, asbestos wastes are treated as solid wastes for purposes of RCRA regulation, and EPA has listed asbestos as a hazardous substance covered by the Comprehensive Environmental Response, Compensation ad Liability Act (CERCLA/Superfund.)[1]

Hazardous Materials Transportation Act (HMTA) This act governs the transportation of hazardous materials within the United States and shipments leaving and entering the United States, and is under the direction of the U.S. Department of Transportation (DOT). Hazardous waste is a designated category under the hazardous materials description for DOT regulation. DOE facilities are subject to the associated regulations 49 CFR Parts 100 through 199 for transporting of any hazardous materials off-site. This includes radioactive material, hazardous wastes, and other hazardous substances. 49 CFR regulates the transportation of hazardous waste in conjunction with 40 CFR Part 263.

DOE Order 5820.2A, Radioactive Waste Management DOE facilities are subject to all DOE Orders. DOE Order 5820.2A establishes policies, guidelines, and minimum requirements by which DOE manages its radioactive and mixed waste and contaminated facilities. The Order applies to all DOE contractors and subcontractors performing work that involves management of waste containing radioactivity and/or radioactively contaminated facilities. This Order does not apply to the management of commercially generated spent nuclear fuel or high-level radioactive waste, nor to the geologic disposal of high-level waste produced by DOE's activities and operations.

Toxic Substances Control Act (TSCA), 15 U.S.C.§§ 2601-2629 TSCA governs the following:

- Authority to require testing of chemicals which may present a significant risk or which are produced in substantial quantities and result in substantial human or environmental exposure (TSCA § 4);
- Pre-manufacture review of new chemical substances prior to their commercial production and introduction into the marketplace (TSCA § 5);
- Authority to limit or prohibit the manufacture, use, distribution, and disposal of existing chemical substances (TSCA § 6);
- Record keeping and reporting requirements to ensure that the Environmental Protection Agency (EPA) administrator would continually have access to new information developed regarding adverse health or environmental effects associated with chemical substances (TSCA § 8);
- Export notice requirements that allow EPA to inform foreign governments of shipments of chemical substances to their countries (TSCA § 12); and,
- Import certification requirement to ensure that all chemical substances imported into the United States comply with the act (TSCA § 13).

TSCA § 6 is of interest to all DOE facilities that have used polychlorinated biphenyls (PCBs). Oils containing PCBs are usually found in electric transformers. TSCA § 6 establishes a legal presumption that PCBs pose an unreasonable risk. EPA's regulations, set forth in 40 CFR Part 761, cover the following areas:

- Prohibited and authorized commercial activities;
- Marking requirements;
- Storage and disposal requirements;
- Exemptions from the general prohibitions;
- Spill cleanup policy; and,
- Record keeping requirements.[1]

Under TSCA, EPA has promulgated regulations requiring all persons who manufacture, import, or process asbestos to meet certain reporting requirements. Pursuant to Section 6 of TSCA, EPA has, by regulatory action, proposed to phase out and/or ban nearly all uses of asbestos in new products over the next seven years. Exemptions from this ban would

have been granted on a case-by-case basis. However, this ban was overturned in *Corrosion Proof Fittings*.[1]

b. Describe the relationship of the Hazardous Materials Transportation Act (49 CFR Parts 170-179) to the Resource Conservation and Recovery Act transportation regulations (49 CFR Part 263).

EPA has promulgated standards for all transporters of hazardous wastes in 40 CFR Part 263. These standards are closely coordinated with the standards issued by the U.S. Department of Transportation (DOT) under the Hazardous Materials Transportation Act (HMTA) for the shipment of hazardous materials. For the most part, EPA's regulations incorporate and require compliance with the DOT provisions for labeling, marking, and placarding; using proper containers; and responding to spills. All transporters of hazardous waste must obtain an EPA ID number prior to transporting any hazardous waste, and they may only accept hazardous waste which is accompanied by a manifest signed by the generator.

c. Discuss the relationship of DOE Order 5820.2A, Radioactive Waste Management, to the Resource Conservation and Recovery Act.

DOE Order 5820. 2A established policies, guidelines, and minimum requirements by which DOE manages its radioactive and mixed waste and contaminated facilities. Although radioactive waste generated at a DOE facility is not regulated under RCRA, mixed waste is, due to its hazardous waste makeup. The radioactive portion of the mixed waste does not meet the definition of a solid waste, due to the special nuclear material (SNM) exclusion, but is regulated under RCRA by the contained-in policy. The policy states that a material that is not a solid waste but contains hazardous waste constituents will be managed as a hazardous waste until the hazardous waste constituents have been removed or are below a certain risk level. Then the material, in this case, the mixed waste, becomes radioactive waste, and is no longer subject to RCRA regulation.

The delisting path is time consuming and has proven to be difficult with a minimal number of petitions being approved by the EPA and state authorities. However, a successful delisting petition can present several benefits:

- Reduces costs associated with hazardous waste disposal;
- Enables potential for on-site disposal or treatment;
- Reduces transportation costs; or,
- Increases economic viability of treatment facilities.

The development of a delisting petition can consume significant resources with the cycle for petition development and regulator review taking up to two years; therefore, careful consideration should be given to the costs for the delisting versus the potential overall project gains. However, there can be a significant overall cost benefit realized for waste disposal if a delisting petition is approved.

A facility may petition the EPA to remove its waste from hazardous waste control by excluding them from the lists of hazardous waste contained in 40 CFR 261.31 and 261.32. The petition may also be for the residues from the treatment, storage, or disposal of listed hazardous wastes. The petitioner must provide sufficient information to allow the EPA to determine:

- That the waste to be delisted is not hazardous based upon the criteria for which it was listed;
- That no other hazardous constituents are present in the waste at levels of regulatory concern; and,
- That the waste does not exhibit any hazardous waste characteristics.

There are several types of delisting petitions:

- Standard - For wastes which are and will continue to be generated;
- One Time - For wastes which have been generated, and for which the entire volume of waste is available for analysis and disposal;
- Up Front - For wastes which have not been generated but for which there is adequate information to conclude that the waste is likely to meet delisting requirements; and,
- Conditional - For wastes with sufficient variability to suggest that nonconforming waste could be periodically generated.

The EPA encourages the use of upfront delisting petitions because they have the advantage of allowing the applicant to know what treatment levels for constituents should be sufficient to render specific wastes nonhazardous before investing in new or modified waste treatment facilities. Therefore, upfront delisting allows new facilities to receive exclusions prior to generating wastes, that without upfront exclusions, would unnecessarily be considered hazardous.

d. Explain the relationship between the Resource Conservation and Recovery Act and the Federal Facility Compliance Act (FFCA). Include in your discussion the development of Site Treatment Plans and development of Waste Treatment Technologies.

One of the requirements of RCRA is that all hazardous waste being generated must be able to be disposed without treatment, subject to the land disposal restrictions (LDR), or must have a treatment technology available to enable the waste to be treated to the appropriate land disposal restrictions. In general, no hazardous waste may be stored beyond one year, before treatment or disposal, unless a capacity variance for an identified treatment technology has been issued by EPA. Mixed wastes have had a treatment variance which has continued to be extended, due to little or no existing technologies for treating the hazardous portion of the wastes.

The Federal Facility Compliance Act of 1992 (FFCA), 42 U.S.C. § 6901, et seq., requires all Federal facilities (in this case, DOE) to develop appropriate and timely site treatment plans and waste treatment technologies for all mixed waste stored and/or being generated at the Federal facilities. A Site Treatment Plan should specify activities to be carried out by DOE to develop mixed waste treatment technologies and capacities and to treat mixed wastes in order to meet the requirements of the FFCA. Also to be included are system

descriptions, milestones, and target dates. Waste Treatment Technologies are required to be developed to meet the milestones in the Site Treatment Plan.

The two acts, RCRA and FFCA, will continue to work in tandem until Federal facilities have developed mixed waste treatment technologies, treatment capacities, and final disposition for the mixed wastes.

e. Describe the types of facilities that need Resource Conservation and Recovery Act permits; list differences between a RCRA Part A and a RCRA Part B permit application; and give examples of RCRA Part B permit application requirements that apply to all facilities and those that apply to specific types of facilities.

Permitted Facilities– The RCRA hazardous waste permit program is described in 40 CFR Part 270. A RCRA hazardous waste permit is required for the treatment, storage, and/or disposal (TSD) of any hazardous waste described in 40 CFR Part 261. Other facilities included in these requirements are hazardous waste injection wells, NPDES permitted TSD sites, and barges or ocean-going vessels disposing of hazardous wastes (except as excluded under Section 270.60(a)-(c) – "permit by rule"). Owners and operators of waste management units must have permits during the active life and closure period of the facility. In addition, post-closure permits are required for owners and operators of surface impoundments, landfills, land treatment units, and waste piles receiving wastes after July 26, 1982, or that have certified closure after January 26, 1983 (40 CFR 265.115), unless they demonstrate closure by removal [40 CFR 270.1(c)(5)-(6)].

Part A of a RCRA permit application (as defined in 40 CFR 270.13) is an abbreviated document that provides general facility information and brief descriptions of hazardous waste being managed at the facility. A Part A permit application can be submitted as a standalone document if a facility has been in operation with hazardous waste management occurring at the site prior to the effective date of statutory or regulatory amendments under RCRA that render the facility subject to the requirement to have a RCRA permit. Granting of the Part A permit by either the state or the EPA gives the facility interim status until the Part B permit application can be completed. If a facility or the portions relating to the waste management activities outlined in the Part A permit application will be moving or has moved into shutdown mode, a Part B permit application is usually not submitted, as the facility can operate its shutdown and cleanup activities under interim status. If the facility is new or is just commencing hazardous waste management activities, the Part A is submitted as the first of the overall RCRA permit application, with the Part B being the major part of the application.

Data required in the Part A RCRA permit application includes:

- RCRA regulated activities;
- Name, address, and geographic location of the facility;
- Standard Industrial Codes (SIC) pertinent to the facility;
- Owner and operator data;

- Whether the facility is located on Native American lands;
- Information on facility age and application status;
- For existing facilities -- drawings and photographs of the past, current, and proposed TSD areas;
- TSD process description and design capacity;
- Specifications for and estimated quantities of regulated wastes, including a description of treatment processes;
- List of permits/construction approvals or applications under specific programs as listed in 40 CFR 270.13(k);
- Detailed topographic map of the facility and surrounding area delineating structures, wells, and TSD areas;
- Brief description of the nature of the facility's business; and,
- Hazardous debris, a description of the debris and contaminant categories to undergo TSD at the facility.

Part B of the RCRA permit application (as defined under 40 CFR 270.14 through 270.26) includes a much greater level of detail about the facility and waste to be handled than is included in Part A. Information requirements included specific data according to facility and containment types and are defined in the following 40 CFR Subparts:

- Containers – 40 CFR 270.15
- Tank Systems – 40 CFR 270.16
- Surface Impoundments – 40 CFR 270.17
- Waste Piles – 40 CFR 270.18
- Incinerators – 40 CFR 270.19
- Land Treatment Facilities – 40 CFR 270.20
- Landfills – 40 CFR 270.21
- Boilers and Industrial Furnaces – 40 CFR 270.22
- Miscellaneous Units – 40 CFR 270.23
- Process Vents – 40 CFR 270.24
- Equipment – 40 CFR 270.25
- Drip Pads – 40 CFR 270.26

General Part B requirements include:

- General facility description;
- Chemical and physical analyses of wastes to be treated;
- Copy of the waste analysis plan;
- Description of facility physical security;
- General inspection schedule;
- Waiver justifications;
- Contingency plan;
- Hazard prevention plan (including equipment lists);
- Ignitability/reactivity prevention plan;
- Traffic information;

- Detailed facility location information;
- Outline of training programs;
- Copy of the facility closure plan(s);
- Closure documentation (if a closure permit);
- Closure/post closure estimate of costs;
- Insurance/fiscal responsibility documentation;
- Detailed topographic map including facility features; and,
- Other information as specifically required for groundwater protection [40 CFR 270.14(c)] and solid waste management units [40 CFR 270.14(d)].

Specific Facility Permit Requirements – An example of Part B requirements specific to a facility type (landfill) are provided in 40 CFR 270.21, which requires:

- List of hazardous wastes to be placed in each landfill/cell;
- Detailed landfill design plans and engineering reports for liner systems (or exception conditions), leak detection systems;
- Plans for construction quality assurance, leakage/response action, control of run-on/run-off conditions, control of wind dispersal, and collection/holding facilities;
- Specific inspection plans;
- Detailed engineering reports and plans for the final cover;
- Explanation of management plans for ignitable/reactive wastes, liquid wastes, incompatible wastes, and containerized hazardous wastes; and,
- Waste management plan for F020-F023, F026, and F027 hazardous wastes to include waste properties, volumes, and characterization; soils/substrate properties; mobilization properties of co-disposed materials; and the effectiveness of additional treatment, design, and monitoring techniques.

f. Describe how to determine if a material is a solid waste. Given a material that is a solid waste, describe how to determine if it is a hazardous or mixed waste.

Solid Waste – a solid, liquid, semi-solid, or contained gaseous material which:

- is discarded;
- has served its intended purpose; or,
- is a manufacturing or mining by-product.

There are several excluded materials from solid waste regulation [40 CFR 261.4(a)]:

- Domestic sewage
- Clean Water Act (CWA) point source discharge
- Irrigation return flow
- Atomic Energy Act (AEA) source, special nuclear, or by-product material
- In situ mining waste

Unless excluded, all of the materials defined as solid waste (includes garbage, refuse, and sludge) are RCRA solid wastes whether it will be:

- Discarded
- Used
- Reused
- Recycled
- Reclaimed
- Stored or accumulated

Hazardous Waste– In order to be classified as a hazardous waste, the waste must first meet the definition of a solid waste. A hazardous waste is defined as:

- Solid waste not excluded from regulation under 40 CFR 261.4(b)
- Solid waste listed in 40 CFR§ 261, Subpart D (unless it has been excluded in §§ 260.20 and 260.22 and listed in Appendix IX)
- Solid waste exhibiting a hazardous waste characteristic [§§ 261.21 through 261.24]

Listed wastes include wastes that exhibit characteristics (ignitable, corrosive, reactive, or toxic), are deemed acutely hazardous (fatal to humans in low doses), or could pose a risk to human health and the environment.

"F"-listed wastes [§ 261.31] consist of wastes from non-specific sources:

- Spent solvents (F001-F005)
- Electroplating and metal finishing wastes (F006-F019)
- Wastes from other non-specific sources (F020-F039), including:
    - ◊ Certain chlorophenols;
    - ◊ Certain incinerator and heat treatment residuals;
    - ◊ Wood preserving wastes;
    - ◊ Petroleum processing wastes; and,
    - ◊ Landfilled hazardous waste leachate.

"K"-listed wastes include specific wastes generated by specific industries, as defined in §§ 261.32. "P"-listed and "U"-listed wastes [§§ 261.33] includes discarded commercial products, off-specification commercial products, container residues from these commercial products, and spill residues from these commercial products. Chemicals listed in §§ 261.33(e) are considered acutely hazardous ("P" wastes), while those listed in §§ 261.33(f) are considered toxic ("U" wastes). Discarded chemicals falling under these categories are regulated as hazardous wastes if they are in their pure form or if they constitute the sole active ingredient of the waste.

Characteristic wastes exhibit at least one of the properties of ignitability, reactivity, corrosivity, or toxicity.

- Ignitable characteristic hazardous wastes (D001) are liquids with a flash point of less than 140 F, as defined in §§ 262.21;
- Corrosive characteristic hazardous wastes (d002) have a pH of <2 or >12.5, or corrode steel at a rate of >6.35 mm per year, as defined in §§ 261.22;
- Reactive characteristic hazardous wastes (D003) are defined in §§ 261.23, and include wastes that have the potential of exploding or releasing toxic gases during the waste management process; and,
- Toxicity characteristic hazardous wastes (D004 through D043) are defined in §§ 261.24 and consist of specific heavy metals, insecticides and herbicides, and other organic compounds. Toxicity characteristic wastes are tested using the Toxicity Characteristic Leaching Procedure (TCLP), as described in 40 CFR 261, Appendix II.

Mixed Waste– According to DOE Order 5820.2A, the definition of mixed waste is "waste containing both radioactive and hazardous components as defined by the Atomic Energy Act and the Resource Conservation and Recovery Act, respectively". Mixed waste contains listed or characteristic RCRA hazardous waste and regulated radioactive material. The radioactive material may be waste which contains SNM, regulated under the Atomic Energy Act of 1954, or may be waste or residue which contains Nuclear Regulatory Commission (NRC) nuclear material, such as medical isotopes or commercial spent nuclear fuel (SNF). Categorically, however, SNM and SNF that is contaminated with hazardous waste, is not considered mixed waste under RCRA.

"Mixed" waste also refers to waste that contains RCRA hazardous waste constituents, but is also managed under TSCA regulations. This type of waste is called TSCA mixed waste.

Characteristic Wastes, defined in 40 CFR Section 261.10, and Section 261.20 through 261.24, are solid wastes that are determined to exhibit characteristics that cause, or significantly contribute to, an increase in mortality or an increase in serious illnesses. The characteristics can be measured by an available standardized test method or can be reasonably detected by generators of solid waste through their knowledge of the waste.

A solid waste, which is not excluded from regulation as a hazardous waste, is a hazardous waste if it exhibits any of the following characteristics:

- Ignitability;
- Corrosivity;
- Reactivity; or,
- Toxicity.

Characteristics of Ignitability (Section 261.21)

A solid waste exhibits the characteristics of ignitability (EPA HW No. D001) if a sample has any of the following properties:

- It is a liquid and has a flash point less than 60°C (140°F) as determined by one of several listed American Society for Testing and Materials (ASTM) standardized tests;
- It is not a liquid and is capable of causing fire through friction, absorption of moisture or spontaneous chemical changes and, when ignited burns vigorously;
- It is an ignitable compressed gas as defined in 49 CFR 173.300; and,
- It is an oxidizer as defined in 49 CFR 173.151.

Characteristics of Corrosivity (Section 261.22)

A solid waste exhibits the characteristics of corrosivity (EPA HW No. D002) if the waste has either of the following properties:

- It is aqueous and has a pH less than or equal to 2 or greater than or equal to 12.5; or,
- It is a liquid and corrodes steel at a rate greater than 6.35 mm (0.25 inch) per year per the listed tests.

Characteristics of Reactivity (Section 261.23)

A solid waste exhibits the characteristics of reactivity (EPA HW No. D003) if the waste has any of the following properties:

- It is normally unstable and readily undergoes violent change without detonating;
- It reacts violently with water;
- It forms potentially explosive mixtures with water; or,
- When exposed to other conditions listed in 261.23, it is capable of generating toxic gases, vapors or fumes, or of detonating or an explosive reaction.

Characteristics of Toxicity (Section 261.24)

A solid waste exhibits the characteristics of toxicity (EPA HW No. D004) if, using the Toxicity Characteristic Leaching Procedure (TCLP) described in Appendix II to Part 261, the extract from a sample of the waste contains any of the contaminants listed in Table 1 in Section 261.24 at a concentration equal to or greater than the respective value given in that table.

g. Discuss the Land Disposal Restrictions, including the different types of treatment standards, the dilution prohibition, the storage prohibition, and different types of variances and exemptions.

The Land Disposal Restrictions (LDRs) were mandated in the Hazardous and Solid Waste Amendments of 1984 to RCRA. Numerous major final rules have been issued, beginning in 1986, addressing the many requirements of LDRs. For each hazardous waste, EPA must establish treatment standards that are protective of human health and the environment when the wastes are land disposed. Land disposal includes placement in a landfill, surface impoundment, waste pile, injection well, land treatment facility, salt dome or salt bed formation, underground mine or cave, or concrete vault or bunker.

The treatment standards either require the use of one or more specified treatment technologies, or they require that wastes be treated to meet certain concentration limits for hazardous constituents. Where concentration limits are used, EPA assumes that a waste is treated with the best demonstrated available technology (BDAT). Although such wastes can be treated by any technology, the concentration of hazardous constituents in any treatment residues cannot be higher than those obtained using BDAT.

For example, incineration is BDAT for many organic hazardous wastes. Incinerators typically produce two treatment residues -- ash and scrubber water. EPA analyzes the concentrations of hazardous constituents in the ash and scrubber water when a particular waste is being burned and then uses those concentrations as the BDAT treatment standards for the waste. In this case, one treatment standard for "non-wastewaters" is applied to the ash, and a different treatment standard for "wastewaters" is applied to the scrubber water. Although the use of incineration isn't required, the treated waste and/or treatment residues cannot be land disposed unless the concentrations of hazardous constituents is equal to or less than the concentration limits (treatment standards) based on the use of incineration.

Once BDAT has been established for a particular waste, EPA next establishes an effective date for the LDR standards based on the availability of BDAT capacity. The capacity determination is made on a nationwide basis -- no allowance is made for the fact that waste from a specific facility might have to be shipped all the way across the country to utilize the available capacity. If inadequate capacity exists to handle additional wastes subject to LDR, EPA can delay the effective date of the treatment standards for up to two years.

The dilution prohibition is a very complex aspect of the LDRs. In summary, no dilution is allowed for listed wastes in order to meet LDRs. For characteristic wastes not going into a system regulated under the Clean Water Act (CWA), dilution is only allowed for corrosive wastes. For characteristic wastes going into a system regulated under the CWA, underlying hazardous constituents must be treated, thereby usually removing the dilution option for corrosive wastes. For a comprehensive discussion of this subject, refer to Chapter 4, the *RCRA Land Disposal Restrictions: A Guide to Compliance*, The Hazardous Waste Consultant.[2]

The storage prohibition refers to the requirement that it is illegal to store a LDR hazardous waste for longer than one year, unless a treatment or disposal capacity variance has been granted by EPA.

Different Types of Variances and Exemptions – Parties subject to the LDR may be able to postpone compliance or obtain exemptions from the requirements by three general mechanisms:

- "No-migration" exemptions - land disposal of restricted wastes that do not meet treatment standards may be allowed by EPA if "there will be no migration of hazardous constituents from the disposal unit...for as long as the wastes remain hazardous [§ 268.6(a)]";

- Case-by-case extensions of effective dates - EPA may grant an extension of an LDR effective date if an applicant can demonstrate all of the following:

  - ◊ Good faith effort has been made to locate and contract with treatment, recovery, or disposal facilities nationwide to manage the wastes by the effective date; and,
  - ◊ Binding contract has been entered into to construct or otherwise provide alternative capacity (that is, recycling), or disposal capacity that meets the treatment standards.

- Treatability variances - it may not be possible to treat some waste streams to the levels specified by the LDR treatment standards. EPA will allow a generator or owner/operator of a TSD facility to submit a petition requesting a variance that will establish an alternative treatment standard, providing the petitioner can prove that the treatment standard for a given waste cannot be met[3].

h. Discuss the regulatory requirements applicable to Federal facility solid waste landfills (including Resource Conservation and Recovery Act Subtitle D).

Subtitle D of the Resource Conservation and Recovery Act (RCRA), entitled "State or Regional Solid Waste Plans", was enacted with the objectives to assist in developing and encouraging methods for the disposal of solid waste (other than hazardous waste) which are environmentally sound and which maximize the utilization of valuable resources and to encourage resource conservation.

Under Subtitle D, the EPA Administrator was required to publish guidelines for the identification of those areas which have common solid waste management problems and are appropriate units for planning regional solid waste management services. In addition, the EPA Administrator was required to promulgate regulations containing guidelines to assist in the development and implementation of state solid waste management plans. These requirements were completed by July 31, 1979.

In order for a state plan to be approved, it must:

- Identify the responsible state, local, and regional planning;
- Prohibit new open dumps;
- Provide for the closing or upgrading of existing open dumps on a compliance schedule;

- Require that all solid waste be utilized for resource recovery, disposed of in sanitary landfills, or be otherwise disposed of in an "environmentally sound manner";
- Provide that no local government shall be prohibited from entering into long-term contracts for the supply of solid waste to resource recovery facilities; and,
- Demonstrate sufficient regulatory authority to implement the plan

In addition to financial aid, EPA offers states technical assistance in developing and implementing these state plans. Two smaller grant programs are available to give special solid waste management planning assistance to small and rural communities.

The quasi-regulatory portion of Subtitle D involves open dumps. EPA has published criteria to distinguish between open dumps and sanitary landfills, and the EPA Administrator was directed to make an inventory of all open dumps except those operating under compliance schedules not to extend five years from the date of the inventory (EPA has since determined that the states should be responsible for conducting the inventory). It appears that the only remedies for violation of the open dump prohibition are:

- Cut-off of funds
- Injunctive relief if the dump presents an "imminent hazard"

All of the states have developed the required state plans. An example is the State of Colorado, which has the local areas issue solid waste disposal permits for landfills, but reviews and comments on all permit applications. For Federal facilities, the states issue the permits, not the local governments.

In Colorado, as in many states, two different types of landfills are permitted: municipal and industrial. Many permitted landfills accept both types of waste. The requirements for developing and maintaining new solid waste landfills are, in many states, becoming almost as stringent as for developing and maintaining RCRA hazardous waste landfills.[1]

i. Describe the different classes of hazardous waste generators and their responsibilities with respect to manifesting, packaging, labeling, marking, and placarding in accordance with Department of Transportation (DOT) requirements; and biennial reporting.

(Note: Purely radioactive waste is governed under the Atomic Energy Act (AEA) and regulated by the Nuclear Regulatory Commission (NRC). Mixed waste, (a mixed hazardous and radioactive waste) is regulated under RCRA as a hazardous material.

Classes of Hazardous Waste Generators

A "generator" is defined as any person, by site location, whose act or process produces hazardous waste identified or listed in 40 CFR Part 261. There are three classes of hazardous waste generators:

Conditionally Exempt Small Quantity Generator

A generator who generates no more than 100 kg. of hazardous waste in a given calendar month and hence, is generally not subject to regulation under Parts 262 through 266, 268 and 270. However, the small quantity generator is subject to full regulation for certain types of hazardous wastes such as:

- Recyclable materials listed in Section 261.6 and Subparts C, D, and F of Part 266; and,
- Generation of 1 kg of acutely hazardous wastes or a total of 100 kg. of residue resulting from the clean-up of any acute hazardous wastes listed in Sections 261.31, 261.32, or 261.33 (e).

Generators of Between 100 and 1000 kg. of Hazardous Waste in a Given Month

This class of generator is subject to full regulation per Parts 266 and 270. Generally, regulation under Parts 262 through 265 is per a graded approach following from the requirements listed in Part 262 Subpart B -Manifest, Subpart C - Pre-Transport Requirements and Subpart D - Recordkeeping and Reporting.

The graded manifesting requirements identified in Part 262 Subpart B are regulated in Part 263. Parts 264 and 265 regulate the on-site storage of the hazardous wastes if the accumulation and storage times listed in Subpart C, Section 262.34 are greater than 90 days.

This generator is subject to full regulation per Parts 262 through 266, 268 and 270 for certain types of hazardous wastes such as the generation of 1 kg of acutely hazardous wastes or a total of 100 kg. of residue resulting from the clean-up of any acute hazardous wastes listed in Sections 261.31, 261.32, or 261.33 (e).

Generators Who Generate Greater than 1000 kg. of Hazardous Waste in a Given Month

This class of generator is subject to full regulation per Parts 262 through 266, 268 and 270. Additionally, this generator is subject to full regulation for certain types of hazardous wastes such as the generation of 1 kg of acutely hazardous wastes or a total of 100 kg of residue resulting from the clean-up of any acute hazardous wastes listed in Sections 261.31, 261.32, or 261.33 (e).

Manifesting – (40 CFR 262 Subpart B) A generator who transports, or offers for transportation, hazardous waste for off-site treatment, storage, or disposal must prepare a hazardous waste manifest. The generator must:

- Prepare a manifest.
- Designate on the manifest one facility which is permitted to handle the waste described on the manifest.
- For DOT Class 7 Radioactive Materials the following information must be included per 49 CFR 172.203:

    ◊ The name of each radionuclide that is listed in 49 CFR 173.435 or the mixture of radionuclides as determined in accordance with 49 CFR 173.433;
    ◊ A description of the physical and chemical form of the material; and,
    ◊ The activity contained in each package of the shipment.

- Use the manifest by:
    ◊ Signing the manifest certification by hand;
    ◊ Obtaining the handwritten signature of the initial transporter and date of acceptance on the manifest;
    ◊ Retaining one copy; and,
    ◊ Giving the transporter the remaining copies of the manifest
- A generator who transports, or offers for transportation hazardous waste for offsite treatment, storage or disposal must prepare a manifest.
- A generator must designate on the manifest one facility which is permitted to handle the waste described on the manifest.
- For DOT Class 7 Radioactive Materials the following information must be included per 49 CFR 172.203:
    ◊ The name of each radionuclide that is listed in 49 CFR 173.435 or the mixture of radionuclides as determined in accordance with 49 CFR 173.433
    ◊ A description of the physical and chemical form of the material
    ◊ The activity contained in each package of the shipment

Packaging – (40 CFR 262.30) Before transporting or offering hazardous waste for transportation off-site, a generator must package the waste in accordance with the applicable DOT regulations on packaging under 49 CFR Parts 173, 178, and 179.

Some general design requirements are as follows:

- The package can be easily handled and secured;
- The external surface can be easily decontaminated;
- Each feature that is added to the package will not reduce the safety of the package;
- The containers must meet performance-based design criteria to ensure container integrity/survivability during credible accident scenarios;
- The materials of construction of the packaging will be physically and chemically compatible with the package contents;
- For Type A packages, which comprise the category of many low level radioactive waste shipping packages, the container must have the provision for a seal that is not readily breakable to provide evidence that the package has not been opened. Or for packages shipped in closed transport vehicles, the cargo compartment may be sealed; and,

- All Type A packages must include a containment system securely closed by a positive fastening device that cannot be opened unintentionally or by pressure that may arise within the package during normal transport.

Labeling– (40 CFR 262.31) Before transporting or offering hazardous waste for transportation off-site, a generator must label each package of hazardous waste in accordance with the applicable DOT regulations on hazardous materials under 49 CFR Part 172, Subpart E.

In summary, for hazardous materials the label will contain the following type of information:

- Hazardous materials descriptions and proper shipping name;
- Hazard class per 49 CFR 173.2 (explosive, poisonous gas, radioactive material, etc.);
- Special provisions such as ambient temperature, flash point etc.;
- Vessel stowage requirements; and,
- Radionuclides and activity.

Marking– (40 CFR 262.32) Before transporting or offering hazardous waste for transportation off-site, a generator must mark each package of hazardous waste in accordance with the applicable DOT regulations on hazardous materials under 49 CFR Part 172, Subpart D. In addition, a generator must mark each container of 110 gallons or less with the following words and information displayed in accordance with the requirements of 49 CFR 172.304:

> HAZARDOUS WASTE – Federal Law Prohibits Improper Disposal. If found, contact the nearest police or public safety authority or the U.S. Environmental Protection Agency.
>
> Generator's Name and Address_____.
>
> Manifest Document Number_____.

Placarding– (40 CFR 262.33) Before transporting hazardous waste or offering hazardous waste for transportation off-site, a generator must placard or offer the initial transporter the appropriate placards according to DOT regulations for hazardous materials under 49 CFR Part 172, Subpart F.

Biennial Reporting– (40 CFR 262.41) A generator who ships any hazardous waste off-site to a treatment, storage, or disposal facility within the United States must prepare and submit a single copy of a Biennial Report to the Regional Administrator by March 1 of each even numbered year. It must cover generator activities during the previous year. (Note: although the regulations use the singular form "year" for reporting activities for

previous activities, it would appear that the activities should be reported for the two previous years, since the report is made once every two years.)

Any generator who treats, stores, or disposes of hazardous waste on-site must submit a biennial report covering those wastes.

j. Discuss the Personal Protective Equipment (PPE) requirements for work activities in hazardous areas.

(**Note:**. Questions regarding the PPE requirements and updates can be found at the following Internet address: http://law.house.gov/cfr.html. This address is the U.S. House of Representatives, Searchable Code of Federal Regulations. PPE regulations can be found in 29 CFR 192610)

Personal Protective Equipment (PPE) – PPE controls the degree of worker exposure. PPE is acceptable as a hazard control measure (1) when engineering or administrative controls are not feasible or do not totally eliminate the hazard; (2) while engineering controls are being developed; or, (3) during emergencies.

The type of PPE and the material from which the PPE is made are to protect against the hazards that are present. Worksite managers should be aware that no single combination of protective equipment and clothing can guard against all hazards. Moreover, because every worksite is different and the degree of known or unknown hazards varies, the PPE ensemble required is likely to change as work progresses. For hazardous waste work, PPE is conveniently organized into levels of protection under a system originally developed by EPA. There are four levels: A, B, C, and D. Table 2.3-1 lists the PPE requirements by level. Although each level specifies a complete clothing ensemble, in practice, the level of protection selected for a particular task is driven by the respiratory protection requirements; clothing is then matched to the dermal and safety hazards present. OSHA requires that PPE be selected based on three distinct tasks:

- Conduct a hazard characterization and exposure assessment to identify;
  (1) Actual or potential hazards, and
  (2) Possible exposure routes;
- Organize and analyze the data and select PPE based on the type of hazard, the level of risk, and seriousness of potential harm from each identified hazard; and,
- Make certain that the PPE fits and that it protects against the hazards and periodically reassess the hazards and PPE selection.

Manufacturer's literature is often the best source of information for selecting PPE. However, there are some useful references for hazardous waste work:

- *Guidelines for the Selection of Chemical-Protective Clothing*, by A.D. Schwope, published by the American Conference of Governmental Industrial Hygienists;

- *Standard Operating Safety Guides*, published by the U.S. EPA Office of Emergency and Remedial Response; and,
- *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*, published by National Institute for Occupational Safety and Health (NIOSH), OSHA, the U.S. Coast Guard, and U.S. EPA.

Table 2.3-1
Levels of Protection

LEVELS OF PROTECTION	REQUIRED/RECOMMENDED* PPE
LEVEL A	
The highest respiratory, skin, and eye protection.	Pressure-demand full-facepiece and self-contained breathing apparatus (SCBA) or supplied-air respirator (SAR)
	Fully-encapsulating chemical-resistant suit (i.e., Saranex)
	Disposable Inner and outer chemical-resistant gloves
	Chemical-resistant safety boots which include steel toe and shank
	Chemical resistant boot covers
	Coveralls: cotton or similar material worn beneath chemical resistant suit
	Long cotton underwear*
	Hard hat
	Two-way radio communications*
	Cooling unit*
LEVEL B	
The same respiratory and eye protection as Level A, but less skin protection	Pressure-demand full-facepiece SCBA or SCBA or SAR
	Chemical-resistant clothing (i.e., Tyvek material)
	Disposal Inner and outer chemical-resistant gloves
	Chemical-resistant safety boots including steel toes and shank
	Disposable chemical resistant boot covers

	Cooling unit*
	Coveralls: cotton or similar material worn beneath chemical resistant suit
	Long cotton underwear*
	Hard hat
	Two-way radio communications*
LEVEL C	
Hazard-based skin and eye protection, but less respiratory protection than Level B	Full-facepiece air-purifying respirator (APR)
	Chemical-resistant clothing (i.e., Tyvek material)
	Disposable Inner and outer chemical-resistant gloves
	Chemical-resistant safety boots including steel toes and shank
	Disposable chemical resistant boot covers
	Coveralls: cotton or similar material worn beneath chemical resistant clothing
	Long cotton underwear*
	Hard hat
	Two-way radio communication*
LEVEL D	
No respiratory protection.	Coveralls: cotton or similar material worn as outer garment
Minimal skin protection.	Abrasion-resistant gloves
	Safety boots including steel toes and shank
	Hard hat
	Splash resistant safety goggles/glasses or Face shield (for flying debris hazards)

Note: For all levels of protection (A-D) DOE usually requires the use of a personal radiation detector (i.e., dosimeter). This is definitely true for areas known to have radiological hazards and may be required in areas suspected of radiological hazards.

For radiological activities, the DOE RadCon Manual provides guidance for worksite managers in determining what combination of PPE is to be used. The process is

analogous to that used for non-radiological hazards. The radiological control organization is responsible for determining the PPE to be used for work performed under a Radiological Work Permit (RWP) on a task-by-task basis. Articles 325 and 461 as well as Appendix 3C of the DOE RadCon Manual present guidelines for the selection of protective clothing, doffing procedures, and use of step-off pads for contamination control. The DOE RadCon Manual warns against the use of PPE beyond that authorized by the radiological control organization as "detract[ing] from work performance and [being] contrary to As Low As Reasonably Achievable (ALARA) principles and waste minimization practices". This is analogous to best practice in non-radiological health and safety hazard control, which also discourages the over-prescription of PPE that can result in problems related to heat stress and worker inefficiency.

Although chemical and radiological PPE requirements are different, they can be applied simultaneously. In some situations where both types of hazards co-exist, chemical issues require the more restrictive level of protection; in others, radiological issues are more restrictive. Successful integration of PPE requirements for mixed wastes or for other combinations of chemical and radiological contaminants requires coordination between radiological and chemical safety professionals and workers. Whatever the circumstances, successfully addressing both types of hazards is essential. As an example, where particulate airborne chemical and radiological hazards exist, the more prescriptive provisions of the DOE RadCon Manual are followed as the protection specified will protect against both hazards. Where chemical vapors and airborne radiological hazards co-exist, the PPE is marked to ensure proper radiological surveys and decontamination of PPE.

The references listed at the end of this section provide additional and more detailed information on issues such as advantages and disadvantages of PPE, compatibility of various types of PPE with chemical hazards, respiratory protection factors, training and proper fitting, and consideration of work mission duration. Therefore, this information is not repeated here. General training requirements for works at hazardous waste sites are contained in OSHA regulations found in CFR 1910.120. The training is generally referred to as HAZWOPER (Hazardous Waste Operations in Emergency Response) training. Training requirements for workers at a particular site are site specific and are outlined in the project Health and Safety Plan.

k. Discuss the potential liabilities of the Department of Energy and its contractors inherent in the enforcement of environmental regulations (i.e., compliance orders, enforcement actions, fines and penalties, and provisions for civil suits).

Potential Liabilities of DOE– Compliance orders are usually issued against DOE, not its contractors, although states prefer to have the contractor named in the orders. DOE prefers not having the contractors named in the orders, due to the change-over of contractors. Enforcement actions have been brought against both DOE and its contractors for environmental regulatory violations. Fines and penalties are usually negotiated between DOE and the states or EPA. Civil suits can be brought against DOE.

Potential Liabilities of DOE Contractors – Compliance orders are usually issued against DOE, not its contractors, although states prefer to have the contractor named in the orders. DOE has traditionally not preferred having the contractors named in the orders, due to the change-over of contractors. Enforcement actions have been brought against both DOE and its contractors for environmental regulatory violations. Fines and penalties can be assessed against a DOE contractor outside of the negotiated ones between DOE and the states or EPA. Civil suits can be brought against DOE contractors (Table 2.3-2).

Table 2.3-2
Potential Liabilities of DOE Contractors

STATUTE	CIVIL LIABILITIES	CRIMINAL LIABILITIES
Hazardous Material Transportation Act (HMTA)	Up to $25,000 per day for each day of violation with a $250 minimum	$500,000 per day for corporations and $250,000 per day for individuals and/or 5 years in prison
Resource Conservation Recovery Act (RCRA)	Up to $25,000 per day for each day of violation	$50,000 per day, for each day of violation and/or 5 years in prison Knowing endangerment $250,000 and/or 15 years in prison for an individual and $1,000,000 for a corporation
Toxic Substance Control Act (TSCA)	Up to $25,000 per day, per violation	$25,000 per day for each day of violation, and/or 1 year in prison

Federal Agency Liability – Per the FFCA, Federal facilities do not have sovereign immunity from state enforcement of state environmental laws under the solid and hazardous waste provisions of the Solid Waste Disposal Act (SWDA). Additionally, Federal facilities are obligated to pay fines and penalties assessed by the states.

Federal Employee Liability – Federal employees can be personally liable for both civil and criminal penalties imposed under the solid and hazardous waste provisions of the Solid Waste Disposal Act (SWDA).

Civil Penalties – The Act exempts personal liability of agents, employees, or officers of the United States for any civil penalty under any Federal, state, interstate, or local solid or hazardous waste law with respect to any act or omission **within the scope of the official duties** of the agent, employee, or officer. However, Federal agencies are now liable for civil penalties and fines.

Criminal Penalties– The Act states, "an agent, employee, or officer of the United States shall be subject to any criminal sanction (including, but not limited to, any fine or imprisonment) under any Federal or state solid or hazardous waste law, but no department, agency, or instrumentality of the executive, legislative, or judicial branch of the Federal Government shall be subject to any such sanction".

Resources Conservation and Recovery Act (RCRA) The FFCA amends RCRA to waive the sovereign immunity previously afforded to Federal facilities. Federal facilities are now subject to the Federal, state, interstate, and local substantive and procedural requirements of the Resource Conservation Recovery Act.

l. Disucss the requirements identified in DOE Order 5820.2A, Radioactive Waste Management, for the following types of waste:

- Low-level
- High-level
- Transuranic

Requirements for low-level waste- DOE Order 5820.2A has numerous requirements for low-level waste as follow:

- **Performance Objectives**– Protect public health and safety; assure that external exposure does not exceed 25 mrem/yr and meets ALARA; assure that effective dose equivalents after 100 years does not exceed 100 mrem/yr for continuous exposure or 500 mrem for single exposure;

- **Performance Assessment**– Site specific radiological performance assessment; overall waste management systems performance assessment; monitoring measurements to evaluate actual and prospective performance;
- **Waste Generation**– Technical and administrative controls for reducing gross volume of waste generated and/or radioactivity requiring disposal; waste generation reduction; waste segregation; waste minimization;

- **Waste Characterization**– Characterize low-level waste; record waste characterization data on waste manifest; determine concentration of radionuclides;

- **Waste Acceptance Criteria** (WAC) – Waste shipped shall be in accordance with requirements established by receiving facility; WAC shall be established for each low-level waste TSD facility; generators of waste shall implement a low-level certification program; generator low-level waste certification shall be audited by receiving facility; 8 issues shall be addressed by the WAC;

- **Waste Treatment**– Waste shall be treated to meet performance objectives; waste treatment techniques shall be implemented to meet performance requirements;

development of large-scale waste treatment facilities shall be supported by NEPA documentation; operation of waste treatment facilities shall be supported by adequate documentation;

- **Shipment** – Volume of waste and number of shipments shall be minimized; generators shall provide annual forecast of waste to be shipped to receiving facility; generators must receive approval from receiving facility prior to shipment; each package must comply with labeling requirements;

- **Long-Term Storage** – Low-level waste shall be stored by appropriate methods to meet performance objectives; records shall be maintained for all low-level waste; development and operation waste storage facility shall be supported by documentation; storage of waste by approved methods is acceptable;

- **Disposal** – Low-level waste shall be disposed of by appropriate methods to meet performance objectives; engineered modifications shall be developed through performance assessment model; an Oversight and Peer Review Panel shall be selected; disposition of waste greater than Class C must be handled as special cases; additional disposal requirements; below regulatory concern wastes disposed without regard to radioactivity content; disposal site selection criteria; disposal facility and disposal site design; disposal facility operations;

- **Disposal Site Closure/Post Closure** – Site specific comprehensive closure plans for new and existing operating low-level waste disposal sites; residual radioactivity levels for surface soils shall comply with DOE decommissioning guidelines; corrective measures shall be applied, if needed; inactive disposal sites shall be managed in accordance with RCRA and CERCLA; closure plans shall be reviewed and approved; termination of monitoring and maintenance activities at closed facilities shall be based on analysis of site performance;
- **Environmental Monitoring** – Each operational or non-operational low-level waste TSD facility shall be monitored by an environmental monitoring program; the environmental monitoring program shall be designed to monitor specific parameters; the environmental monitoring program shall monitor air, water, and soil, as needed; the monitoring program shall be capable of detecting changing trends in performance;

- **Quality Assurance** – The low-level waste operational and disposal practices shall be conducted in accordance with applicable requirements; and,

- **Records and Reports** – Each field organization shall develop and maintain a recordkeeping system; records (waste manifest) shall be kept and accompany each waste package from generator through final disposal.

Requirements for high-level waste- DOE Order 5820.2A has numerous requirements for high-level waste as follow:

- **Design** – Requirements for new facilities; design review for existing facilities;
- **Storage Operations**– Doubly Contained Systems - waste characterization; storage and transfer operations; monitoring, surveillance, and leak detection; contingency actions; training; quality assurance; waste treatment and minimization;
- **Storage Operations**– Singly Contained Tank Systems - waste characterization; storage and transfer operations; monitoring; surveillance, and leak detection; contingency action; training; quality assurance; and,
- **Disposal** – New and readily retrievable; other waste.

Requirements for high-level waste- DOE Order 5820.2A has numerous requirements for transuranic (TRU) waste as follow:

- **Waste Characterization**– Any material known or suspected to be TRU waste should be evaluated as soon as possible in the generating process; lower concentration limit for TRU waste (>100 nCi/g of waste) shall apply to the contents of any single waste package at the time of assay; radioactive wastes with quantities of TRU radionuclides in concentrations of 100 nCi/g of waste or less shall be considered to be low-level waste;

- **TRU Waste Generation and Treatment**- Technical and administrative controls shall reduce the gross volume of waste generated and/or the amount of radioactivity requiring disposal; TRU waste shall be assayed; mixed TRU waste shall be treated to remove hazardous waste component; classified TRU waste shall be treated to remove classified characteristic;

- **TRU Waste Certification**– TRU waste shall be certified; uncertified TRU waste shall not be sent to the Waste Isolation Pilot Plant (WIPP); all TRU waste certification sites shall prepare a certification plan; each certification plan shall define controls and other measures; certification plans shall be submitted for review, comment, and approval by the WIPP-WAC Certification Committee; the WIPP-WAC Certification Committee shall submit certification plan to New Mexico's Environmental Evaluation Group for review; the Environmental Review Group's comments shall be resolved before granting final approval; approved certification plans shall be implemented by generating sites procedures; certification activities shall be audited; the WIPP-WAC Certification Committee shall issue an audit report; failure to resolve audit findings shall result in suspension of certifying authority;

- **TRU Packaging**– Newly generated TRU waste shall be placed in noncombustible packaging; all Type A TRU waste containers shall be equipped with pressure relief devices; waste packages shall be marked, labeled and sealed properly;

- **Temporary Storage at Generating Sites** – Segregate TRU waste; certified TRU waste shall not be commingled with non-certified; TRU waste in storage areas shall be protected from unauthorized access; TRU wastes shall be monitored; TRU waste storage facilities shall be safely designed, constructed, maintained, and operated; contingency plan required; radiation exposures should meet ALARA;

- **Transportation/Shipping to WIPP** – Follow appropriate regulations with appropriate documentation;

- **Interim Storage** – Storage sites appropriately designated; new facilities sited, designed, constructed, and operated with RCRA regulations;

- **WIPP** – Description of WIPP and WIPP requirements;

- **Buried TRU – Contaminated Waste** – Discussion of closure of buried waste sites; and,

- **Quality Assurance** – TRU waste operations shall be consistent with applicable requirements.

m. Discuss the waste management requirements for polychlorinated biphenyls (PCBs) outlined by the Toxic Substances Control Act (TSCA).

When PCBs and PCB-containing items are removed from use, they may be stored up to one year while awaiting disposal. All items stored must be marked to indicate the date the item was removed from service, and the storage facility must be constructed to contain spills. In addition, operators must inspect the stored PCBs every 30 days and follow specific recordkeeping requirements.

EPA has issued a policy governing the reporting and cleanup of all spills resulting from the release of materials containing PCBs in concentrations greater than 50 ppm. The policy classifies PCB spills as either low concentration spills or high concentration spills. Low concentration spills have a PCB concentration less than 500 ppm and involve less than one pound of PCBs. High concentration spills have a PCB concentration greater than 500 ppm or are low concentration spills that either involve one pound or more of PCBs or 270 gallons or more of untested mineral oil. Any spill that involves a release of more than 10 pounds of PCBs must be reported immediately to the appropriate EPA Regional Office. (CERCLA also requires reporting to the National Response Center.)

The level of cleanup required under the PCB cleanup policy is determined by the following facts:

- Spill location;
- Potential for exposure to residual PCBs remaining after the cleanup;
- Concentration of PCBs initially spilled; and,
- Nature and size of the population potentially at risk from exposure.

In general, the greater the potential human exposure, the more stringent the cleanup standard.

Compliance with the PCB cleanup policy will "create a presumption against both enforcement action for penalties and the need for further cleanup under TSCA." However, when cleanups are required under RCRA, CERCLA, or other statutes, they may have to meet standards different from those imposed under TSCA.

Operators of a facility must prepare and keep at hand an annual report for the previous calendar year if their facility contains 45 kg or more of PCBs in PCB containers, one or more PCB transformers, 50 or more large PCB capacitors, or is used for PCB storage or disposal. Other records described specifically in Part 761 must be maintained by persons engaged in activities involving PCBs.

EPA has promulgated a rule that creates a nationwide PCB manifesting system under TSCA. The rule requires all PCB disposal companies, transporters, commercial storers, and generators of PCB wastes who store their own wastes to notify EPA of their activities and identify their facilities. All companies that notify EPA receive an EPA registration number. EPA has attempted to use the least burdensome restrictions by integrating its Federal PCB regulations with state regulations under RCRA and by allowing PCB operators to utilize the RCRA Uniform Manifest, which has space designated for additional information required under various state RCRA programs.[1]

n. Discuss the Resource Conservation and Recovery Act underground storage tank regulations (Subtitle I).

Subtitle I of RCRA is codified in 40 CFR Part 280. Part 280 covers the regulatory standards that apply to underground storage tanks (USTs) containing petroleum and hazardous substances. (Note that underground tanks containing hazardous wastes are regulated by either 40 CFR Part 264 or Part 265.)

In general, the tanks that are regulated by this Part have 10% or more of their volume underground (the volume of underground pipes attached to the tanks must be included in this calculation). Besides CERCLA hazardous substances, underground tanks containing any petroleum product that is liquid at 60°F and atmospheric pressure are regulated. A few types of tanks, such as those used in wastewater treatment systems, are excluded from the regulation (§ 280.10).

New tanks and their associated piping are subject to design, construction, installation, operating, and release detection requirements, some of which differ depending on whether

the tanks hold petroleum or hazardous substances. The general standard (§ 280.20) that applies to new tanks is that they must be designed and constructed in a manner that will prevent leaks due to structural failure or corrosion over their useful lives. The tanks must be constructed from fiberglass-reinforced plastic (FRP), composite steel/FRP, or coated steel with cathodic protection unless an equivalent design has been approved or unless noncorrosive soil conditions exist. New tank installations must comply with industry standards, and the installation must be certified.

Once tanks are placed in operation, steps must be taken to prevent spills and accidental overfills. In addition, corrosion prevention systems must be maintained, and any required repairs must be made in compliance with industry codes (§§ 280.30-280.33).

All underground tanks must operate with provisions for detecting releases of the tank contents. Release detection systems must have been retrofitted to existing tanks and piping based on the applicable retrofitting schedule in § 280.40(c). If the tank contains hazardous substances, it must be equipped with secondary containment with interstitial monitoring between the tank and the containment system (§ 280.42). For example, a double-walled tank equipped with leak detectors between the two walls provides an acceptable release protection system. Additional release protection options are available for tanks holding petroleum (§ 280.41):

- Tightness testing with monthly inventory control or weekly tank gauging;
- Automatic tank gauging and monthly inventory control;
- Soil vapor monitoring;
- Groundwater monitoring;
- Interstitial monitoring; or,
- Approved alternative.

Regardless of the release detection method used, both the underground tank and its associated piping must be covered.

Perhaps the most important requirement of the UST regulations is that all existing underground tanks must be either upgraded or closed by December 22, 1998. At a minimum, steel tanks must be upgraded by installing an internal liner or cathodic protection, metal piping must be cathodically protected, and spill and overfill prevention equipment must be installed. Alternatively, existing tanks can be upgraded to meet new tank standards (§ 280.21).

All owners and operators of UST systems must comply with a 3-phase leak response program (§§ 280.60-280.67):

(1) If a leak is suspected, it must be reported within 24 hours;
(2) Suspected must be investigated and confirmed; and,
(3) Release must be cleaned up if a threat to human health or the environment exists.

Also, whenever a UST system is temporarily or permanently closed, or when it is converted to some other type of service, strict closure requirements must be met to ensure that no leak has gone undetected (and uncorrected) (§§ 280.70-280.74[6]).

[1] *Environmental Law Handbook*, 12th ed., Arbuckle, et.al., published by Government Institutes, Inc., 1993.
[2] *Environmental Law Handbook*, 12th ed., Arbuckle, et.al., published by Government Institutes, Inc., 1994.
[3] *The Hazardous Waste Consultant - RCRA Land Disposal Restrictions: A Guide to Compliance*, 1995 ed., Elsevier Science, Inc., Vol. 12, Issue 6, Oct./Nov. 1994.
[4] *Hazardous Waste Management Guide*, J.J. Keller & Associates, Inc., 1992.
[5] *Environmental Law Handbook*, 12th ed., Arbuckle, et.al., published by Government Institutes, Inc., 1994.
[6] *RCRA Regulations and Keyword Index*, 1996 ed., Elsevier Science, Inc.

2.4 Environmental compliance personnel shall demonstrate a working level knowledge of the implementation of the regulations and requirements of the National Environmental Policy Act (NEPA).

a. Explain the purpose and scope of the Council on Environmental Quality regulations (40 CFR 1500-1508) implementing the National Environmental Policy Act.

The National Environmental Policy Act (NEPA) of 1969 establishes a national policy to restore and enhance the quality of the human environment and to avoid and minimize any possible adverse effects of Federal actions upon the quality of the human environment, and establishes the Council on Environmental Quality (CEQ). The two objectives of NEPA are (1) to consider every significant aspect of the environmental impacts of a proposed action, and (2) to inform the public that the agency did indeed consider environmental concerns in its decisionmaking process. Section 101 of NEPA sets the goals, while Section 102 provides the means for carrying out the policy. Section 102 also contains "action-forcing" provisions to make sure that Federal agencies act according to the letter and spirit of NEPA.

The CEQ regulations (40 CFR 1500-1508) implement section 102 of NEPA (Table 2.4-1) and provide Federal agencies with procedures for complying with the intent of NEPA.

Table 2.4-1
The Council of Environmental Quality Regulations Highlights
40 CFR 1500-1508

Part 1500-Purpose, Policy, and Mandate - Provides the purpose of the regulations; the policy; the mandate; agency authority; and the requirements for reducing paperwork and reducing delay.

Part 1501-NEPA and Agency Planning - Requires early integration of NEPA into agency planning process; emphasizes cooperative consultation among agencies; resolution of agency disputes; identifies when to prepare an Environmental Assessment (EA) or an Environmental Impact Statement (EIS); and establishes time limits on the NEPA process.

Part 1502-Environmental Impact Statement - Provides the requirements, interdisciplinary approach, and format for the EIS to ensure the infusion of NEPA into ongoing programs and actions of the Federal government

Part 1503-Commenting - Requires stakeholder participation in the NEPA process and provides procedures for inviting and responding to comments.

Part 1504-Predecisional Referrals to the Council of Proposed Federal Actions Determined to be Environmentally Unsatisfactory - Establishes procedures for referring interagency disagreements concerning proposed actions that might cause unsatisfactory environmental effects to the Council, and a means for providing early resolution of such a disagreement.

Part 1505-NEPA and Agency Decision making - Requires agency adoption of procedures to assure compliance with NEPA requirements, and outlines the implementation of the agency decision.

Part 1506-Other Requirements of NEPA - Describes other NEPA requirements, including: limitations on actions during the NEPA process; elimination of duplication with state and local procedures; agency responsibilities; public involvement requirements; filing; timing; and emergencies.

Part 1507-Agency Compliance - Describes applicability of NEPA to all Federal agencies; agencies capabilities required to comply; and the requirement that agencies adopt procedures supplementing the CEQ regulations.

Part 1508-Terminology and Index - Summarizes relevant terminology and provides an index.

The CEQ regulations requires an interdisciplinary approach for defensible scientific analysis; concentration on significant issues; and an objective evaluation of reasonable alternatives to the proposed action. The regulations also provide procedures to ensure that environmental information is available to the public before decisions are made and actions are taken. The planning process, therefore, should result in informed decisions that reflect environmental values.

In addition, the CEQ regulations provide for the preparation by agencies of Environmental Impact Statements (EISs) for the proposed actions with potentially significant effects; Environmental Assessments (EAs) to determine whether to prepare an EIS or a Finding of No Significant Impact (FONSI); or if the proposed action has no individual or cumulative significant effects and an EIS or EA is not required, then there is a Categorical Exclusion (CX) for the action.

b. Discuss the purpose and scope of DOE Order 451.1, National Environmental Policy Act Compliance Program. (DOE Order 5440.1E was canceled and replaced with 451.1 in September of 1995.)

The purpose of DOE Order 451.1 is to establish internal requirements and responsibilities for implementing NEPA, the CEQ regulations, and the DOE NEPA Implementing Procedures (10 CFR 1021). DOE Order 451.1 sets out the requirements and responsibilities to ensure efficient and effective implementation of DOE's NEPA compliance program (Table 2.4-2).

Table 2.4-2
DOE Order 451.1 Highlights

Requirements include:

- System of DOE NEPA Compliance Officers;
- Internal scoping procedures for EAs and EISs;
- NEPA quality assurance plans and public participation plans;
- Annual NEPA planning summaries;
- NEPA Documents Manager assigned for each EIS and EA;
- System for reporting lessons learned; and,
- Tracking and annual reporting of progress on mitigation commitments.

Responsibilities for:

- Secretarial Officer – -Establishes a NEPA Compliance program for matters under the office's purview, including the requirements listed above.
- Head of Field Office– -Establishes a NEPA Compliance program for matters under the office's purview, including the requirements listed above. Ensures NEPA compliance requirements are met.
- NEPA Compliance Officer– -Manages the NEPA compliance program, including approval of CXs, development of NEPA procedures and strategies, assisting with the NEPA documentation process and public involvement, and liaison with the Office of NEPA Policy and Assistance.
- NEPA Documents Manager– -Manages the documentation process, including cost, schedule, public involvement requirements, and technical adequacy.
- Assistant Secretary for Environmental Safety and Health– -Provides DOE policy, guidance, and oversight to ensure adequate and consistent application of NEPA; resolves disputes among offices; and, for EISs, issues the Notice of Intent, determines lead agency, evaluates proposed and alternative actions, adopts another agency's EIS, and concurs in the environmental content of the record of decision.
- Director of NEPA Policy and Assistance– -Develops policy and guidance documents, provides technical advice and assistance, and performs independent review.

c. Describe the public participation process

- Categorical Exclusion (CX)– Neither CEQ nor DOE NEPA regulations require public participation in CX determinations. The purpose of the CX is to avoid clogging the system with documentation for proposed actions that clearly have no significant impact on the environment.

- Environmental Assessment (EA) – There are no regulatory or procedural requirements that require the DOE to offer opportunities for public input into the scope or review of EAs. The DOE will notify the host state and host and affected tribes of the intent to prepare an EA, and will provide the opportunity for the state and tribes to comment on EAs (14 to 30 days). DOE shall make NEPA documents available to the public (40 CFR 1506.6, 10 CFR 1021.301).

- Finding of No Significant Impact (FONSI) – Normally, the DOE will issue an approved FONSI concurrently with the final EA. In certain circumstances, the DOE must make a proposed FONSI available for public review and comment for 30 days before the FONSI is approved [10 CFR 1021.322(d)]. The public is notified of the availability of proposed or final FONSI. A copy of the final FONSI is placed in public reading rooms, and copies are provided to individuals and groups upon request.

- Environmental Impact Statement (EIS) – Providing the public with the opportunity for involvement is mandated at certain steps of the EIS process. Public input must be requested during the scoping process, and the public is given the opportunity to review and comment on a draft EIS before a final EIS is prepared. The DOE regulations requires that the public be involved in the scoping process through at least one public scoping meeting. The review of a draft EIS must have at least one public hearing.

- Scoping – Publication in the Federal Register of the Notice of Intent (NOI) begins the scoping period (a minimum of 30 days) for receiving comments on the DOE's proposal to prepare an EIS and on the draft alternatives outlined in the NOI. Notices of scoping meetings must be published at least 15 days before the date of the scheduled meetings. A written transcript of comments from draft and final EIS scoping activities, and copies of written comments must be made available in public reading rooms as soon as possible. A summary of the scoping process and the disposition of comments received are included in the EIS Implementation Plan (IP).

- Implementation Plan (IP) – The IP outlines the plans for preparing the EIS and recording the results of the scoping process. The IP is made available to the public by placing it in public reading rooms and mailing it to individuals and groups upon request. (The DOE regulations 10 CFR 1021 are currently being revised. The requirement to prepare an IP will be deleted in the revisions.)

- Draft EIS – Publication of the notice of availability of a draft EIS begins the period of at least 45 days for public review and comment. The draft EIS and appropriate related material are made available in public reading rooms and mailed to interested groups and individuals upon request. The DOE must conduct at least one public hearing after the notice of availability is published. The hearing must be

scheduled at least 15 days after the date of public notification of that hearing. A written transcript of comments from the public hearing, summaries of other review and comment activities, and copies of written comments are made available, as soon as possible, in public reading rooms. A summary of the comment process and the disposition of comments received on a draft EIS are included in a Comment Response Document, which is made available to the public as a part of the final EIS.

- Final EIS – The final EIS and appropriate related materials are made available in public reading rooms and distributed to interested groups and individuals upon request. The DOE publishes a notice of availability of the final EIS in the *Federal Register*. The DOE must wait 30 days after publication of the notice of availability before making a decision on the proposed action.

- Record of Decision (ROD) – The ROD is published in the *Federal Register*. A copy of the ROD is placed in public reading rooms as soon as possible after it is signed, and copies are provided to individuals and groups upon request.

d. Discuss the integration of consultation requirements under the other environmental legislation (e.g., National Environmental Policy Act and Endangered Species Act and Fish and Wildlife Coordination Act).

Agencies are required to coordinate NEPA planning activities with other agencies and groups, as appropriate, per the requirements of relevant environmental laws and executive orders. DOE will consult with agencies regarding appropriate permits and licenses. Examples include Clean Air Act (CAA); Clean Water Act (CWA) ; and Resource Conservation and Recovery Act (RCRA) permits (Table 2.4-3).

Table 2.4-3
Laws and Orders Commonly Related to Agency Projects

Environmental Laws and Executive Orders	Oversight Agency	Concern/Action
Endangered Species Act	U.S. Fish and Wildlife National Marine Fisheries Service	Protection of threatened and endangered species/biological assessments and opinions
Fish and Wildlife Coordination Act	U.S. Fish and Wildlife	Impacts to fish and wildlife/consult, mitigation
Coastal Zone Management Act	National Oceanic and Atmospheric Agency	Impacts on coastal zone/findings of consistency with State Management Plans
National Historic Preservation Act	State Historic Preservation Office (SHPO)	Preservation of prehistoric and historic sites/consultation
Native American Graves Protection and Repatriation Act	State Historic Preservation Officer Affected Native American Tribes	Protection to gravesites, human remains, and funerary objects/consultation with Native American Groups and SHPO

Clean Air Act (Conformity Rule)	Environmental Protection Agency (State Primacy)	Air pollution/permits, inspection, reports
Federal Water Pollution Control Act (Clean Water Act)	Environmental Protection Agency (State Primacy)	Water pollution/ National Pollution Discharge Elimination System (NPDES) permit (EPA) and Section 404 permit-Dredge/fill (Corps of Engineers) inspections, reports
Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)	Environmental Protection Agency (State Primacy)	Past disposal of waste/taxing, reporting, liabilities
Resource Conservation and Recovery Act (RCRA)	Environmental Protection Agency (State Primacy)	Hazardous and Nonhazardous waste management/permits, manifests, inspections, reports

The CEQ regulations (40 CFR 1502.25) require, to the fullest extent possible, that agencies prepare draft EISs concurrently with and integrated with environmental impact analyses and related surveys and studies required by the Fish and Wildlife Coordination Act, the National Historic Preservation Act of 1966, the Endangered Species Act of 1973 and other environmental review laws and executive orders.

CEQ regulations also require that all Federal permits, licenses and other entitlements needed to implement the proposal be identified during the scoping period (40 CFR 15021.7) and be listed in the draft EIS (40 CFR 1502.25).

Additional regulations and executive orders that involve consultation and/or stakeholder involvement include:

- Executive Order for Environmental Justice-affected Minority and Low Income Groups
- American Indian Religious Freedom Act-affected Native American Groups
- Prime and Unique Agricultural Lands-Department of Agriculture

e. Discuss the content and procedures specified by the Department implementing regulations 10 CFR 1021, Compliance with the National Environmental Policy Act and Secretarial Policy on the National Environmental Policy Act, June 13, 1994.

10 CFR 1021

The DOE 10 CFR 1021(National Environmental Policy Act Implementing Procedures and Guidelines) establishes procedures for DOE to comply with NEPA. These regulations adopt the CEQ regulations and are supplements to, and to be used in conjunction with, the CEQ regulations. Based on these procedures, DOE shall provide adequate and timely review for the incorporation of NEPA into the planning process. NEPA reviews shall be completed before DOE decisions are made.

- DOE Decisionmaking and Planning

    ◊ DOE shall incorporate NEPA early into the planning process, shall complete the NEPA process before making its decisions, limit actions, during the EIS process, that may impact the decision to be made in an on-going EIS.

- Implementing Procedures

    ◊ DOE shall make NEPA documents available to state, Federal, and local governments, American Indian Tribes, interested groups, and general public;.
    ◊ DOE shall notify host state and tribe of intent to prepare an EA or EIS, and provide them the opportunity to review and comment
    ◊ DOE shall prepare an implementation plan for each EIS to be prepared
    ◊ DOE shall prepare programmatic NEPA documents to support programmatic decisions, and prepare site-wide EISs for certain large, multiple projects; and,
    ◊ Mitigation Action Plan shall be prepared upon completion of each EIS and EA and associated ROD or FONSI, that addresses mitigation commitments expressed in the ROD.

- Classes of Actions

    ◊ The regulation also identifies level of NEPA review (EIS, EA, or CX) for typical classes of actions Appendix A and B list the action typically categorically excluded, Appendix C lists actions usually requiring an EA, and Appendix D lists classes of actions normally requiring an EIS.

In summary, 10 CFR 1021 applies to all DOE facilities and activities; provides opportunities for public, state and tribal participation in the DOE NEPA process; specifies DOE planning, decision making, and NEPA review requirements; and identifies typical classes of actions for EIS, EA, and CX.

Secretarial Policy on NEPA

The NEPA Secretarial Policy Statement establishes policies to streamline the NEPA process, to minimize costs and time for document preparation and review, to emphasize teamwork, and to make the process more useful to decision makers and the public.

The NEPA Secretarial policy statement summarizes delegations of authority for NEPA implementation. Heads of field organization have full authority for EAs; FONSIs; and associated floodplains and wetlands action documentation requirements related to their proposed actions. To support this delegation, field offices must (1) designate a NEPA

compliance officer; (2) prepare internal scoping procedures, public participation plans, and quality assurance plans; and (3) provide adequate legal resources.

Secretarial officers and heads of field offices will submit annual NEPA planning summaries to the Assistant Secretary for Environment, Safety, and Health. The Assistant Secretary for Environment, Safety, and Health is delegated authority to provide NEPA variances. The Office of Environment, Safety, and Health will provide NEPA guidance and training.

The NEPA Document Manager will conduct an early scoping process for the EIS or EA being prepared which will include a proposed schedule. EISs will be completed within 15 months of the issuance of the NOI.

The DOE will continue to work to improve the NEPA process through: (1) contract reform (for contracts to prepare EISs and EAs); (2) enhanced public involvement efforts; and (3) continued process improvement in the DOE NEPA document review times; emphasizing quality and encouraging innovation.

The DOE will rely on the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process for review of actions to be taken under CERCLA and will address NEPA values and public involvement procedures under CERCLA process.

f. Participate in the preparation of the documents listed below:

- Environmental Impact Statement (EIS)
- Environmental Assessment (EA)
- Finding of No Significant Impact (FONSI)
- Categorical Exclusion (CX)
- Record of Decision (ROD)

This is a demonstration requirement and an individual will actually be performing the activity rather than acknowledging comprehension. The following Table 2.4-4 is the required format or contents of the above listed documents and additional guidance and reference documents to be used in their development are found in Table 2.4-5.

Table 2.4-4
NEPA Document Format and/or Contents

Environmental Impact Statement (EIS) - The following standard format should be followed unless the agency determines there is compelling reason to do otherwise (40 CFR 1502.10):

(a) Cover sheet;
(b) Summary;
(c) Table of contents;
(d) Purpose of and need for action;
(e) Alternatives including the proposed action;
(f) Affected environment;
(g) Environmental consequences;
(h) List of preparers;
(i) Index; and,
(j) Appendices.

Environmental Assessment (EA) -

Shall include brief discussions of the need for the proposal, of alternatives[including the "no action" alternative[10 CFR 1021.231(c)], the environmental consequences of the proposed action and the alternatives, and a listing of agencies and persons consulted [(40 CFR 1508.9(3)(b)].

Finding of No Significant Impact (FONSI) -

Briefly present the reasons why an action will not have a significant effect on the human environment and for which an EIS will, therefore, not be prepared. It shall include the EA or a summary of it and shall note any other environmental documents related to it. If the EA is included, the finding need not repeat any of the discussion in the EA, but many incorporate by reference (40 CFR 1508.13).

A summary of the supporting EA, including a brief description of the proposed action and alternatives considered in the EA, factors considered, and projected impacts[10 CFR 1021.322(b)].

A final FONSI will include a summary of any comments received on the proposed FONSI and comments received on the EA and their disposition.

Categorical Exclusion (CX) -

Categorical Exclusions need not be documented[(DOE Order 451.1-5.d(2)]).

Record of Decision (ROD) -

State what the decision was. Identify all alternatives considered by the agency in reaching its decision, specifying the alternative or alternatives which were considered to be environmentally preferable. Identify and discuss all such factors including any essential considerations of national policy which were balanced by the agency in making its decision and state how those considerations entered into its decision.

State whether all practicable means to avoid or minimize environmental harm from the alternative selected have been adopted, and if not, why not. A monitoring and enforcement program shall be adopted and summarized where applicable for any mitigation [(40 CFR 1505.2].

Table 2.4-5
Reference and Guidance Documents

CEQ Memorandum to Agencies, March 23, 1981, *Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulations*
Council on Environmental Quality (CEQ) Regulations, 40 CFR Parts 1500-1508, as amended 07/01/86.
DOE Order 451.1, National Environmental Policy Act Compliance Program, of 6/16/95.
National Environmental Policy Act, 42 U.S.C. 4321 *et seq.*, of 01/1/70.
U.S. Department of Energy, National Environmental Policy Act; Implementing Procedures and Guidelines, 10 CFR 1021, of 4/24/92.
U.S. Department of Energy, Office of NEPA Oversight, May 1992, *Frequently Asked Questions on the Department of Energy's National Environmental Policy Act Regulations.*
U.S. Department of Energy, July 1994, *Questions and Answers on the Secretarial Policy Statement on the National Environmental Policy Act*
U.S. Department of Energy, Office of NEPA Oversight, May 1993, *Recommendations for the Preparation of Environmental Assessments and Environmental Impact Statements (Green Book).*
U.S. Department of Energy, Office of NEPA Oversight, August 16, 1994, *Environmental Assessments Checklist.*

g. Discuss the potential liabilities of the Department and its contractors inherent in the enforcement of environmental regulations (i.e., compliance orders, enforcement actions, fines, and penalties, and provision for civil suit).

Almost all Federal environmental legislation provides for some form of criminal liability. NEPA is an exception. Consequently, when in violation of NEPA, Federal agencies are not penalized by means of compliance orders, enforcement actions, fines, and/or penalties. Civil suits, however, may be filed against the agency for lack of compliance with procedural requirements.

2.5 Environmental compliance personnel shall demonstrate a working level knowledge of the following laws, regulations, and Department of Energy Orders as related to environmental radiation:

- Atomic Energy Act
- 10 CFR 834, Radiation Protection of the Public and Environment
- 40 CFR 61 Subpart H, National Emission Standards for Hazardous Air Pollutants
- 40 CFR 141, National Primary Drinking Water Regulations
- DOE Order 5400.1, General Environmental Protection Program
- DOE Order 5400.5, Radiation Protection of the Public and the Environment
- DOE Order 5820.2A, Radioactive Waste Management
- 40 CFR 122, EPA Administered Permit Programs: The National Pollutant Discharge Elimination System

Supporting Knowledge and/or Skills

a. Discuss the application of the above listed documents to the Department of Energy and its facilities.

Atomic Energy Act – The Atomic Energy Act (AEA) of 1954 was enacted for the development and control of atomic energy. It is stated in Section 1 that atomic energy is capable of application for peaceful as well as military purposes. Therefore, the development, use, and control of atomic energy should be used to promote world peace, improve the general welfare, increase the standard of living, and strengthen free competition in private enterprise, subject to the paramount objective of making a maximum contribution to the common defense and security of the United States.

The Act provided for programs for research and development, dissemination and control of unclassified and restricted data, government control of atomic energy and special nuclear material (SNM), development of atomic energy for peaceful purposes, international cooperation for defense and security, and administration of all the above. Thus was created the Atomic Energy Commission, which is now known as the Department of Energy.

10 CFR 834, Radiation Protection of the Public and Environment – Part 834 has not yet been promulgated (proposed, not approved yet) in 10 CFR. 10 CFR are regulations relating to radiation. Part 834 will replace DOE 5400.5, Radiation Protection of the Public and the Environment.

The Department of Energy (DOE) is promulgating final regulations for the protection of the public and the environment against ionizing radiation. These regulations control radiation exposures to the public and the environment from operations of DOE or DOE contractors. By promulgating these regulations, the essence of the requirements contained in DOE Order 5400.5 will be backed by enforcement procedures and penalties for non-

compliance. Thus, compliance with the radiation protection standard requirements will be enhanced.

40 CFR 61 Subpart H, National Emission Standards for Hazardous Air Pollutants (should be entitled National Emission Standards for Emissions of Radionuclides Other than Radon from Department of Energy Facilities) The provisions of Subpart H apply to operations at any facility owned or operated by DOE that emits radionuclides other than radon-222 or radon-220 into the air.

40 CFR 141, National Primary Drinking Water Regulations Part 141 establishes primary drinking water regulations pursuant to the Public Health Service Act, as amended by the Safe Drinking Water Act, and related regulations applicable to public water systems. This part applies to all DOE facilities that have water systems that meet at least one of the conditions of a public water system:

- Consists of not only distribution and storage facilities, but also of collection and treatment facilities;
- Does not obtain all of its water from, or is owned or operated by, a public water system to which such regulations apply;
- Sells water to any person;or,
- Is a carrier which conveys passengers in interstate commerce.

Since most, if not all DOE facilities collect and treat water, Part 141 applies to DOE facilities.

DOE Order 5400.1, General Environmental Protection Program This DOE Order is directly applicable to DOE and its facilities, as it is written and administered by DOE. The purpose of this Order is to establish and specifically define environmental protection program requirements, authorities, and responsibilities for DOE operations for assuring compliance with applicable Federal, State, and local environmental protection laws and regulations, Executive Orders, and internal Department policies. In recognition of the environmental significance of Departmental activities authorized by the AEA, this Order addresses and, of necessity, emphasizes requirements for radiation protection.

DOE Order 5400.5, Radiation Protection of the Public and the Environment This DOE Order is directly applicable to DOE and its facilities, as it is written and administered by DOE. The purpose of this Order is to establish standards and requirements for operations of DOE and DOE contractors with respect to protection of members of the public and the environment against undue risk from radiation.

DOE Order 5820.2A, Radioactive Waste Management This DOE Order is directly applicable to DOE and its facilities, as it is written and administered by DOE. The purpose of this Order is to establish policies, guidelines, and minimum requirements by which DOE manages its radioactive and mixed waste and contaminated facilities. This Order applies to all DOE elements and DOE contractors and subcontractors performing

work that involves management of waste containing radioactivity and/or radioactively-contaminated facilities for DOE under the AEA.

40 CFR 122, EPA Administered Permit Programs: The National Pollutant Discharge Elimination System – Part 122 contains provisions for the National Pollutant Discharge Elimination System (NPDES) Program under the Clean Water Act and covers basic EPA permitting requirements. The NPDES program requires permits for the discharge of pollutants from any point source into waters of the United States. The point sources most likely to occur on a DOE facility are discharges of storm water, thereby making most, if not all DOE facilities subject to operating their storm water treatment/ collection/release systems under a NPDES permit.

b. Define the following terms and their implications for regulation in the Department of Energy:

- Source material
- Special nuclear material
- By-product material
- Naturally occurring or accelerator-produced radioactive material

Source material – Any physical or chemical form of uranium or thorium or ores that contain by weight 0.05% or more of uranium or thorium. Air emission standards are probably the only environmental regulations that might impact source material handling.

Special nuclear material – Includes plutonium, uranium-233, or uranium enriched in the isotopes uranium-233 or uranium-235. Air emission standards are probably the only environmental regulations that might impact special nuclear material handling.

By-product material – (a) Any radioactive material (except special nuclear material) yielded in, or made radioactive by, exposure to the radiation incident or to the process of producing or utilizing special nuclear material. For purposes of determining the applicability of the Resource Conservation and Recovery Act (RCRA) to any radioactive waste, the term "any radioactive material" refers only to the actual radionuclides dispersed or suspended in the waste substance. The non-radioactive hazardous waste component of the waste substance will be subject to regulation under RCRA; or (b) The tailings or waste produced by the extraction or concentration of uranium or thorium from any ore processed primarily for its source material content. Ore bodies depleted by uranium solution extraction operations and which remain underground do not constitute "by-product material".

All environmental regulations are likely to have an impact on the handling of by-product material.

Naturally occurring radioactive material (NORM) or accelerator-produced radioactive material – Any radioactive material that can be considered naturally

occurring and is not source, special nuclear, or by-product material or that is produced in a charged particle accelerator.

Congress enacted the Uranium Mill Tailings Radiation Control Act (UMTRCA) in 1978. Under the authority of Section 108 of the Act, the EPA promulgated 40 CFR 192, Health and Environment Protection Standards for Uranium and Thorium Mill Tailings. These standards were designed to govern the disposal and cleanup of the designated inactive mill tailings sites. EPA published new final standards on January 11, 1995.

40 CFR 192.31(b) states that the tailings or waste produced by the extraction or concentration of uranium or thorium from any ore processed primarily for its source material content is defined as Uranium by-product material. NORM is defined as any radioactive material that can be considered naturally occurring and is not by-product material. Therefore, Uranium mill tailings which are by-product material are not NORM since NORM specifically excludes by-product material. Furthermore, as 40 CFR 192 was promulgated for Uranium and Thorium, it will not affect Naturally Occurring Radioactive Material.

c. Describe the major requirements of 10 CFR 834, Radiation Protection of the Public and Environment

These regulations cover four basic areas relating to radiation protection of the public and the environment:

(1) Dose limits for exposure of members of the public to radiation and implementation of DOE's ALARA policy;
(2) Management of radioactive materials in liquid waste discharges, in soil columns, and in selected solid waste containing radioactive materials, including a groundwater protection program for each DOE site;
(3) Requirements for decontamination, survey and release of buildings land, equipment, and personal property containing residual radioactive material and the management, storage, and disposal of wastes generated by these activities; and,
(4) Requirements for an effluent monitoring and environmental surveillance program.

An Environmental Radiation Protection Plan (ERPP) must be established to address the details of methods and procedures for implementing the requirements in the rule.

d. Describe the concept of Reportable Quantity and identify that quantity for a given radionuclide.

Reportable Quantity– A CERCLA/Superfund Amendments and Reauthorization Act (SARA) Title III term used to describe the minimum amount of a spilled or leaked hazardous substance that must be reported to the EPA Spill Response Center. Radionuclides are included in 40 CFR Part 302.4, Table 302.4 – List of Hazardous Substances and Reportable Quantities; therefore, they have a reportable quantity (RQ)

assigned. The statutory RQ value is one pound, but the adjusted final RQs for individual radionuclides are listed in Appendix B to Part 302.4 – Radionuclides. All regulated isotopes are listed in Appendix B. Several radionuclides critical to DOE facilities are shown in Table 2.5-1. For information on other radionuclides, refer to Table 302.4.

Table 2.5-1
Radionuclides Critical to DOE Facilities

Radionuclide	Final RQ (Ci)
Americium-241	0.01
Plutonium-239	0.01
Uranium-233	0.01
Uranium-235	0.01

e. Describe the system for classifying mixed waste and the general requirements for treatment, storage, and disposal.

System for Classifying Mixed Waste – Mixed waste is waste containing both radioactive and hazardous components as defined by the Atomic Energy Act and the Resource Conservation and Recovery Act, respectively. Source material and SNM do not meet the definition of waste; therefore, even if these materials were contaminated with hazardous components, they would not be mixed wastes. NORM and accelerator-produced material also do not meet the definition of waste. By-product material, if contaminated with hazardous components, would be considered mixed waste, due to its being generated as a by-product from another process.

General Requirements for Treatment, Storage, and Disposal – Mixed waste must meet all treatment, storage, and disposal (TSD) requirements in the RCRA Subtitle C hazardous waste regulations (40 CFR 260-270). In addition, mixed waste must meet the requirements for managing radioactive waste, as described in DOE Order 5820. 2A, Radioactive Waste Management.

f. Describe the basic monitoring and reporting requirements of radionuclides in National Emissions Standards for Hazardous Air Pollutants and state the dose limit.

Emissions of radionuclides to the ambient air from DOE facilities shall not exceed those amounts that would cause any member of the public to receive in any year an effective dose equivalent of 10 mrem/yr. There are specific emission monitoring and test procedures to determine compliance with the emissions standard (§61.93), as well as specific rules and reporting requirements for determining the level of compliance (§61.94).

All facilities must maintain records documenting the source of input parameters including the results of all measurements upon which they are based, the calculations and/or analytical methods used to derive values for input parameters, and the procedure used to determine effective dose equivalent. This documentation should be sufficient to allow an independent auditor to verify the accuracy of the determination made concerning the

facility's compliance with the standard. These records must be kept at the site of the facility for at least five years and, upon request, be made available for inspection by the EPA Administrator, orthe authorized representative.

g. Describe the basic limits for radionuclides in drinking water and their application to Department operations.

Basic Limits for Radionuclides in Drinking Water –

The following are the maximum contaminant levels for radium-226, radium-228, and gross alpha particle radioactivity:

(1) Combined radium-226 and radium-228 – 5 pCi/l
(2) Gross alpha particle activity (including radium-226 but excluding radon and uranium) – 15 pCi/l

The average annual concentration of beta particle and photon radioactivity from man-made radionuclides in drinking water shall not produce an annual dose equivalent to the total body or any internal organ greater than 4 mrem/yr. Except for the radionuclides listed in Table 2.5-2, the concentration of man-made radionuclides causing 4 mrem total body or organ dose equivalents shall be calculated on the basis of a 2 liter per day drinking water intake using the 168 hour data listed in "Maximum Permissible Body Burdens and Maximum Permissible Concentration of Radionuclides in Air or Water for Occupational Exposure," National Bureau of Standards (NBS) Handbook 69 as amended August 1963, U.S. Department of Commerce. If two or more radionuclides are present, the sum of their annual dose equivalent to the total body or to any organ shall not exceed 4 mrem/yr.

Table 2.5-2
Average Annual Concentrations Assumed To Produce A Total Body Or Orga Dose Of 4 MREM/YR

Radionuclide	Critical Organ	pCi per liter
Tritium	Total body	20,000
Strontium-90	Bone marrow	8

h. Describe the fdlowing types of radioactive waste and the associated requirements:

- Low-level waste
- High-level waste
- Transuranic waste
- Spent nuclear fuel
- Uranium mine and mill tailings

Low-level waste –Waste that contains radioactivity and is not classified as high-level waste, transuranic waste, or spent nuclear fuel or by-product material as defined by DOE Order 5820.2A. Test specimens of fissionable material irradiated for research and development only, and not for the production of power or plutonium, may be classified as low-level waste, providing the concentration of transuranic is less than 100 nCi/g. The associated requirements for the management of low-level waste are set forth in DOE Order 5820.2A, Chapter III, Management of Low-Level Waste.

High-level waste –The highly radioactive waste material that results from the reprocessing of spent nuclear fuel, including liquid waste produced directly in reprocessing of spent nuclear fuel, including liquid waste produced directly in reprocessing and any solid waste derived from the liquid, that contains a combination of transuranic waste and fission products in concentrations requiring permanent isolation. The associated requirements for the management of high-level waste are set forth in DOE Order 5820.2A, Chapter I, High-Level Waste.

Transuranic waste –Without regard to source or form, waste that is contaminated with alpha-emitting transuranium radionuclides with half-lives greater than 20 years and concentrations greater than 100 nCi/g at the time of assay. Other alpha contaminated wastes, peculiar to a specific DOE site, must also be managed as transuranic waste. The associated requirements for the management of transuranic waste are set forth in DOE Order 5820.2A, Chapter II, Management of Transuranic Waste.

Spent nuclear fuel –Fuel that has been withdrawn from a nuclear reactor following irradiation, but that has not been reprocessed to remove its constituent elements. No specific requirements are set forth in the above referenced DOE Orders or CFRs regarding spent nuclear fuel, although, in general, 10 CFR 834, 40 CFR 61 Subpart H, and DOE Order 5400.5 would all apply.

Uranium mine and mill tailings –Rock remaining from the mining and milling of uranium ore after the primary quantities of uranium have been removed. No specific requirements are set forth in the above referenced DOE Orders or CFRs regarding uranium mine and mill tailings, although, in general, 10 CFR 834, 40 CFR 61 Subpart H, 40 CFR 141, DOE Order 5400.1, DOE Order 5400.5, and 40 CFR 122 would all apply.

i. Discuss the potential liabilities of the Department and its contractors inherent in the enforcement of environmental regulations (i.e., compliance orders, enforcement actions, fines and penalties, and provisions for civil suits).

Potential Liabilities of DOE –Compliance orders are usually issued against DOE, not against its contractors, although states prefer to have the contractor named in the orders. DOE prefers not having the contractors named in the orders, due to the change-over of contractors. Enforcement actions have been brought against both DOE and its contractors for environmental regulatory violations. Fines and penalties are usually negotiated between DOE and the states or EPA. Civil suits can be brought against DOE.

Potential Liabilities of DOE Contractors – Compliance orders are usually issued against DOE, not its contractors, although states prefer to have the contractor named in the orders. DOE has traditionally not preferred having the contractors named in the orders, due to the change-over of contractors. Enforcement actions have been brought against both DOE and its contractors for environmental regulatory violations. Fines and penalties can be assessed against a DOE contractor outside of the negotiated ones between DOE and the states or EPA. Civil suits can be brought against DOE contractors (Table 2.5-3)

Table 2.5-3
Potential Liabilities of DOE Contractors

STATUTE	CIVIL LIABILITIES	CRIMINAL LIABILITIES
Clean Water Act (CWA)	Up to $25,000 per day for each day of violation	Negligent violations: $25,000 per day, or 1 year in prison, or both. Knowing violations: $5,000-$50,000 per day, or 3 years in prison, or both Knowing endangerment: $250,000, or 15 years in prison, or both
Clean Air Act (CAA)	Up to $25,000 per day for each day of violation	Negligent = 1 year Knowing = 5 years + $$ Knowing endangerment = 15 years + $1M Falsification = 2 years
National Pollution Discharge Elimination System (NPDES)	See CWA	See CWA
Safe Drinking Water Act (SDWA)	Up to $25,000 per day for each day of violation	$25,000 per day for each day of violation, and/or 3 years in prison

Federal Agency Liability – Per the Federal Facilities Compliance Act (FFCA) Federal facilities do not have sovereign immunity from state enforcement of state environmental laws under the solid and hazardous waste provisions of the Solid Waste Disposal Act (SWDA). Additionally, Federal facilities are obligated to pay fines and penalties assessed by the states.

Federal Employee Liability – Federal employees can be personally liable for both civil and criminal penalties imposed under the solid and hazardous waste provisions of the Solid Waste Disposal Act (SWDA).

Civil Penalties– The Act exempts personal liability of agents, employees, or officers of the United States for any civil penalty under any Federal, state, interstate, or local solid or hazardous waste law with respect to any act or omission **within the scope of the official duties** of the agent, employee, or officer. However, Federal agencies are now liable for civil penalties and fines.

Criminal Penalties– The Act states, "an agent, employee, or officer of the United States shall be subject to any criminal sanction (including, but not limited to, any fine or imprisonment) under any Federal or state solid or hazardous waste law, but no department, agency, or instrumentality of the executive, legislative, or judicial branch of the Federal Government shall be subject to any such sanction".

2.6 Environmental compliance personnel shall demonstrate a working level knowledge of the supporting environmental laws and regulations including:

- Pollution Prevention Act (PPA)
- Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)
- Toxic Substances Control Act (TSCA)
- Endangered Species Act (ESA)
- Comprehensive Environmental Response, Compensation & Liability Act/Superfund Amendments and Reauthorization Act (Superfund)
- Emergency Planning and Community Right-to-Know Act (EPCRA)
- Atomic Energy Act
- Federal Facilities Act (FFCA)

Supporting Knowledge and/or Skills

a. Describe the deadlines identified in the Pollution Prevention Act.

The Pollution Prevention Act (PPA) of 1990, as incorporated into the Emergency Planning and Community Right-to-Know Act (EPCRA) under the provisions of Superfund, requires owners and operators of facilities that must file toxic release inventory (TRI) reports as delineated under Section 313 to provide information annually on pollutant source reduction and recycling activities in conjunction with the filing of their TRI report beginning in calendar year 1991. Initially, these reports were to be submitted by July 1, 1992, but on May 27, 1992, EPA agreed not to initiate enforcement actions against facilities as long as they submitted an accurate Form R report between July 1, 1992, and September 1, 1992 (due to delays in finalizing and distributing Form R).

b. Identify the disciplines /areas in which Pollution Prevention Act applies.

The Pollution Prevention Act (PPA) applies to facilities required to submit toxic chemical release inventories in accordance with Section 313 of CERCLA. These industries fall within Standard Industrial Classification (SIC) Codes 20 through 39, have more than 10 full-time employees (defined by total hours worked at the facility being greater than 20,000 hours, rather than head count) , and manufacture, import, process, or use listed toxic chemicals [under 40 CFR section 372.65(a)] at higher than established threshold quantities.

c. Describe the process for licensing applicators as defined in the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA).

Standards for certification of commercial pesticide applicators are found in 40 CFR 171.4, with standards for certification of private applicators appearing in 40 CFR 171.5.

The commercial applicator must demonstrate competency in the use and handling of pesticides as determined by passing a written examination (in conjunction with performance testing, if required). General requirements include a demonstration of

practical knowledge with regard to pest control and pesticide safety in the following areas: label/labeling and instruction comprehension; pesticide safety; environmental factors; pest identification and biology; pesticide types, interactions, persistence, toxicity, hazards, effectiveness and dilution procedures; pertinent equipment use and maintenance; application techniques; and knowledge of the applicable Federal and state laws.

In addition, specific standards of competency must be demonstrated for each of the different applicable categories of commercial pesticide application; agricultural pest control; (plants and animal); forest pest control; ornamental and turf pest control; seed treatment; aquatic pest control; right-of-way pest control; industrial, institutional, structural , and health-related pest control; public health pest control; regulatory pest control; and demonstration and research pest control.

In contrast, certification of a private pesticide applicator requires the applicator to demonstrate "a practical knowledge of the pest problems and pest control practices associated with his agricultural operations; proper storage, use, handling, and disposal of pesticides and containers; and his related legal responsibility" [40 CFR 171.5(a)]

d. Discuss the purpose and history of the Comprehensive Environmental Response, Compensation, and Liability Act/Superfund Amendments and Reauthorization Act (Superfund).

The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (42 U.S.C. Section 9601), also known as CERCLA and Superfund, became law on December 11, 1980 and has since undergone subsequent revisions under the Superfund Amendments and Reauthorization Act (SARA). CERCLA imposes cleanup and reporting requirements on the owners and operators of facilities and vessels where there is a release or a threatened release of a hazardous substance into the environment. While the Resource Conservation and Recovery Act (RCRA) provides regulatory control of active (and recently closed) waste management sites, CERCLA addresses the problem of contamination emanating from abandoned facilities, and from vessels and facilities not subject to RCRA. CERCLA provides a response mechanism for the release of a hazardous substance from any facility at any time. Under CERCLA, strict liability is imposed on potentially responsible parties (PRPs), providing the ability for EPA to order a cleanup by the PRPs or to undertake the cleanup and bill the responsible parties.

e. Explain how the Reportable Quantities (RQ) specified by Comprehensive Environmental Response, Compensation, and Liability Act are applied.

Under CERCLA, a reportable quantity (RQ) is defined as the quantity of a released hazardous substance which requires EPA notification under 40 CFR Part 302. Reportable quantities are determined in accordance with 40 CFR Section 302.4 for toxic chemicals (and Appendix B to this section for radionuclides), with the lowest RQ applying where two or more substances exist in the same event. For unlisted hazardous substances [under 40 CFR 302.4(b)], the reportable quantity is 100 pounds, except for those that exhibit extraction procedure (EP) toxicity per 40 CFR 261.24 and are subject to the RQs listed in

Table 302.4 under EP-toxic contaminants. In cases where more than one EP-toxic substance is present, the lowest RQ on the table applies. The reportable quantity applies to the waste as a whole, not just the toxic contaminant. Reportable quantities for non-nuclear hazardous substances range from one to five thousand pounds.

f. Describe the removal/cleanup actions required by Comprehensive Environmental Response, Compensation, and Liability Act/Resource Conservation and Recovery Act.

CERCLA response actions designated as removals (as opposed to remedial actions) must be completed within 12 months and at a cost of less than $2 million, except where: the continued action is in a response to an emergency; there is an immediate risk to public health, welfare, or the environment; it is part of an approved remedial action; or it is consistent with a remedial action to be taken [42 U.S.C. 9604(c)(1)].

Removal actions can include providing alternate water sources to offset the effects of groundwater pollution, immediate cleanup of a hazardous waste, or barrier erection around a contaminated site. Almost any short-term action that diminishes the threat to the public and/or the environmental can qualify as a removal action.

Under RCRA corrective action provisions (40 CFR 264.100 and 264.101) there is no time or financial limitation imposed on the cleanup action. The EPA Regional Administrator (or designated state official) may specify a period in which the cleanup action must commence. RCRA corrective actions require that a groundwater monitoring program be instituted and that cleanup of contaminants beyond the facility boundaries (except in limited circumstances) be instituted to meet the applicable groundwater protection standards, and to protect human health and the environment [40 CFR 264.100(d)].

g. Discuss the interface/coordination with Environmental Restoration efforts required by Comprehensive Environmental Response, Compensation, and Liability Act/Resource Conservation and Recovery Act.

The Environmental Protection Agency (EPA) proposed corrective action requirements for Solid Waste Management Units (SWMUs) under RCRA Subpart S to expand its corrective action regulatory authority to include the prompt cleanup of sites which pose an imminent hazard to the environment, to facilitate voluntary cleanups, to allow remedy selection streamlining, and to control the source of contamination through utilization of response actions that essentially duplicate those under CERCLA's National Contingency Plan response actions.

CERCLA has been used to supplement RCRA authority in cases where an owner or operator of a RCRA facility is unwilling or unable to pay for cleanup actions at a RCRA site, where cleanup success is hampered by inadequate financial guarantees to insure site cleanup, and where the EPA or State priorities for addressing the RCRA site are not likely to result in cleanup. Where RCRA provisions are adequate to insure site cleanup, CERCLA has deferred listing the site on the National Priorities List.

The National Contingency Plan (NCP) Section 300.425(b)(4) states that the EPA may exercise its authority under CERCLA, RCRA, or both to accomplish site remediation. In addition, if an "imminent and substantial" endangerment exists to human health and the environment, EPA may compel an immediate cleanup action through a RCRA Section 7003 order or an order under CERCLA Section 106.

At Federal facilities operating under RCRA hazardous waste treatment, storage, and disposal (TSD) permits, both CERCLA and RCRA may sometimes be interfaced. The interface is usually accomplished by a Federal Facilities Compliance Agreement that sets forth the authority of the state (RCRA) and EPA (CERCLA) in the specifics of environmental restoration.

h. Describe the application of the Emergency Planning and Community Right-to-Know Act to Department facilities (e.g., Toxic Release Inventory and coordination requirements with local emergency planning committees)

The Emergency Planning and Community Right-to-Know Act (EPCRTKA, 42 U.S.C. §§ 11001 to 11050) is intended to provide emergency planning and community information requirements. The Act sets forth reporting requirements for the following:

- Material Safety Data Sheet (MSDS) - DOE must have available an MSDS for all hazardous chemicals as defined by OSHA (29 U.S.C. § 651 et. seq.)
- Emergency and hazardous chemical inventory forms - DOE must fill out this form and give to local emergency planning committee, fire department, and state emergency response committee.
- Toxic chemical release forms - DOE must complete this form and submit to EPA or the state annually. The form covers toxic chemicals as listed in § 11023 (a) and (c).
- Emergency Response Plan - DOE must develop a emergency response plan for the local community.

The Act also provides for civil penalties and enforcement actions.

i. Describe the following types of waste defined by the Atomic Energy Act:

- High-level waste
- Transuranic waste
- Low-level waste
- Special nuclear material
- Source material

High-level waste – The highly radioactive and thermally hot waste material that results from the reprocessing of spent nuclear fuel, including liquid waste produced directly in reprocessing and any solid waste derived from the liquid, that contains a combination of transuranic waste and fission products in concentrations requiring permanent isolation.

Transuranic waste– Without regard to source or form, waste that is contaminated with alpha-emitting transuranium radionuclides with half-lives greater than 20 years and concentrations greater than 100 nCi/g at the time of assay. Other alpha contaminated wastes, peculiar to a specific DOE site, must also be managed as transuranic waste. Note: Half-life refers to the time required for a radioactive substance to lose 50 percent of its activity by decay. The half-life of the radioisotope plutonium-239, for example, is about 24,000 years.

Low-level waste– Waste that contains radioactivity and is not classified as high-level waste, transuranic waste, or spent nuclear fuel or byproduct material as defined by DOE Order 5820.2A. Test specimens of fissionable material irradiated for research and development only, and not for the production of power or plutonium, may be classified as low-level waste, providing the transuranic concentration is less than 100 nCi/g

Byproduct material– (a) Any radioactive material (except special nuclear material) yielded in, or made radioactive by, exposure to the radiation incident or to the process of producing or utilizing special nuclear material. For purposes of determining the applicability of the Resource Conservation and Recovery Act (RCRA) to any radioactive waste, the term "any radioactive material" refers only to the actual radionuclides dispersed or suspended in the waste substance. The non-radioactive hazardous waste component of the waste substance will be subject to regulation under RCRA; or (b) the tailings or waste produced by the extraction or concentration of uranium or thorium from any ore processed primarily for its source material content. Ore bodies depleted by uranium solution extraction operations and which remain underground do not constitute "byproduct material."

Special nuclear material– Includes plutonium, uranium-233, or uranium enriched in the isotopes uranium-233 or uranium-235.

Source material– Any physical or chemical form of uranium or thorium or ores that contains by weight 0.05% or more of uranium or thorium.

j. Discuss the Endangered Species Act consultation requirements.

Under the Endangered Species Act of 1973 (ESA) [50 CFR Part 17, Section 7(a)(1)], other Federal agencies are required to consult with the Secretary of the Interior to "utilize their authority if furtherance of the purposes of this Act by carrying out programs for the conservation of endangered species and threatened species" as listed within the Act. Conservation of endangered or threatened species includes preservation of their habitat as well as the species in question. In consultation with the Secretary, if it is determined that an endangered or threatened species may be present in the area of the Agency's proposed action (construction), the Agency must conduct a biological assessment [Section 7(b)] to be completed within 180 days of inception to determine whether the species in question is likely to be affected by this action. Agency resources nay not be irretrievably or irreversibly committed to any action which would "foreclose the formulation or implementation of any reasonable and prudent alternative measures" [50 CFR 7(d)].

k. Discuss the marking of PCS [PCBs] and PCB items required by the Toxic Substances Control Act.

Marking requirements for PCBs and PCB items are located in 40 CFR 761.40. Part 761.40 lists the containers, electrical components and assemblies, hydraulic and heat transfer systems, and transport vehicles that must be marked as containing PCBs (as well as electronic components that must be labeled "No PCBs"). PCB transformer locations must be marked in accordance with Part 761.40(j). Marking formats required on PCBs and PCB items are delineated in Part 761.45, stating: "letters and striping on a white or yellow background shall be sufficiently durable to equal or exceed the life (including storage for disposal)" of the PCB-containing material. For a large PCB item, the size of the marking is specified to be 6" x 6" (or 2" x 2" if the item will not accommodate the larger marking). For a small PCB item, marking dimensions are specified at 1" x 2," unless the item is too small for this marking, in which case the marking can be reduced to a minimum of 0.4" x 0.8".

l. Describe how the Federal Facilities Compliance Act will impact Department compliance actions.

The Federal Facilities Compliance Act (FFCA) requires the Secretary of the DOE to develop and submit site treatment plans (STPs) addressing the treatment of mixed wastes. Under the FFCA, RCRA was amended to include fines and penalties, applicable to Federal agencies, for the violation of RCRA provisions. Although DOE was exempted from these fines and penalties until after October 8, 1995, it retains its exemption after this date in cases where it is operating in compliance with an approved plan and order. DOE has been unable to comply with RCRA in the past due to insufficient treatment capacity, and in certain cases, a lack of adequate treatment technology for mixed wastes.

DOE is required to develop 35 STPs and compliance orders for 38 sites located in 20 states that currently generate or store mixed wastes. As of October 1995, negotiations have been completed on 28 plans, and one plan has been finalized. These site treatment plans identify the timetables for compliance and development of treatment capacity for each specific site. For wastes that currently have no available treatment technologies, the FFCA requires the submittal of schedules relating to research and development for these technologies.

Although the FFCA does not require the DOE to address the disposal of treated mixed wastes, DOE and the states are evaluating disposal options and potential disposal sites with the realization that disposal is an integral part of mixed waste management.

(Information derived from DOE electronic publication on the DOE-FFCA Internet BBS.)

2.7 Environmental compliance personnel shall demonstrate a working level knowledge of the following Department of Energy (DOE) Orders:

- DOE Order 5400.1, General Environmental Protection Program
- DOE Order 5400.2A, Environmental Compliance Issue Coordination

Note: At the time this section was written, Order 231.1, Safety and Health Reporting Requirements, canceled DOE Order 5400.2A, Paragraphs 5a(2) and 5a(7): However, this cancellation does not, by itself, modify or otherwise effect any contractual obligation to comply with paragraphs of Orders. Canceled paragraphs incorporated into a contract shall remain in effect until the contract is modified to delete the reference of the requirements in the canceled Orders. The study guide introduction provides World Wide Web (WWW) locations to check for the latest information.

Supporting Knowledge and/or Skills

a. Discuss the relationship between Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and DOE Order 5400.1, General Environmental Protection Program.

DOE Order 5400.1 establishes environmental protection program requirements, authorities, and responsibilities for DOE operations. The purpose of this Order is to assure compliance with applicable Federal, state, and local environmental protection laws and regulations (including CERCLA), Executive Orders, and internal DOE policies. DOE Order 5400.1 defines environmental protection requirements and provides a detailed list of applicable Federal environmental protection standards that are mandatory for DOE operations and facilities.

CERCLA has major provisions designed to address comprehensively the problems associated with hazardous waste sites. CERCLA provides EPA the authority to clean up these sites under the response or remedial provisions and details the procedures and standards which must be followed in remediating these sites. CERCLA also contains provisions specifying when releases of hazardous substances must be reported and the procedures to be followed for the cleanup of Federal facilities. Hazardous substances are defined in CERCLA Section 101, and are defined by reference to other environmental statutes. They include hazardous wastes under RCRA, hazardous substances and toxic pollutants under the CWA, hazardous air pollutants under the CAA, and imminently hazardous chemical substances under Toxic Substance Control Act (TSCA).

Chapter II of the Order [5400.1, II(2)(a)] requires that field organizations and DOE contractors notify the Headquarters Emergency Operations Center (EOC) of the significant non-routine release of any hazardous substance (that is, releases reportable under CERCLA). Notification to the EOC shall be concurrent with notification to regulatory agencies.

b. Describe the requirements, deadlines, and update frequency for the following Plans mandated by DOE Order 5400.1, General Environmental Protection Program (Table 2.7-1):

- Environmental Protection Implementation Plan
- Groundwater Protection Management Program
- Long-Range Environmental Protection Plan
- Waste Minimization Plan
- Pollution Prevention (Protection) Program
- Environmental Monitoring Plan
- Pollution Abatement Projects 5-year Plan

Environmental Protection Implementation Plan (5400.1, III(2)). Each field organization is required to prepare a plan for implementing the requirements of this Order. The implementation plan shall:

- Provide environmental protection goals and objectives for each facility or group of facilities, and identify strategies and time-tables for attaining them; Organization and staffing, including the assignment of responsibilities for environmental activities, policies, facility operating procedures, and budgeting, will be described;
- Provide an overall framework for the design and implementation of an environmental protection program for each DOE facility;
- Assign responsibilities for complying with requirements under all Federal, state, and local environmental laws and/or regulations for all DOE facilities; and,
- Be prepared no later than 12 months after the effective date of this Order (November 9, 1988) and updated annually (canceled September 30, 1995 by DOE Order 231.1).

Groundwater Protection Management Program (5400.1, III(4)(a)). Each field organization must prepare a plan that reflects the following Groundwater Protection Management Program requirements:

- Documentation of the groundwater regime with respect to quantity and quality;
- Design and implementation of a groundwater monitoring program to support resource management and comply with applicable environmental laws and regulations;
- Management program for groundwater protection and remediation, including specific Safe Drinking Water Act (SDWA), RCRA, and CERCLA actions;
- Summary and identification of areas that may be contaminated by hazardous substances;
- Strategies for controlling sources of these contaminants;
- Remedial action program that is part of the site CERCLA program required by DOE Order 5400.4; and,
- Decontamination and decommissioning, and other remedial programs contained in DOE directives.

Plans, permits, and other technical documents such as those associated with compliance with the SDWA, RCRA, and CERCLA may be used in whole or in part to satisfy this requirement. This plan shall be completed no later than 18 months after the effective date of this Order (November 9, 1988) and shall be reviewed annually and updated every 3 years.

Long-Range Environmental Protection Plan (5400.1, II(3)) Each field organization must develop a Long-Range Environmental Protection Plan that shall:

- Identify requirements;
- Compare operations against requirements to identify needs;
- Establish strategies for meeting identified needs;
- Identify activities required to implement the strategies; and,
- Identify needed resources and develop a schedule to accomplish those activities.

No time frame is given in the Order for the completion or updating of the Long-Range Environmental Protection Plan.

Waste Minimization Plan (5400.1, III(4)(b)) – Each field organization must prepare a plan that reflects the following Waste Minimization Program requirements:

- Goals for minimizing the volume and toxicity of all wastes that are generated, with annual reductions if programmatic requirements allow;
- Changes in waste quantity, volume, and toxicity that are achieved shall be compared with quantities generated in the previous year;
- Proposed methods of treatment, storage, and disposal that accomplish waste minimization that are technically and economically practicable shall be reported as appropriate;
- Waste minimization plans required by specific legislation, such as RCRA, shall be included as a part of this program plan; and,
- Completion shall be no later than 18 months after the effective date of this Order (November 9, 1988) and plans shall be reviewed annually and updated every 3 years.

Pollution Prevention (Awareness) Program (5400.1, III(4)(c)) – Each field organization shall prepare a plan that reflects the following Pollution Prevention Awareness Program requirements:

- Identify specifically in the environmental protection statement;
- Recognize in all mission statements and project plans a requirement for pollution prevention, where appropriate;
- Document pollution prevention awareness program, including elements for employee awareness through specific training, special awareness campaigns, and incentive and awareness programs; and,

- Complete plans no later than 12 months after the effective date of this Order (November 9, 1988) and review annually and update every 3 years.

Environmental Monitoring Plan (5400.1, IV(4)) – A written environmental monitoring plan shall be prepared for each site, facility, or process that uses, generates, releases, or manages significant pollutants or hazardous materials. The plan shall contain the following:

- Rationale and design criteria for the monitoring program;
- Extent and frequency of monitoring and measurements;
- Procedures for laboratory analyses;
- Quality assurance (QA) requirements;
- Program implementation procedures; and,
- Direction for the preparation and disposition of reports.

The plan shall identify and discuss two major activities:

- Effluent monitoring
- Environmental surveillance

The plan shall be reviewed annually and updated every 3 years.

Pollution Abatement Projects 5-year Plan (5400.1, II(3)) – Departmental pollution abatement projects shall be reported in a 5-year plan as required by Office of Management and Budget (OMB) Circular A-106. Field organizations shall submit their reports semiannually to DOE Environmental, Safety, and Health (EH-1) on dates determined by EH-1, but no later than May 1st and December 15th of each year. Confirmatory reports are to be submitted when there are no pollution abatement projects planned or underway.

Table 2.7-1
Environmental Protection Reporting Requirements from DOE Order 5400.1

Requirements	Deadlines	Update Frequency
Environmental Protection Implementation Plan	12 months from November 9, 1988	Canceled September 30, 1995 by DOE Order 231.1
Groundwater Protection Management Program	18 months after November 9, 1988	Reviewed annually Updated every 3 years
Long-Range Environmental Protection Plan	No date given	No update frequency given
Waste Minimization Plan	18 months after November 9, 1988	Reviewed annually Updated every 3 years
Pollution Prevention Awareness Program	12 months from November 9, 1988	Reviewed annually Updated every 3 years
Environmental Monitoring Plan	No date given	Reviewed annually Updated every 3 years
Pollution Abatement Projects 5-year Plan	No later than May 1 and December 15 of each year	Semiannually

c. Explain the Environmental Compliance Issue Coordination and Reporting outlined in DOE Order 5400.2, Environmental Compliance Issue Coordination.

DOE Order 5400.2A establishes DOE requirements for coordination of significant environmental compliance issues to ensure timely development and consistent application of Departmental environmental policy.

"Significant environmental compliance issues" are issues that are or have the potential of being precedent-setting or controversial, and/or involve Headquarters (HQ) notification, concurrence, or approval. Examples include:

- Settlement agreements;
- Hazardous waste and mixed waste permits and permit applications;
- Proposed consent decrees and consent administrative orders;
- Notices of violations;
- Proposed Federal Facility Compliance Agreements;
- Memoranda of understanding;
- Lawsuits;
- Notices of intent to sue; and,
- Results of verification activities (such as, audits, inspections, appraisals, assessments, etc.).

To assure timely coordination of such issues, all field organizations are responsible for notifying and coordinating with appropriate HQ and field elements. The Assistant Secretary for Environment, Safety, and Health (EH-1) is responsible for coordinating with

HQ and field personnel on environmental compliance issues. EH-1 selects an appropriate lead HQ or field personnel to coordinate actions. The lead office is responsible for coordinating, documenting, resolving, and reporting on the assigned environmental compliance issue with appropriate HQ and field personnel.

2.8 Environmental compliance personnel shall demonstrate a working level knowledge of the management and negotiation of regulatory agreements and permits.

Supporting Knowledge and/or Skills

a. Describe the responsibilities involved with the management of the following documents:

- National Pollutant Discharge Elimination System Permit
- Federal Facility Agreement
- Consent Orders & Settlement Agreements
- Record Of Decision
- Resource Conservation and Recovery Act Part B Permit
- Grant conditions

National Pollutant Discharge Elimination System (NPDES) Permit – An NPDES permit allows discharge of pollutants from a point source into waters of the United States; the permit gives the right to discharge specific pollutants from specific outfalls, generally for a period of five years.

The NPDES permit provides an enforceable document which establishes effluent limitations; monitoring and reporting requirements; system operation and maintenance responsibilities; recordkeeping requirements; and inspection and entry provisions. An NPDES permit may require use of best management practices. The permit may also contain a schedule of compliance in situations where the permittee can not come into compliance with the permit requirements immediately.

NPDES implementation and enforcement depends largely on self-monitoring. As a consequence, dischargers are required to keep stipulated records and report results on standardized reports (discharge monitoring reports).

Proper management of a site permitted through NPDES, therefore, requires sufficient internal controls to assure recordkeeping requirements are followed and reporting requirements are complied with per permit terms and conditions.

Federal Facility Agreement

CERCLA – The SARA Amendments to CERCLA (1986) enacted an entire section devoted to the cleanup of Federal facilities (Section 120). CERCLA Section 120 requires substantive and procedural cleanup of Federal facilities to the same extent as any private company or firm. CERCLA contains waivers of sovereign immunity for Federal agencies; individuals and states may bring cost recovery actions and citizens may bring suits against Federal facilities. Requirements of CERCLA Section 120 include:

- Requirements associated with listing sites on the National Priority List (NPL) (site assessments, hazardous ranking, evaluation procedures); and,
- Creation of a Federal Agency Hazardous Waste Compliance Docket which lists facilities which manage hazardous waste or have potential hazardous waste issues.

Once sites are listed on the Compliance Docket, timetables are prepared for addressing problems. Within 18 months, preliminary assessments and site inspections are required. The facility is then scored under the hazardous ranking system to place it on the NPL. If listed, the facility must begin a Remedial Investigation/Feasibility Study (RI/FS) within six months. During the RI/FS stage, consultation with EPA must occur. Within 180 days of EPA's review of the RI/FS, an interagency agreement (for remedy selection) between EPA and the agency must be signed. Once signed, management of a Federal facility agreement requires a complete understanding of compliance schedules, performance standards, and reporting requirements.

RCRA – The Federal Facility Compliance Act of 1992 (FFCA) amended RCRA. The FFCA waived sovereign immunity with respect to the imposition of administrative and civil fines and penalties against Federal agencies. Agencies, therefore, could be fined for violations of Federal, state, and local statutes associated with hazardous waste management (handling, transport, treatment, storage, and disposal of solid and hazardous wastes). The practical effect of this legislation is that Federal agencies, for the purposes of environmental enforcement penalty actions, are in similar positions as private and commercial entities.

The FFCA provides EPA with authority to issue administrative compliance orders. The agency has 30 days from the date of receipt of the compliance order to file a response. Informal settlement conferences and exchanges are attempted to resolve issues. If those fail, cases may proceed to an administrative law judge for resolution.

Consent Orders & Settlement Agreements – Settlements with the EPA are usually formalized in a CERCLA consent decree or a consent order (administrative order on consent). A consent decree is filed with and signed by a Federal court. A consent order, on the other hand, does not require judicial action.

Management of consent orders and settlement agreements require a complete understanding of compliance schedules, performance standards, and reporting requirements. Failure to meet commitments may result in payment of stipulated penalties for non-compliance.

Record Of Decision– After completion of the RI/FS, the agency issues a Record of Decision (ROD) to summarize the selected remedy as supported by facts, analyses of facts, and site specific policy determinations.

After a public comment review period and public hearings, a final ROD is published. The agency is responsible for implementing all remedial actions identified in the ROD. Managing the requirements of the remediation effort require an understanding of the remediation selection and an implementation plan to complete cleanup requirements.

Resource Conservation and Recovery Act Part B Permit RCRA requires owners and operators of Treatment, Storage, and Disposal (TSD) units to get a permit per RCRA Section 3005. A Permit A application contains basic facility information. A Permit B application is a detailed document that provides information demonstrating compliance with applicable technical standards for TSD facilities, including written plans and procedures related to facility operations. Technical standards for a facility will be governed by the annual RCRA permit. States with delegation authority from EPA administer programs to review applications and issue permits. Permits are issued when the facility has been found to comply with all relevant RCRA requirements.

Under RCRA, EPA can take several types of enforcement action; administrative orders and civil and criminal penalties can be imposed on TSD facilities. Violators may be issued a compliance order or EPA may seek injunctive relief in a U.S. District Court. Failure to comply with an administrative order may result in either suspension or revocation of a facility's RCRA permit. Civil penalties may be levied for up to $25,000 for per day per violation. In addition, criminal penalties may be imposed for up to $50,000, two years in prison, or both for knowingly committing certain violations. Violations for knowing endangerment may result in fines of up to $250,000 and up to fifteen years imprisonment.

Government officials responsible for management of RCRA Part B Permits, therefore, should clearly consider the message sent by Congress that more rigorous enforcement of hazardous waste laws is intended. Responsible officials should be familiar with all RCRA Part B Permit requirements and assure internal controls are sufficient to ensure compliance.

Grant conditions– Under certain circumstances the building of a component/portion of a wastewater treatment system may be justified in advance of completing all NEPA requirements for the remainder of the system(s). When there are overriding considerations of cost or impaired program effectiveness, the responsible official may award a construction grant, or approve procurement by other than EPA funds, for a discrete component of a complete wastewater treatment system(s). The process of partitioning the environmental review for the discrete component shall comply with the criteria and procedures described below in the “Criteria for partitioning.” In addition, all reasonable alternatives for the overall wastewater treatment works system(s) of which the component is a part shall have been previously identified.

Criteria for partitioning:

- Projects may be partitioned under the following circumstances:

  ◊ To overcome impaired program effectiveness, the project component must immediately remedy a severe public health, water quality or other environmental problem; or,
  ◊ To significantly reduce direct costs on EPA projects, or other related public works projects, the project component (such as major pieces of equipment, portions of conveyances or small structures) must achieve a cost savings to the Federal government and/or to the grantee's or potential grantee's overall costs incurred in procuring the wastewater treatment component(s) and/or the installation of other related public works projects funded in coordination with other Federal, state, tribal or local agencies.

- The project component also must:

  ◊ Not foreclose any reasonable alternatives identified for the overall wastewater treatment works system(s);
  ◊ Not cause significant adverse direct or indirect environmental impacts including those which cannot be acceptably mitigated without completing the entire wastewater treatment system of which the component is a part; and
  ◊ Not be highly controversial.

(50 FR 26317, June 25, 1985, as amended at 51 FR 32612, Sept. 12, 1986)

b. Discuss the requirements and methods of negotiation for the following documents:

- National Pollutant Discharge Elimination System Permit;
- Federal Facility Agreement;
- Consent Orders & Settlement Agreements;
- Record Of Decision;
- Resource Conservation and Recovery Act Part B Permit; and,
- Grant conditions.

National Pollutant Discharge Elimination System Permit While much of the language in a NPDES permit is standardized (boilerplate), permittees may negotiate certain conditions and terms. Permit conditions should not be accepted if such restrictions place an undue burden on the facility.

Federal Facility Agreement

CERCLA – Under CERCLA 120 negotiation opportunities exist when, after completion of the RI/FS, consultation with the EPA is initiated. The RI/FS provides the agency's strategy for remediating the site. EPA's agreement with the selection of the proposed remediation plan is essential. Once agreement is achieved, the two Federal agencies can enter into an interagency agreement.

RCRA – The FFCA provides EPA with authority to issue administrative compliance orders. The agency has 30 days from the date of receipt of the compliance order to file a response. Informal settlement conferences and exchanges are attempted to resolve issues. If those fail, cases may proceed to an administrative law judge for resolution. An opportunity for negotiation and agreement exists, therefore, during informal settlement conferences and exchanges. If those fail, an administrative law judge will determine the settlement.

Further, negotiation opportunities exist in determining appropriate facility penalties. Generally, penalty amounts have been decreased considerably through exchanges and negotiations. In some situations, supplemental environmental projects have been substituted for payment of penalties and fines.

Consent Order & Settlement Agreements – Settlements with EPA are negotiated, then formalized into consent decrees or orders. Terms and conditions of CERCLA consent decrees and orders have historically been heavily negotiated between EPA and potential settlers. Recent trends, however, have resulted in the drafting of model consent decrees and orders, which are much less subject to negotiation. Potential settlers, however, should continue to negotiate in good faith regarding terms and conditions that are considered appropriate for their site and/or facility.

While many CERCLA cases have gone to court, the majority have been resolved through settlement procedures. The preferred option for EPA, settlement, saves financial and staff resources. In addition, settlement agreements offer Potentially Responsible Parties (PRPs) more control over remediation selection. Some control, in addition to the elimination of a need to litigate, may help control costs. While negotiations may be difficult, and possibly protracted and costly (especially given multi-party sites), negotiations often result in settlement agreements.

In the past, EPA's strong stance toward remediation actions and settlement terms and conditions have resulted in some PRPs performing cleanups under routinely issued EPA Section 106 administrative orders. In addition, restrictive CERCLA provisions, the publication and implementation of EPA guidance, and use of model settlement agreements have resulted in less EPA flexibility.

Nonetheless, CERCLA settlements are subject to a great amount of negotiation. The following issues commonly arise in CERCLA settlements and are subject to negotiations. Because of the frequency of occurrence of these issues in CERCLA settlements, Section 122 and individual EPA guidance discuss them in greater detail.

- "Mixed funding" determinations (partial funding by the Superfund), especially if the sites are found to be multi-party (has multiple PRPs), may be negotiated. EPA, for example, has authority to provide funds for CERCLA sites, especially to fund "orphan shares" for cleanup responsibilities of companies that have gone bankrupt or are defunct. In addition, EPA has authority to "carve out" a portion of its costs or remediation costs to be funded by non-settling PRPs;
- Incorporation of "not to sue" covenants in agreements, to assure that EPA will not sue in the future, may be a negotiation point. Given that negotiation of a settlement with EPA does not assure a complete release from future liability, such covenants provide a commitment by EPA not to sue, except in certain designated circumstances. In addition, covenants not to sue must be accompanied by reopeners (a provision which allows EPA to sue for future liability for unknown conditions);
- Settlements for de minimis level of responsibility may be agreed upon by EPA and PRPs. At many multi-party sites, a large number of companies may have disposed of small quantities of hazardous substances. In return for a premium payment, de minimis parties may receive a settlement of real finality, which assures no future requirement to participate in future remediation activities; and,
- Agreement on stipulated penalties in the event that milestones were not met may be incorporated into settlement language. The use and amount of such penalties are subject to negotiation. EPA ties penalties to compliance schedules, performance standards, and reporting requirements.

Record Of Decision– Under CERCLA 120, negotiation opportunities exist when, after completion of the RI/FS, consultation with the EPA is initiated. The RI/FS provides the agency's strategy for remediating the site. EPA's agreement with the selection of the proposed remediation plan is essential. Once agreement is achieved, the two Federal agencies can enter into an interagency agreement.

After completion of the RI/FS, the agency issues a Record of Decision (ROD) to summarize the selected remedy as supported by facts, analyses of facts, and site specific policy determinations. The EPA and other stakeholders have the opportunity to review and comment on the ROD. Comments are reviewed by the agency and either incorporated or not incorporated (with justification). A Responsiveness Summary is prepared by the agency summarizing the disposition of all comments. Differences between the agency and the EPA may be negotiated prior to final publication of the ROD.

Resource Conservation and Recovery Act Part B Permit– RCRA Part B Permit requirements are subject to negotiation and agreement. Such requirements should be

negotiated in good faith with the regulators. A Permit B application is a detailed document that provides information demonstrating compliance with applicable technical standards for TSD facilities, including written plans and procedures related to facility operations. Since technical standards for a facility will be governed by the final RCRA permit, negotiation opportunities exist in defining appropriate technical standards for the facility.

Grant conditions

Requests for partitioning: The applicant's or state's request for partitioning must contain the following:

- A description of the discrete component proposed for construction before completing the environmental review of the entire facilities plan;
- How the component meets the above criteria;
- The environmental information required by this subpart for the component; and,
- Any preliminary information that may be important to EPA in an Environmental Impact Statement (EIS) determination for the entire facilities plan.

Approval of requests for partitioning: The responsible official shall:

- Review the request for partitioning against all requirements of this subpart;
- If approvable, prepare and issue a Finding of No Significant Impact (FONSI); and,
- Include a grant condition prohibiting the building of additional or different components of the entire facilities system(s) in the planning area.

(50 FR 26317, June 25, 1985, as amended at 51 FR 32612, Sept. 12, 1986)]

Facilities plan approval: Before awarding grant assistance for any project, the Regional Administrator shall approve the facilities plan and final design drawings and specifications and determine that the applicant and the applicant's project have met all the applicable requirements.

Agreement on eligible costs:

- The Regional Administrator and the grant applicant will enter into a written agreement which will specify the items in the proposed project that are eligible for Federal payments and which shall be incorporated as a special grant condition in the grant award; and,
- Notwithstanding such agreement, the Regional Administrator may:
    - ◊ Modify eligibility determinations that are found to violate applicable Federal statutes and regulations;
    - ◊ Conduct an audit of the project;

- ◊ Withhold or recover Federal funds for costs that are found to be unreasonable, unsupported by adequate documentation or otherwise unallowable under applicable Federal cost principles; and,
- ◊ Withhold or recover Federal funds for costs that are incurred on a project that fails to meet the design specifications or effluent limitations contained in the grant agreement and NPDES permit issued under Section 402 of the Act.

(55 FR 27096, June 29, 1990)

2.9 Environmental compliance personnel shall demonstrate a familiarity level knowledge of how environmental laws and regulations are enforced.

Supporting Knowledge and/or Skills

a. Discuss the interrelationship between the following:

- Environmental law
- Statutory construction
- The United States Code
- The Code of Federal Regulations
- State Laws and Regulations

Environmental law consists of a system utilizing all of the laws within the U.S. legal system to minimize, prevent, punish, or remedy actions which damage or threaten to damage the public health and safety or the environment. **Statutes or Executive Orders empower an administrative agency (i.e., EPA) to develop and promulgate regulations.** Statutes direct and authorize, while regulations detail implementation. When a statute is passed through both Houses of Congress, and is signed into law by the President (or not vetoed), it becomes the authorization and guidance to a regulating agency to establish a regulation, and is published in the **United States Code** (USC). The regulating agency formulates and promulgates the proposed regulation by publishing it in the Federal Register to allow for public review and comment. When finalized, the regulation is again published in the Federal Register in its amended form to become law. These final regulations are combined annually into the **Code of Federal Regulations** (CFR). **State laws and regulations** are passed in the same manner as Federal laws, except they require the signature of the state's Governor to become law. With respect to environmental laws, the states can enact laws and regulations more stringent than their Federal counterparts, but no less stringent or they are prone to preemption.

b. Describe the organization, mission, and enforcement authorities of the Environmental Protection Agency (EPA).

EPA Organization – The United States Environmental Protection Agency (EPA) is directed by an Administrator and Deputy Administrator who are appointed by the President and subject to the approval of the Senate. The President also appoints the EPA's Inspector General, General Counsel, and nine Assistant Administrators – each subject to Senate confirmation. The nine Assistant Administrators are charged with management of specific programs (protection of air, water, and land resources; direction of Agency functions; and environmental law enforcement). In addition, three Associate Administrators are appointed by the Administrator and tasked with the execution of programs for public affairs, congressional and legislative relations, and regional, state, and local relations. Ten Regional Administrators have the task of interfacing with state and local governments to achieve the Agency's mission (EPA Internet Homepage posted 2/15/96).

EPA Mission – The mission of the EPA, as mandated by Congress and the President, is the protection of the Nation's land, air, and water resources through actions leading to a balance between human activities and the capacity for natural systems to nurture and support life. Activities in support of this mission include the identification, assessment, and management of serious risks to the public health and the environment, and performance of research, development, and technical assistance to achieve Agency goals. EPA works with state, county, municipal, and tribal governments to fulfill its mission, as well as soliciting public involvement to this end.

EPA Enforcement Authorities – The EPA is organized into offices for the enforcement of environmental regulations and the management of Agency functions as follows:

- The Office of Water administers the Safe Drinking Water Act, the Clean Water Act, and the Ocean Dumping Ban Act of 1988, and all aspects of other laws pertaining to water quality, including oversight of state delegated water programs;
- The Office of Air and Radiation enforces the Clean Air Act, sets the National Ambient Air Quality Standards, and establishes criteria, standards, and policies to control radiation and indoor air pollution exposures;
- The Office of Solid Waste and Emergency Response administers the provisions of the Resource Conservation and Recovery Act, the Comprehensive Environmental Response, Compensation and Liability Act, and the Emergency Planning and Community Right-to-Know Act, including oversight of state delegated actions;
- The Office of Pollution Prevention, Pesticides, and Toxic Substances enforces the provisions of the Federal Insecticide, Fungicide, and Rodenticide Act, the Toxic Substances Control Act, and establishes tolerances for pesticide residues in foods under the Federal Food, Drug, and Cosmetics Act; and,
- The Office of Enforcement and Compliance Assurance enforces environmental laws by investigating and preparing cases for judicial action as necessary. The National Environmental Policy Act and other regulations pertaining to Federal agencies are administered by this office. Seven other Offices exist within the EPA, but are tasked with nonenforcement tasks, and as such will not be described.

c. Discuss the role of the Department's legal counsel in environmental compliance activities.

The Department of Energy (DOE) Office of the General Counsel coordinates with the Assistant Secretary for Environment, Safety, and Health (through the Office of Environmental Guidance and Compliance) on significant environmental compliance issues. A significant issue is defined in DOE Order 5400.2A as issues that are controversial, precedence setting (or have the potential to be), or involve DOE headquarters. The Office of the Counsel General is expected to provide advice and assistance on these compliance issues, and others including: settlements, permits and applications, consent decrees and administrative orders, notices of violations, notices from regulating agencies, proposal

agreements and memoranda of understanding, lawsuits, verification (inspection and audit) activities, and reports from regulators. In addition, the Counsel General is responsible for informing the Office of Environmental Guidance and Compliance of any compliance issues that come to their attention independently and are in need of resolution (DOE Order 5400.2A).

d. Discuss the enforcement of environmental statutes under civil and criminal authorities.

Under environmental statutes, enforcement actions can be initiated by several sources. Certain environmental statutes can be enforced, with limited exceptions, only through Federal action-- for example, the Toxic Substances Control Act. EPA, or the regulating agency, can issue administrative penalties and compliance orders. However, in cases where larger penalties are imposed and/or involving court action, EPA is required to seek prosecution through the Department of Justice. In states where enforcement of regulations have been delegated, the state may undertake legislative action in accordance with Federal guidelines (and subject to Federal oversight if exercised). In cases where authority has been delegated to the states, the state, Federal government, or both may exercise enforcement rights. If the statute being enforced is unique to the state (and has no Federal counterpart), the state has the entire responsibility for enforcement. Local laws are enforced by local governments. While criminal enforcement actions are primarily the province of governments, civil actions may be initiated by individuals under “citizen suit" provisions in a variety of environmental regulations. In addition, common law suits by individuals are viable as a means of recovering damages suffered for monetary loss or the loss of use of property as a result of an environmental violation.

Enforcement of environmental laws is achieved through the imposition of various liabilities ranging from administrative fines (a civil penalty) through criminal prosecution. Factors such as the nature of the violation, consequence of the violation, culpability, the particular regulation or law violated, and the party initiating legal action determine the legal avenue to be pursued in redress of the violation. Liabilities fall into three general categories—penalties (civil and criminal), remedy requirements, and compensation requirements. Environmental penalties may be imposed where a violation exists, regardless of actual injury. Penalties can be administrative (civil) or criminal depending on the degree of culpability or blame which is attached to the violation. Culpability is determined based on the intent of the violator and on the absence of “due care.” Civil and administrative penalties comprise the majority of penalties imposed and can take the form of monetary fines ranging from $5 to $25,000 per day per violation. Civil penalties are a result of actions filed in civil courts, while administrative penalties are levied by the regulating agency. In cases where the violator appeals an administrative action or refuses to pay the fine, the case will be referred to the civil court system. Certain environmental statutes (CERCLA, EPCRA, and the Clean Water Act) exercise two classes of administrative penalties. Class I penalties (approximately $10 to $25,000) are imposed with a minimum of formality and no hearing of record. Class II penalties may cost $25,000 per day per violation and require an on-the-record hearing. Civil and administrative penalties may be negotiated with the regulating agency prior to judicial

decision, they may be contained in compliance agreements, and imposed as part of a judicial decree. Criminal penalties for environmental violations are incurred for the commission of a prohibited act or the omission of a required act under an environmental regulation, in conjunction with an element of culpability (i.e., "reckless and willful misconduct"). Criminal penalties can result in imprisonment, in addition to monetary fines, and can be directed against individuals within an organization as well as the organization. Criminal charges are sought after for knowing violations, negligent violations, violation of notice requirements and issuing false statements, and endangerment. The second category of liability is the requirement to respond to (cleanup) the results of an environmental violation. Three primary statutes require response actions-- the Clean Water Act (and sections of the Oil Pollution Act), CERCLA, and RCRA. The third category of liability is the requirement to compensate for the harm caused by the violation. Compensation is in addition to any fines levied and is usually the result of a "toxic tort" suit or an action to recover natural resource damages.

e. Describe the Executive Orders pertaining to environmental protection and compliance.

There are numerous Executive Orders addressing a wide variety of topics from floodplain management, to Federal activities abroad, to administrative and contracting issues, to emergency preparedness. The following list outlines a few key Executive Orders on environmental protection and compliance. This list is in no way exhaustive.

Executive Order 12088, "Federal Compliance with Pollution Control Standards," requires that all Federal facilities and activities comply with applicable pollution control standards.

Executive Order 12580, "Superfund Implementation," delegates to various Federal officials the responsibilities vested in the President for implementing the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA or Superfund) and the Superfund Amendments and Reauthorization Act of 1986 (SARA). [The Order delegates most of these responsibilities to the Administrator of the Environmental Protections Agency (EPA), but several are delegated to the heads of Federal agencies, including DOE.]

Executive Order 11490, "Assigning Preparedness Functions to Federal Departments and Agencies," requires Federal agencies to establish emergency preparedness programs.

Executive Order 11988, "Floodplain Management," requires Federal agencies to establish procedures to ensure that the potential effects of flood hazards and floodplains management are considered for any action undertaken in a floodplain, and that the floodplain impacts be avoided to the extent practicable.

Executive Order 11990, "Protection of Wetlands," requires governmental agencies to avoid, to the extent practicable, any short- or long-term adverse impacts on wetlands as they are designated by the Corps of Engineers.

Executive Order 12196, "Occupational Safety and Health Programs for Federal Employees," establishes the requirement for Federal agencies to provide occupational safety and health programs for their employees.

Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," directs each Federal agency to make environmental justice part of its mission by identifying and addressing disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations.

Executive Order 12873, "Federal Agency Recycling and the Council on Federal Recycling and Procurement Policy," establishes requirements for recycling, waste prevention, and Federal acquisition of environmentally preferred and recycled products and services.

Executive Order 11514, "National Environmental Policy Act," requires Federal agencies to monitor and control their activities continually to protect and enhance the quality of the environment.

Executive Order 11593, "Protection and Enhancement of the Cultural Environment," requires Federal agencies, including DOE, to locate, inventory, and nominate properties under their jurisdiction or control to the National Register of Historic Places if those properties qualify for inclusion.

Executive Order 12856, "Right-to-Know Laws and Pollution Prevention Requirements," requires all Federal agencies to reduce and report toxic chemicals entering any waste stream. It improves emergency planning, response, and accident notification procedures and encourages clean technologies and testing of innovative prevention technologies.

4. MANAGEMENT, ASSESSMENT, AND OVERSIGHT

4.1 ***Environmental compliance personnel shall demonstrate the ability to appraise the contractor's program(s) and/or permits to assess compliance with the requirements for the environmental medium of air.***

The following section includes a number of demonstration requirements. To complete this section, environmental compliance personnel must demonstrate competency by completing a formal task or assignment. For example, an individual completing the CAA qualification requirements must evaluate a CAA permit. Reference information that may be helpful in completing the demonstration requirements that are found in this study guide include: (1) the references identified in the footnotes of relevant study guide section; and (2) relevant section of the study guide. (Note that relevant sections are identified below.)

Supporting Knowledge and/or Skills

a. Given a proposed permit application, evaluate the requirements, including monitoring and reporting, established by the regulations that implement the Clean Air Act.

This is a demonstration skill and an individual will actually be performing the activity rather than acknowledging comprehension. Information for this topic is located in Section 2.1(c)..

b. Given an existing or proposed permit application, verify compliance with requirements in the regulations that implement the Clean Air Act for the prevention of significant deterioration (PSD).

This is a demonstration skill and an individual will actually be performing the activity rather than acknowledging comprehension. Information for this topic is located in Section 2.1(d).

c. Given a permitted source, conduct an assessment to verify compliance with the emission limitations per the Clean Air Act, Title I.

This is a demonstration skill and an individual will actually be performing the activity rather than acknowledging comprehension. Information for this topic is located in Section 2.1(f).

d. Given a proposed permit, verify that the administrative controls are in place/planned to establish acceptable limits of air quality.

This is a demonstration skill and an individual will actually be performing the activity rather than acknowledging comprehension. Information for this topic is located in Section 2.1.

e. Given an air permit or a permit application, evaluate the source against the operating conditions in the permit or the permit application

This is a demonstration skill and an individual will actually be performing the activity rather than acknowledging comprehension. Information for this topic is located in Section 2.1.

f. Given an existing permitted source, evaluate the source's future operating requirements in terms of the constraints imposed by their current permit.

This is a demonstration skill and an individual will actually be performing the activity rather than acknowledging comprehension. Information for this topic is located in Section 2.1.

g. Given a proposed source, evaluate the source for all present applicable Federal and state regulations.

This is a demonstration skill and an individual will actually be performing the activity rather than acknowledging comprehension. Information for this topic is located in Section 2.1. State requirements applicable to the facility should be researched.

h. Conduct an appraisal to assess compliance with polychlorinated biphenyls (PCB) waste management activities according to the Toxic Substances Compliance Act (TSCA).

This is a demonstration skill and an individual will actually be performing the activity rather than acknowledging comprehension Information for this topic is located in Sections 2.3(m) and 2.6(k).

4.2 ***Environmental compliance personnel shall demonstrate the ability to appraise the contractor's program(s) and/or permits to assess compliance with the requirements for the environmental medium of water.***

Supporting Knowledge and/or Skills

a. Given a proposed permit, verify that the Water Quality Criteria and Stream Use Classification as identified in the Clean Water Act has been correctly applied.

This is a demonstration skill and an individual will actually be performing the activity rather than acknowledging comprehension. Information for this topic is located in Section 2.2(b).

b. Review the contractor's program for compliance with the Clean Water Act's reporting requirements.

This is a demonstration skill and an individual will actually be performing the activity rather than acknowledging comprehension. Information for this topic is located in Sections 2.2(c) and (d).

c. During an assessment of an existing facility, verify that the pre-treatment standards contained in the Clean Water Act are being met.

This is a demonstration skill and an individual will actually be performing the activity rather than acknowledging comprehension. Information for this topic is located in Section 2.2(c).

d. During an assessment of the contractor's sampling and monitoring program, verify that the standards for maximum contaminant levels (primary and secondary) provided by the Safe Drinking Water Act are being met.

This is a demonstration skill and an individual will actually be performing the activity rather than acknowledging comprehension. Information for this topic is located in Section 2.2(e).

e. Conduct an assessment of the contractor's program to verify that the Safe Drinking Water Act provisions for notification to consumers have been established.

This is a demonstration skill and an individual will actually be performing the activity rather than acknowledging comprehension. Information for this topic is located in Section 2.2(f).

f. Perform an assessment of underground injection procedures and monitoring, and assess for compliance with the restrictions and controls provided by the Safe Drinking Water Act.

This is a demonstration skill and an individual will actually be performing the activity rather than acknowledging comprehension. Information for this topic is located in Section 2.2(g).

g. Conduct an assessment to ensure the contractor's program is in compliance with the Standard Methods for the examination of water and wastewater or other acceptable protocol as detailed in 40 CFR 136, Analytical Test Procedures.

This is a demonstration skill and an individual will actually be performing the activity rather than acknowledging comprehension. Information for this topic is located in Sections 2.2(c) and (h) and Section 4.13(b).

h. Review the contractor's program(s) for adequate provisions to ensure that the cross-connection identification/elimination and backflow prevention is as described by the Safe Drinking Water Act.

This is a demonstration skill and an individual will actually be performing the activity rather than acknowledging comprehension. Information for this topic is located in Section 2.2(k).

i. Prior to closure of a permit, review it for compliance with the Resource Conservation and Recovery Act requirements for groundwater protection.

This is a demonstration skill and an individual will actually be performing the activity rather than acknowledging comprehension. Information for this topic is located in Sections 2.2(l) and (m).

4.3 ***Environmental compliance personnel shall demonstrate the ability to appraise the contractor's program(s) and/or permits to assess compliance with the requirements for Environmental Waste Management.***

Supporting Knowledge and/or Skills

a. Given a proposed permit application, evaluate it for compliance with the Resource Conservation and Recovery Act requirements.

This is a demonstration skill and an individual will actually be performing the activity rather than acknowledging comprehension. Information for this topic is located in Section 2.3.

b. Assess the contractor's plans and procedures for hazardous waste generation to ensure compliance with the Resource Conservation and Recovery Act land disposal and landfill restrictions.

This is a demonstration skill and an individual will actually be performing the activity rather than acknowledging comprehension. Information for this topic is located in Sections 2.3(g) and (h).

c. Assess the contractor's plans and procedures for a hazardous waste storage and disposal are to ensure compliance with the Resource Conservation and Recovery Act land disposal and landfill restrictions.

This is a demonstration skill and an individual will actually be performing the activity rather than acknowledging comprehension. Information for this topic is located in Sections 2.3(g) and (h).

d. Assess the contractor's plans and procedures for compliance with the Resource Conservation and Recovery Act non-hazardous solid waste disposal regulations.

This is a demonstration skill and an individual will be actually performing the activity rather than acknowledging comprehension. Information for this topic is located is specific to each DOE facility.

4.4 ***Environmental compliance personnel shall demonstrate the ability to appraise the contractor's program(s) to assess compliance with the requirements for environmental radiation protection.***

This is a demonstration skill and an individual will actually be performing the activity rather than acknowledging comprehension. The Department's environmental radiation protection requirements are discussed in Section 2.5 of this study guide.

Supporting Knowledge and/or Skills

a. ***Assess whether the effluent monitoring from a facility meets the requirements of DOE Order 5400.4 (Canceled per DOE Notice 251.6), Radiation Protection of the Public and the Environment, 10 CFR 834 Radiation Protection of the Public and Environment, and DOE/EH-0173T, Environmental Regulatory Guide for Effluent Monitoring and Environmental Surveillance.***

This is a demonstration skill and an individual will actually be performing the activity rather than acknowledging comprehension. Information for 10 CFR 834 requirements is located in Section 2.2(p) and Sections 2.5(a) and (c).

b. ***Assess whether adequate methods are used to characterize effluents for purposes of limiting doses to the public in accordance with regulatory and "as low as reasonably achievable (ALARA)" limits.***

This is a demonstration skill and an individual will actually be performing the activity rather than acknowledging comprehension. Information for this topic is specific to each DOE facility.

c. ***Assess whether the Environmental Radiological Protection Program is in accordance with 10 CFR 834, Radiation Protection of the Public and Environment.***

This is a demonstration skill and an individual will actually be performing the activity rather than acknowledging comprehension. Information for this topic is located in Sections 2.5(a) and (c).

4.5 ***Environmental compliance personnel shall demonstrate the ability to review and assess the following National Environmental Policy Act documentation:***

- Environmental Impact Statement (EIS)
- Environmental Assessment (EA)
- Finding Of No Significant Impact (FONSI)
- Categorical Exclusion (CX)
- Record of Decision (ROD)

This is a demonstration requirement and an individual will actually be performing the activity rather than acknowledging comprehension. EPA and the DOE have prepared training courses and guidance documents that would be helpful in the preparation of NEPA documents. NEPA document preparation information may be found in Section 2.4 of this study guide.

DOE course information is located on the Internet at: http://cted.inel.gov/cted/index.html and DOE course catalogs are available through individual field offices. EPA information is located on the Internet at: http://www.epa.gov.

4.6 Environmental compliance personnel shall demonstrate a familiarity level knowledge of evaluating technologies.

a. Discuss the Departments policies and procedures for screening technologies.

The Department has an overall policy that facility improvements and all other projects involving design and implementation of physical plant projects, including those that achieve or facilitate environmental compliance, be planned and designed in a manner that fosters:

- Functional effectiveness (meet environmental compliance objectives);
- Cost-effectiveness (including Life-Cycle Cost Analysis);
- Constructability (in accordance with appropriate Federal, State and local building codes); and
- Ease of operation and maintenance over appropriate design life.

General Design Criteria, DOE Order 6430.1A (§ 0110); and LCAM, DOE Order 430.1 (§ 6e)

These factors are incorporated into a design alternatives analysis, which is required before any physical asset is acquired (Order 430.1) or any facility design is implemented (6430.1A). The design alternatives analysis is a cornerstone process that is used throughout the DOE complex as one means to continual improvement in the Department's business practices. Such an analysis is applied in the environmental compliance (EC) program whenever improvements to the EC infrastructure are planned and designed. Examples of types of EC activities are:

- Waste management facilities – groundwater and wastewater treatment plants; air pollution control units; solid, hazardous and radioactive waste packaging, treatment and disposal facilities, etc.;
- Environmental monitoring systems; and
- Closure of waste management units.

Evaluating of a range of technologies for accomplishment of waste management, monitoring, or closure objectives is a key element of the design alternatives analysis process. The technology evaluation feeds vital information into the design alternatives analysis about the technical feasibility, cost and comparative pros and cons of the range of potentially suitable technologies, which is then used in the alternatives analysis. These steps are usually taken during or before Title I design is completed for an environmental compliance infrastructure project, which is the planning and conceptual design stage in accordance with DOE project management guidance in DOE Order 4700.1 (Chapter V). While Life Cycle Asset Management (LCAM, DOE Order 430.1) has replaced 4700.1 as the Department's requirement for project management, the provisions of 4700.1 for project staging (Title I, Title II, Execution, etc.), which includes the alternatives analysis process with technology evaluation, is still considered necessary guidance in the case of physical asset acquisition for EC projects.

b. Describe the process for performing an analysis of alternative Environmental Compliance options.

In the context of EC infrastructure projects, an alternatives analysis that incorporates technology evaluation is conducted in a staged manner:

- **Project Scoping**– During the initial planning of EC infrastructure projects, alternatives analysis and technology evaluation are initiated to assist project scoping and the project funding decision. Key uncertainties in the project scope in relation to appropriate technology are identified and addressed in the next stage of alternative analysis.

- **Title I Design**– As an initial task in the Title I design process, an alternative analysis with technology evaluation is performed to select the system optimum EC option for design and execution.

Project Scoping– As part of the scoping process, different options for meeting the EC objective(s) of the project are identified and the technologies that could be incorporated into the various options are assessed, sometimes with a state-of-the-art analysis which draws on:

- Reported experience in the Complex, other government administered programs (e.g., Department of Defense installations, municipal wastewater treatment and solid waste disposal facilities) and in industry (e.g., nuclear power generating stations);
- Emerging/innovative technology development studies and demonstration programs (e.g., EPA Technology Transfer program; DOE Remedial Action Program Information Center); and
- Mandated technology-based compliance program requirements (e.g., EPA categorical effluent limitations for industrial wastewater effluents and supporting Development Documents; EPA MACT regulations for air pollution control technology).

From the scoping analysis of options and technologies, a reduced list of potentially feasible options is advanced to the next alternatives analysis stage in Title I Design. The options incorporate available, demonstrated feasible technologies and, as appropriate and necessary, innovative/developing technologies.

Title I Design– In the initial part of Title I design development, a more detailed alternative analysis of the options for EC infrastructure improvements is conducted, incorporating the factors listed for 4.6 (a) above, plus additional attributes required for comparative analysis and selection of the optimum option. The format and content of the options analysis will vary depending upon the type of EC project (waste/media management, monitoring, closure) and the scale of project activity being planned:

- Large or small scale project (DOE Order 4301 mandates a graded approach with increasing level of detail as the project increases in size and funding);

- Programmatic, project development or unit-specific. The alternatives analysis will vary in complexity depending upon whether multiple locations and project objectives are under consideration (programmatic), a group of technologies and project objectives are being combined (project development), or a single physical unit, location and EC objective are being addressed (unit-specific); and
- Replacement of an EC unit/technology or system having multiple technologies, expansion/upgrading of an existing multiple-technology system or a new, grass-roots EC system development.

With some room for project-specific variation, the steps in the analysis will be as follows.

Technology Studies– Prior to the summary analysis and selection, additional study may be conducted for both state-of-the-art and developing technologies to accomplish two objectives :

(1) Develop a more detailed assessment of technical feasibility and costs, and
(2) Obtain design criteria, either of general applicability or directly applicable to the Site-specific and installation-specific conditions.

Such technology studies may take a number of forms and require varying time and funding commitments. The level of detail could involve a range of approaches and complexity. Further literature review could be conducted and contacts made with technology developers and practitioners. Field trips could be made to inspect existing and in-construction installations. During the site visit, performance and cost data can be obtained from technology suppliers and/or the owner. Laboratory and/or field pilot tests, known as treatability studies, may be conducted on the technology either on-site or in a remote test facility.

Technology studies may also be incorporated into the project after the alternatives analysis is complete if the objective is to obtain design criteria for the selected option prior to detailed (Title II) design.

Establish Project Requirements– The first step in the options analysis will be the setting of key project requirements that form the basis for comparative analysis. These may include some or all of the following:

- Regulatory compliance standards (e.g., wastewater effluent or air emissions quality criteria);
- Other applicable Federal, State and local laws and regulations (e.g., the Federal Endangered Species Act consultation requirements for endangered species habitat impacts of site development, State hazardous waste management regulations governing hazardous waste generation and treatment, storage and disposal facilities);
- Cost and schedule constraints and objectives;
- Health & safety requirements for construction and operation;
- Operation & maintenance levels and requirements;

- Environmental protection/review requirements for compliance with the National Environmental Policy Act;
- Secondary waste/residues management requirements;
- Energy conservation goals and objectives; and,
- Safeguards and security requirements.

Develop Option Descriptions – Each option must be developed at least to the extent necessary for comparative analysis. Technology designs are developed to the conceptual level of detail, with major unit sizing, area requirements and identification of necessary process controls, ancillary systems and utility requirements. Process inputs are rough estimated (e.g., treatment chemicals, consumables) and residuals are delineated as to quantities and disposal or other handling requirements. A description is prepared of how the new, expanded or upgraded EC facility will integrate with existing capacity and related systems.

If a complete option includes elements that meet two or more discrete project needs, then the mixing of technologies/alternatives to address each element must be considered. This is often needed to assure that the objective of cost-effectiveness is achieved. For example, a site that requires both upgrades to an existing wastewater treatment plant and improvements to the existing wastewater collection system that conveys wastewater to the existing centrally-located treatment facility would be well served to look at the treatment and collection/conveyance parts of the project separately when options are initially formulated. Then, different collection/conveyance and treatment alternatives can be combined for analysis of a number of options.

Cost Estimation– Cost estimates are prepared for the options at a level of detail commensurate with the stage of the project when the options analysis is performed. If the options analysis is performed prior to Title I design, then Conceptual Design estimates are prepared; while if the analysis occurs during Title I, then Title I estimates are prepared for the alternatives. Although the Title I estimate entails a greater level of detail and requires more resources, usually a fewer number of options require cost estimation at the Title I stage than in the planning conceptual design stage because less feasible options have been recognized and dropped from consideration during early Title I development. The estimates should include implementation, operation, decommissioning and closure costs to allow life-cycle cost analysis, however, especially in the pre-Title I stage, cost estimation often will only include implementation and operation (including maintenance) costs for a simple cost-effectiveness analysis. Life-cycle costing is restricted to Title I alternatives analyses and beyond during validation of the project in Title II.

Numerous estimating techniques and sources of cost data exist for conceptual and Title I estimating. Estimating guidance is provided in the DOE Cost Estimating Guide, Volume 6 Cost Guide.

Criteria Analysis– Each alternative is analyzed using several criteria to allow selection of the optimum project option. The major analyses and specific criteria evaluated in each analysis are outlined as follows:

- Technical Feasibility
  - ◊ Functional effectiveness and reliability (compliance risk);
  - ◊ Level of technology development and availability;
  - ◊ Ease of operation and maintenance (including worker health and safety risks);
  - ◊ Residuals management; and,
  - ◊ Energy requirements.
- Cost Effectiveness
  - ◊ Present worth costs (capital, replacement, salvage and operation and maintenance costs returned to present worth at the selected project base year (either the date of analysis or of scheduled project startup); and,
  - ◊ Cost sensitivity analysis (potential cost impacts of technology uncertainties and other project assumptions).
- Environmental, Safety and Health Review
  - ◊ Assess alternatives, technologies for achievement of core EC project objectives;
  - ◊ Compliance risk analysis;
  - ◊ Health & safety (H&S) analysis, comparison of H&S risks and requirements of alternatives and technologies; and,

- ◊ Identify requirements for environmental impact analysis and consultation on ecological resource effects.

- Administrative Requirements

  ◊ Permits and approvals;
  ◊ Stakeholder involvement in waste management and land use decisions; and,
  ◊ Safeguards and security.

Decision Analysis– Rating and ranking techniques are used to select the optimum - technically feasible, cost-effective, environmentally benign and implementable - alternative with its supporting technologies. Some technology selections may be made contingent upon further field scale demonstration of their feasibility, in the case of technologies with particularly large funding requirements or for technologies which are developmental. Often, a summary decision matrix is used to summarize the analysis, with text support for key differences among the alternatives and attributes of competing technologies.

Selected Alternative and Technologies– The selected alternative is presented in the conclusion of the analysis, highlighting the factors which favored it. The conceptual design and cost estimate, life-cycle cost analysis (if prepared), summary of advantages/ disadvantages, additional technology assessments and other special studies required prior to Title II design, execution schedule and scoping for permits and other administrative requirements are all presented.

4.7 Environmental compliance personnel shall demonstrate a familiarity level knowledge of the structure of the Environmental Management (EM) organization and other organizations related to environmental compliance.

Supporting Knowledge and/or Skills

a. Given a current Environmental Management organization chart, explain the relationship between the organizational elements and describe the functions of each element:

The current relationship of the organizational elements of the Environmental Management (EM) organization are shown in Figure 4.7-1. The functions of these organizational elements are described below:

The **Office of the Assistant Secretary for Environmental Management (EM-1)** provides program policy development and guidance for the assessment and cleanup of inactive waste sites and facilities, and waste management operations; develops and implements an aggressive applied waste research and development program to provide innovative environmental technologies to yield permanent disposal solutions at reduced costs; and oversees the stabilization of nuclear materials, the management of spent nuclear fuel, and the deactivation of facilities deemed to be surplus to their original mission. The Assistant Secretary provides centralized management for the Department for waste management operations, environmental restoration, nuclear materials and facility stabilization, and related applied research and development (R&D) programs and activities, including the EM program policy guidance to all DOE Operations Offices in these areas. These responsibilities do not include Nuclear Waste Fund activities which are managed separately by the DOE Office of Civilian Radioactive Waste Management (RW).

The **Office of Safety and Health (EM-4)** is responsible for issues associated with environment, safety, and health. Under the Deputy Assistant Secretary for Environment, the Office of Safety and Health has responsibility for environmental compliance; environmental guidance, including RCRA/CERCLA and air, water and radiation issues; environmental audit; and NEPA oversight. The Office of Safety and Health represents the Assistant Secretary for Environmental Management to develop and implement an integrated safety and health program, upgrade the safety posture on the Environmental Management (EM) facilities and operations, and address urgent risk issues.

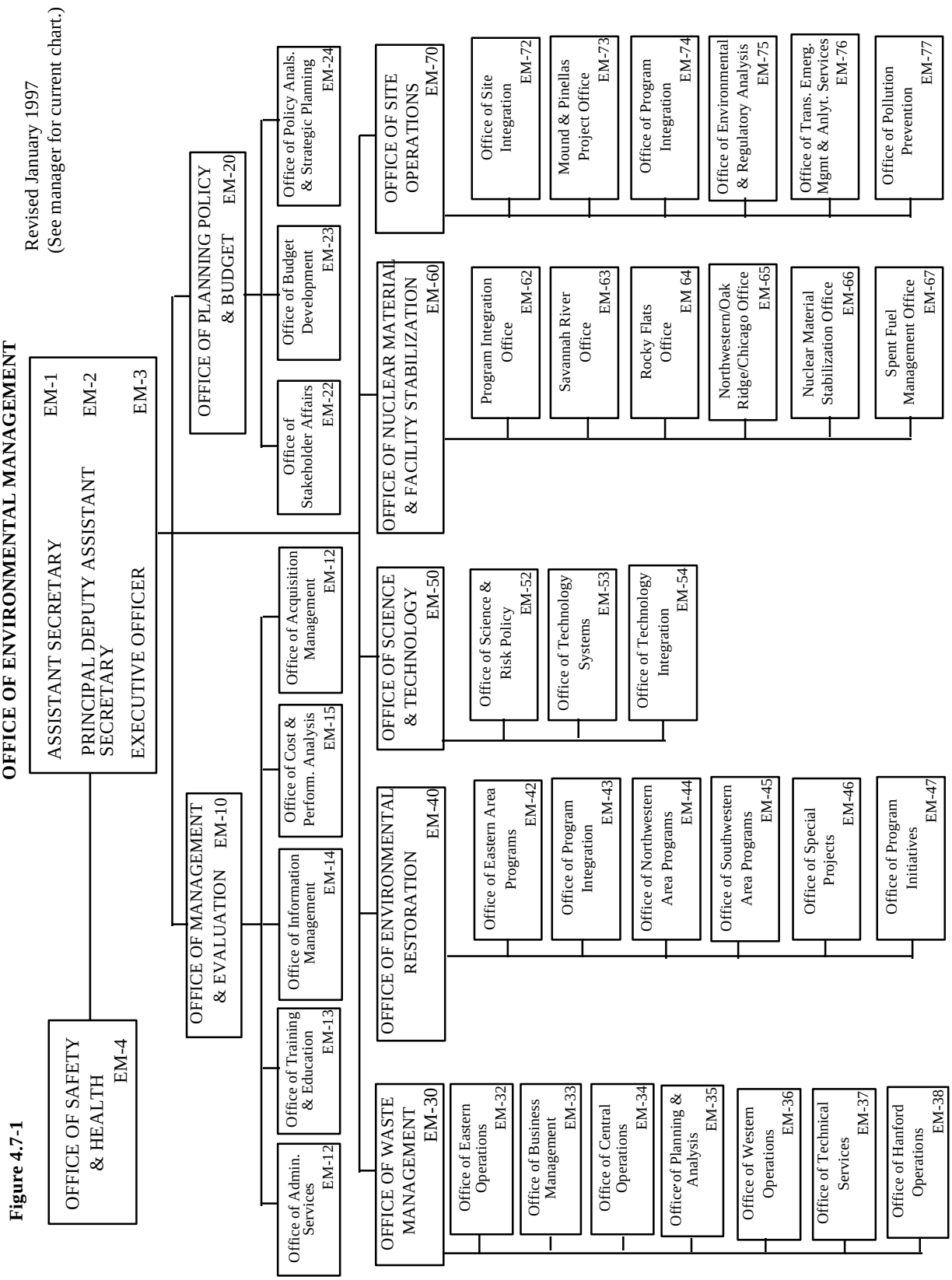

Figure 4.7-1

Figure 4.7-1 Office of Environmental Management

The **Office of Management and Evaluation (EM-10)** serves as the Assistant Secretary's principal advisor on all administrative functions and activities for line offices within the Office of the Assistant Secretary for Environmental Management (EM). These activities cover administrative management, such as personnel administration and general administrative support services (including domestic and foreign travel); training and career development; total quality management (TQM); organization and manpower management; cost and performance management; space and logistics management; acquisition, procurement, and contracts management; and automatic data processing (ADP), automated office support systems (AOSS), and information management (IM).

The **Office of Planning, Policy and Budget (EM-20)** provides critical analysis and other support to the Assistant Secretary and throughout the executive branch on policy and planning issues associated with environmental compliance and cleanup activities, waste management, nuclear materials and facilities stabilization, overall budget and priority setting analyses, nuclear non-proliferation policy practices, and for the ultimate disposition of surplus materials and facilities. The Office is also responsible for the review, coordination, and integration of inter-site, inter-agency and international planning activities related to these issues. Finally, the Office coordinates policy and procedural issues associated with the external regulation of the environmental restoration, waste management, and nuclear materials and facility stabilization programs.

The mission of the **Office of Waste Management (EM-30)** is to protect people and the environment from the hazards of DOE wastes by providing an effective and efficient system which minimizes, treats, stores, and disposes of DOE waste as soon as possible. As such, the Office provides the leadership necessary to accomplish the mission and carries out those program planning and budgeting, evaluation and intervention, and representation functions associated with management of radioactive high-level, transuranic, and low-level waste; hazardous and sanitary waste; and mixed waste. This does not include materials for nuclear materials or weapons production, or facilities, operations, or sites under direction of the DOE Office of Civilian Radioactive Waste Management.

The mission of the **Office of Environmental Restoration (EM-40)** is to protect human health and the environment from the risks posed by inactive and surplus DOE facilities and contaminated areas by remediating sites and facilities in the most efficient and responsible manner possible in order to provide for future beneficial use.

Office of Science and Technology (EM-50) is responsible for managing and directing focused, solution-oriented national technology development programs to support the DOE Office of Environmental Management. These programs involve research, development, demonstration, testing and evaluation activities that are designed to provide innovative technologies and technology systems to meet end-user's needs for regulatory compliance. Science and technology activities include coordination with other stakeholders and the private sector, and collaboration with international organizations, using a systems-approach

to reduce waste management life cycle costs and risks to the environment and people. The Department's Risk and Science Policy Program will also be managed from this Office.

The mission of the **Office of Nuclear Material and Facility Stabilization (EM-60)** is to protect people and the environment from the hazards of nuclear materials and to deactivate surplus facilities in a manner which provides savings to the government by providing an effective and efficient system which stabilizes nuclear materials and deactivates surplus facilities as soon as possible. As such, the Office provides the leadership necessary to accomplish the mission and carries out those program planning and budgeting, evaluation and intervention, and representation functions associated with the stabilization of nuclear materials and the deactivation of surplus facilities.

The mission of the **Office of Site Operations (EM-70)** is to operate as a focal point and champion in EM for the operations offices and field sites by providing leadership for cross-cutting issues and topics raised by the field and/or EM Headquarters, and by serving as facilitator, ombudsman and/or coordinator. The Office of Site Operations will ensure that issues requiring EM and DOE Headquarters review, concurrence, resolution, or other decisions are acted upon quickly, corporately, and equitably. The Office of Site Operations will provide headquarters policy direction for landlord planning and budgeting, including reducing site infrastructure costs and managing workforce restructuring. Further, the Office will provide policy and guidance to improve the effectiveness of crosscutting environment, transportation management, and waste minimization activities. The Office will act as advocate to ensure the field dimension is recognized in major EM decisions and eliminate barriers to excellent performance.

b. Given a current Department organizational chart, explain the relationships between Departmental elements with respect to environmental compliance.

The current organization chart (Figure 4.7-2) for the Department shows 9 elements under the Secretary of Energy.

The **Inspector General** is responsible for assuring that all applicable regulations, policies, and other requirements are implemented. The Inspector General conducts audits of all offices in the Department on a periodic basis to identify any areas of non-compliance. Environmental audits assure that field offices are compiling requirements of such laws as RCRA regarding classification, storage, and disposal of hazardous wastes, permits required under such laws as the CWA, and other requirements.

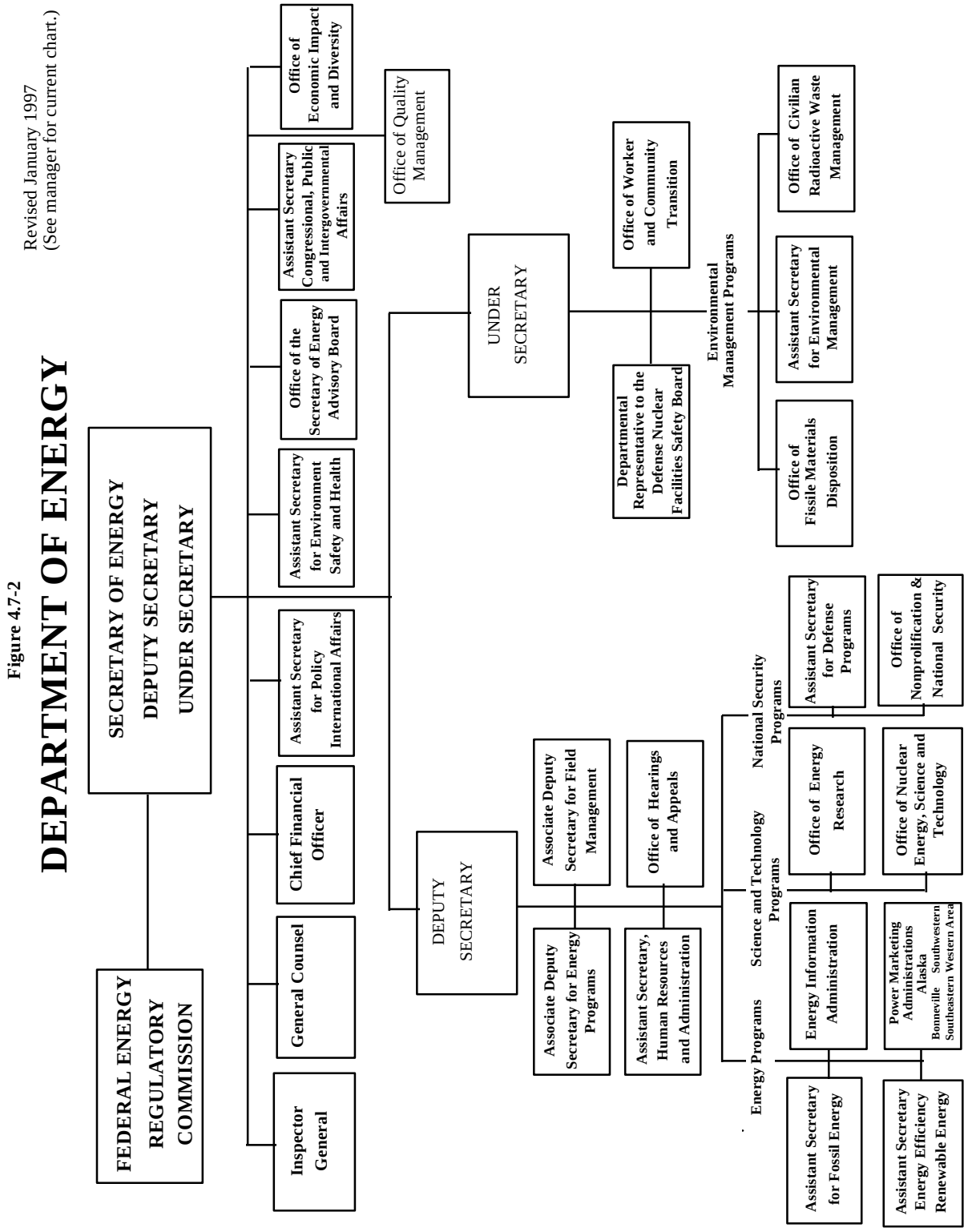

Figure 4.7-2 Department of Energy

The **General Counsel** is responsible for providing legal advice. The General Counsel reviews agreements and commitments made by the Department and provides legal advice regarding these agreements. It determines the extent of legal liability resulting from actions taken. It advises the Department and its offices in legal matters during negotiations and disputes with regulatory agencies, stakeholders, and other parties such as contractors and litigants. The General Counsel advises EM on issues such as the applicability of NEPA and other environmental laws, on the impacts and consequences of entering into interagency agreements such as the Rocky Flats Cleanup Agreement, on disputes that evolve from disagreements related to interagency agreements, and on other issues.

The **Chief Financial Officer** (CFO) is responsible for the budget. It provides budget projections to field offices, develops the Department's budget, and prepares budget requests. The CFO tracks expenses and provides reports to Congress related to budget performance.

The **Assistant Secretary for Policy, International Affairs** is responsible for developing policy for the conduct of operations. This office develops policy that impacts operations of field offices in so far as these operations are reflective of foreign and defense initiatives. Such policy issues may result in the decommissioning of facilities as a result of arms reduction agreements.

The **Assistant Secretary for Environment, Safety, and Health** (ES&H) is responsible for the environmental, safety, andhealth issues throughout the DOE complex. ES&H assures that all applicable standards are employed for the protection of the environment and worker and public safety and health. OSHA regulations are specific to safety and health issues associated with environmental investigations and clean up.

The **Office of the Secretary of Energy Advisory Board** advises the Department on a wide variety of issues. This office analyzes issues that are important to the Department and offers options and advice regarding significant policies that impact Department actions and goals. Some of these issues may be related to national goals for environmental protection and clean up.

The **Assistant Secretary for Congressional, Public, and Intergovernmental Affairs** is responsible for advising the Department and developing policy that is responsive to congressional, public, and other agency needs and goals. It provides input for congressional inquiries and other information to the congress, it responds to public inquiries, and it determines the impacts of other government agency policies and works with those agencies to create a unified policy that meets the needs and goals of all. Some of these policies are related to environmental issues. In some cases, agencies that are responsible for environmental management may have expectations that are not consistent with the Department's policies, goals, or funding capabilities. This assistant secretary is responsible for resolving such conflicts.

The **Office of Economic Impact and Diversity** is responsible for determining the economic impact of the Department's actions on the community, and assures that the Department is responsive to labor policies regarding employment and contacting.

The **Office of Quality Management** is responsible for assuring that all quality requirements are implemented and achieved. This office conducts inspections and tests that determine the reliability and quality of the products associated with the varied offices and their missions within the complex. EM products include successful clean up and closure of sites, adequate investigation, and reporting of environmental issues, among others.

c. List other Federal agencies, including regulatory agencies, and/or subbasements of those agencies that play a role, both technological and regulatory, in the environmental compliance at Department sites, and describe their roles.

The EPA is heavily involved in the oversight of environmental efforts at DOE sites. DOE must work closely with EPA Headquarters and EPA regions, as appropriate, on environmental matters. EPA and/or delegated states, are responsible for oversight of most environmental laws (including CAA, CWA, TSCA, etc.).

Under the requirements of the Endangered Species Act (ESA), DOE must consult with the U.S. Fish and Wildlife Service (USFWS) regarding issues associated with threatened and endangered species.

DOE is required to consult with the Consul on Environmental Quality (CEQ) on issues associated with DOE implementation of NEPA by CEQ regulations. For example, when DOE prepared changes to the DOE's NEPA regulations (found at 10CFR1021), DOE was required to consult with CEQ.

4.13 Environmental compliance personnel shall demonstrate a working level knowledge of monitoring techniques related to environmental compliance.

Supporting Knowledge and/or Skills

a. Describe the types of equipment used to monitor a site for the following:

- Ambient air quality
- Emissions
- Groundwater contamination
- Meteorological factors
- Streams and rivers contamination
- Soil and sediment contamination
- Wildlife contamination

Ambient Air Quality

Sampling of ambient air quality requires different analytical techniques and equipment depending on the atmospheric phase (gas, aerosol, or condensed water) and the chemical species under consideration. In the absence of a condensed aqueous phase, aerosol particles are removed by filtration (impaction, diffusion, or interception onto a filter surface), with the air stream analyzed for the contaminant of concern.[1]

Particles may be collected by a variety of techniques including gravitation settling, filtration, electrostatic and thermostatic precipitation, and impaction. Of these, gravitational settling, filtration, and impaction have been the most widely used for sampling ambient particulate matter.

The simplest particle sampling method employs the principle of gravitational settling. Large settleable particles are collected in an open top vessel placed in the atmosphere for a period of 30 days. This is a static or passive sampling method requiring no air-moving equipment. This method has been used for a long time.

Hi- volume Sampling– The hi-volume sampler has been the most common particle sampling device employed in ambient air quality monitoring programs. A collecting glass fiber filter is located upstream of a heavy-duty vacuum cleaner type motor which is operated at a high air flow rate (40-60 cubic feet/minute). The sampler is mounted in a shelter with the filter parallel to the ground. The covered housing protects the glass fiber filter from wind and debris, and from the direct impact of precipitation. The hi- volume sampler collects particles efficiently in the size range of 0.3-100 micrometers. The mass concentration of total suspended particulates is expressed as micrograms per cubic meter for a 24-hour period. The hi- volume sampler is an intermittent sampling method. It is normally operated on a 6-day sampling schedule, with a 24-hour sample collected every sixth day.

Paper Tape Samplers – Paper tape samplers are continuous sampling devices. The sampler draws ambient air through a cellulose tape filter. After a 2-hour sampling period, the instrument automatically advances to a clean piece of tape and begins a new sampling cycle. Paper tape samplers do not show instantaneous data. Because of difficulties in relating data acquired by this optical method to the gravimeteric data of the hi-volume reference method, most paper tape sampling has been discontinued or used only as a backup system.

Size Selective Samplers – Various sampling devices are available that segregate collected suspended particulate matter into discrete size ranges based on their aerodynamic diameters. These samplers may employ one or more fractioning stages. The physical principle that is used in the segregation is inertial impaction of the particle. Therefore, these samplers are referred to as impactors.

Impactors draw air throughout the unit and deflect the particle from its original flow path. The size of the particle depends on: (1) gas velocity, (2) particle density and shape, (3) air flow geometry, (4) gas viscosity, and (5) the main free path of the gas.[2] Multistage impactors can fractionate suspended particles into six or more size fractions depending on the number of stages built into the sampler. Impactors can fractionate suspended particles into coarse (from 2.5-10 micrometers) and fine (less than 2.5 micrometers) size fractions. The smaller fraction impactors are referred to as dichotomous impactors. EPA reference method specifications for PM_{10} can be met by a variety of devices, including both cascade and dichotomous samplers.

A multiple slotted-rod collector inserted through the skin of an aircraft can be used to collects samples of liquid water from clouds, with water collection taking place within the aircraft for analysis. Supercooled cloud water can be collected on any surface outside of the aircraft's slipstream, but phase transitions can render the results ambiguous.[1]

Continuous gas-phase techniques are commonly used for airborne monitoring of ozone, carbon monoxide, nitrogen oxides, sulfur dioxide, ammonia, peroxyacyl nitrate (PAN), and hydrogen peroxide. Ozone is monitored using the ethylene chemiluminescence technique with precision of ±10% or better, and accuracy in the range of 20 to 200 ppb. Carbon monoxide is monitored using nondispersive infrared (IR) spectroscopy. Nitrogen oxides (NO_X) are measured using the chemiluminescent reaction of ozone with NO and viewed with a red-sensitive photomultiplier tube. Sulfur dioxide detection requires a modified flame photometric detector. Ammonia monitoring uses Venturi collection, chemical reaction to an ammonia derivative such as isoindole, and determination by fluorescence in a flow-through a fluorimeter. Gaseous peroxides are difficult to collect and analyze without generation of "artifact" peroxides. Artifacts are constituents that are detected and may mask the actual contaminant present. Use of diode-laser absorbence, ozone removal techniques, and prompt derivation and analysis have yielded "artifact-free" results.[1]

Aerosol monitoring (in situ) of aerosol number, size distribution, and mass can be performed with a nephelometer (mass), an electrical aerosol analyzer, optical particle counters, optical particle probes, and impactor separation with piezoelectric balance.[1]

Organic components are separated by use of the appropriate filtering media and a high volume particulate sampler, with analysis performed for the component of concern using the appropriate analytical equipment (as gas chromatography-mass spectroscopy, flame ionization, electron capture, infrared spectroscopy, etc.). Inorganic particulates can be analyzed using scanning electron microscopy or a variety of chemical techniques.

Liquid Bubblers are used to measure concentrations of oxidized sulfur compounds (SO_x) and ozone (O_3) in the atmosphere. These devices collect gases by bubbling ambient air through a liquid medium that dissolves the components of interest. Although bubblers are constructed to provide long-term reliability, they are not recommended for use in long-term monitoring in the United States because the liquid medium may evaporate or promote chemical speciation of the target compounds.[1]

A **nondispersive infrared (IR) spectrometer** is commonly used to measure carbon monoxide (CO) concentrations and can be modified to analyze nitric and sulfuric acid concentrations. The device measures the attenuation of specific wavelengths of infrared light which is compared to a reference cell containing a known quantity of CO. Airborne instruments have a detection limit of approximately 50 ppb with a time resolution of 10 seconds.[1] Nitric acid can be detected to a level of 4 parts per billion (ppb) by using Fourier transform infrared spectroscopy. An IR-tunable diode laser spectroscope can detect nitric acid at a level of 100 parts per trillion (ppt). Using a technique termed IR-laser backscattering, sulfuric acid can be detected at concentrations of less than 1 g/m^3.

Emissions

Emissions are sampled and analyzed using the same types of equipment and techniques (to detect the same type of substances) as listed under ambient air quality. Sampling and analysis procedures for pollutants from stationary sources are listed under 40 CFR Part 60. For example, among these methods is EPA Method 3A (to detect carbon monoxide [CO] and oxygen [O]), EPA Method 6C (for the detection of sulfur oxides [SO_x] by pulsed fluorescence), and others for particular contaminants of concern.[1]

The term "effluent" refers to something that flows out into the environment. At DOE sites, effluent air refers to air emissions released to the environment from processing and laboratory facilities. Ventilation and filtration systems constantly filter the air while monitoring equipment measures emissions to the environment.

Radionuclides such as plutonium, uranium, and americium occur as solid particles. As a result, particle filtration of airborne effluent streams is an important and effective means of preventing the release of these materials to the environment. Radioactive particles enter

exhaust air streams where the particulate materials are removed by High Efficiency Particulate Air (HEPA) filters.

HEPA filters are designed to be fire- and chemical-resistant. They are constructed of tiny glass fibers combined with a small amount of organic material added for strength and water repellency. Multiple banks of HEPA filters, called filter plenums, are installed in series in air exhaust systems.

At Rocky Flats, the radiological particulate monitoring program uses a three-tier approach, comprising Selective Alpha Air Monitors (SAAMs), total long-lived alpha screening of air duct emission sample filters, and radiochemical analysis of isotopes collected from air duct emission samples. This approach balances both detectability and timeliness of results. SAAMs are sensitive to specific alpha particle energies. Therefore, for immediate detection of abnormal conditions, monitor alarms can be automatically programmed to sound if any out-of-tolerance conditions are detected.

At regular intervals, particulate material samples from continuous sampling systems are removed from the exhaust systems and radiometrically analyzed for long-lived alpha emitters. Composite samples can be subjected to radiochemical separation and alpha spectral analysis, which quantifies specific alpha-emitting radionuclides. Bubble-type samplers are used to determine tritium concentrations and are measured using a liquid scintillation photospectrometer.

A variety of techniques are used to monitor radiation in air, soil, and water. Table 4.13-1 gives examples of the types of devices used and their application.

Table 4.13-1
Examples of Radiation Monitoring Devices

Detector Type	**Instrument**	**Radiation Detected**	**Application**
Ionization Chambers	Victoreen 440 (non-portable)	Gamma	Building entryways, health physics measurements
Gas Proportional	Ludlum 12-1A (hand-held, portable)	Alpha	Screening small areas, equipment, and personnel. Lab measurement of water, air, soil, and smear samples.
Geiger Mueller	Ludlum 31 (hand-held portable)	Beta, Gamma	Surface scanning, surface contamination measurement.
Scintillation	Bicron Fidler (hand-held portable) Ludlum 111	Gamma, X-ray Alpha	Surface scanning, lab gamma ray spectroscopy, in situ surface contamination measurement. Surface contamination

Table 4.13-1
Examples of Radiation Monitoring Devices

Detector Type	Instrument	Radiation Detected	Application
	(portable on a wheeled cart)		measurement, lab measurement of air, soil, water, and smear samples.
Semiconductor	HPGe (vehicle-mounted)	Gamma, X-ray	In situ characterization of soil or rock via gamma ray spectroscopy.
Electrometer	Long-range alpha detector (LRAD) (hand-held to tractor-mounted)	Alpha	In situ characterization of soil, rock, air, or other solid media. Unit measures ions produced by alpha radiation using an induced current.

Radiation monitoring can be done in situ (e.g., a scintillation detector is set atop soil to obtain a site-specific measurement), by collecting samples and transporting them to a lab for analysis, or by scanning broad regions to locate areas of higher than normal radiation (e.g., mounting a semiconductor detector on the back of a vehicle and driving around a site). Specific project requirements and the radioactive elements of interest (whether they are alpha or beta emitters) determine the optimum monitoring technique.

Groundwater Contamination

Monitoring groundwater contamination is accomplished through collection of groundwater samples from a series of wells. A series of wells is typically installed to define the extent of contamination and to determine whether a "plume" of contamination exists. A number of wells are required to ascertain the direction of flow and rate of movement. Baseline conditions, which provide a basis for comparison, can be determined by collecting samples from nearby wells that are known to be free of contaminants. Groundwater samples are subjected to chemical analysis for constituents of interest, with temporal changes in the chemistry of a given location providing information regarding contamination variability, and possibly trends and movement of the contaminant over time. Evaluating changes in groundwater chemistry requires knowledge of changes in related factors such as water table elevation and subsurface flow rate.Table 4.13-2 lists some of the devices used for sampling groundwater quality monitoring wells:

Table 4.13-2
Groundwater Sampling Devices[3]

Type	Advantages	Disadvantages
Bailer	Can be constructed in a wide variety of diameters	Sampling procedure is time consuming sometimes impractical to properly evacuate casing before taking samples
	Can be constructed from a wide variety of materials	Aeration may occur when transferring water to the sample bottle
	No external power source	
	Extremely portable	
	Low surface area to volume ratio, resulting in a very small amount of outgassing of volatile organics while sample is contained in bailer	
	Easy to clean	
	Readily available	
	Inexpensive	
Suction-lift Pump	Relatively portable	Sampling is limited to situations where water levels are within about 20 ft of the ground surface
	Readily available	Vacuum effect can cause the water to lose some dissolved gas
	Inexpensive	
Air-lift Samplers	Relatively portable	Causes changes in carbon dioxide concentrations; therefore, this method is unsuitable for sampling for pH-sensitive parameters
	Readily available	In general, this method is inappropriate for acquiring waste samples for detailed chemical analyses because it promotes sample degassing
	Inexpensive	
	Suitable for well development	
Gas-operated Pump	Can be constructed in diameters as small as 1 inch	Gas source required
	Can be constructed from a wide variety of materials	Large gas volumes and long cycles are necessary when pumping from deep wells
	Relatively portable	Pumping rates are lower than those of suction or jet pumps

Table 4.13-2
Groundwater Sampling Devices[3]

Type	Advantages	Disadvantages
Gas-operated Pump(Cont)	Reasonable range of pumping rates	Commercial units are relatively expensive
	Driving gas does not contact water sample, eliminating possible contamination or gas stripping	
Submersible Pump	Wide range of diameters	With one exception, submersible pumps are too large for 2-in diameter boreholes
	Constructed from various materials	Conventional units are unable to pump sediment-laden water without incurring damage to the pump
	12-volume pump is highly portable; other volume units may not be as portable	1 3/4-inch pump delivers low pumping rates at high heads
	Depending on size of pump and pumping depths, relatively large pumping rates are possible for wells larger that 2-in diameter	Smallest diameter pump is relatively expensive
	1 3/4-inch helical screw pump has rotor and stator construction that permits pumping fine-grained materials without damage to the pump	

In addition to the use of monitoring wells, other methods and equipment are often used in studies of groundwater contamination. These methods include other sampling techniques as well as geophysical methods. Surface geophysical surveys and downhole geophysical logging are used to define geological characteristics and assist in delineating zones of groundwater flow and contaminant transport. The discussion on borehole geophysical methods relies on Driscoll (1986).

- Pressure-vacuum **lysimeters** may be used to obtain samples of in situ soil moisture in the unsaturated zone. They consist of a porous ceramic cup capable of holding a vacuum, a small-diameter sample chamber made of PVC pipe, and two sampling tubes leading to the surface.

- A **piezometer** measures pressure and is frequently used for monitoring water pressure in earthen dams, under foundations, or in aquifers. It can also be used to measure vertical head differences under unconfined conditions. Piezometers are also used to monitor water levels.

- A **tensiometer** consists of a porous cup attached to an airtight, water-filled tube. The porous cup is inserted into the soil at the desired depth, where it comes into contact with the soil water and reaches hydraulic equilibrium. Water moves through the porous cup from the tube into the soil. A vacuum is created at the top of the airtight tube and is a measure of the pressure head in the soil. The measured pressure head is thenconverted to a calculatedhydraulic head.

- **Organic vapor analyzers** are used to detect volatile organic carbon (VOC) compounds in groundwater. Field organic vapor analyzers are inserted into the air space above the groundwater table in a monitoring well to measure the air quality and indicate the presence of VOC compounds emitted from contaminated groundwater.

- A **Cone Penetrometer (CP)** has five main applications: 1) to determine the soil profile and identify the soils present, 2) to interpolate ground conditions between control boreholes, 3) to evaluate the engineering parameters of the soils and to assess bearing capacity and settlement, 4) to extract samples for the detection and quantification of hazardous materials in subsurface soils and groundwater, and 5) to detect and measure the migration of subsurface contaminants through the measurement of groundwater flow, imaging techniques, and/or other methods. The CP has a standard set of sensors for measuring cone tip pressure, sleeve friction, soil conductivity, and pore pressure. By measuring these parameters, contamination can be detected in both soils and groundwater.

- The **Geoprobe** collects one-time groundwater samples in unconsolidated material. It is driven into the soil and when the bottom of the probe is at least 5 ft below the water table, the outer cylinder can be pulled back exposing a perforated stainless steel sample entry barrel covered with either a nylon or polyethylene filter material. Hydrostatic pressure forces groundwater into the sample compartment. The geoprobe is an inexpensive method of obtaining a groundwater sample, but may be of limited application in certain types of geologic materials (e.g., highly consolidated materials, etc.).

- **Soil Gas Surveys** are used to assist remedial investigations where the contaminants of concern include volatile organic compounds (VOCs). Soil gas surveys are most effective in mapping low molecular weight, halogenated solvents and petroleum hydrocarbons. They are used to delineate VOC contamination in subsurface soils and groundwater. There are two basic soil gas equipment configurations. First, a mobile van-mounted probe that can collect samples in real-time and perform chemical analysis in the van. This method has been used to define contamination phases and direct placement of wells while in the field. The other configuration emplaces static samples in the soil approximately one foot deep. These samples are usually collected on a gridSoil gas surveying results are usually considered to be qualitative data and are not sufficient by themselves to

characterize a site. This is because the results do not reflect the concentration of contaminants in the soil or groundwater.

- **Ground Penetrating Radar** (GPR) is used for the detection of buried waste, waste trenches and pits, and void spaces. GPR can often be employed in areas with extensive infrastructures and search depth can be set to be highly site specific. GPR is based on the physical property of measuring two-way travel time to reflection caused by changes in dielectric constants.

- A **Time Domain EM Object Detector** detects anomalies in transient Electromagnetic (EM) fields. EM is used for the detection of electrically conductive buried objects, pipes, waste pits and trenches, landfill boundaries, and cells within landfills. With EM, interference by infrastructure is substantially mitigated.

- **Magnetic (Mag) Surveys** measure the total magnetic field and vertical gradient of the magnetic field. Mag is used to detect ferromagnetic debris, drums, underground storage tanks (USTs), landfill boundaries, and uncontrolled waste pits and trenches. Mag has limited application within areas with extensive infrastructures and surface debris because of interference from these items.

- **Frequency Domain EM Profiling** measures ground conductivity and anomalies in the EM field caused by metallic objects. EM is used to detect and delineate waste pits, trenches, landfill boundaries, and contaminant plumes dissolved in ground water. EM has limited application within areas with extensive infrastructure and surface debris.

- **Metal Detectors/Pipe Detectors** measure distortions in electromagnetic (EM) fields. They are used to detect metallic objects and pipes. They are limited in the below surface depth they can detect.

- **Shallow Seismic Surveys** are used, in conjunction with subsurface borehole data, to generate a geologic model which can show preferred flow paths for groundwater and plumes. Additionally, subsurface features such as faults can be detected as part of the characterization of the flow regime. From these data further investigation or remedial alternatives can be planned.

- **Borehole Resistivity Logs** are usually referred to as electric logs when combined with spontaneous potential curve information. The electric log gives a detailed picture of the character and thickness of the various strata at the well site and an indication of the water quality by measuring the apparent resistivity of the materials surrounding the well bore. Electric logs offer several important advantages. These include locating the top and bottom of each distinct formation, determining relative water quality, and differentiating clean sand strata from silty

sand strata and from sand strata with clay stringers. An electric log is obtained by lowering one or more electrodes which are suspended on a conductor cable into a borehole filled with drilling fluid. An electric current is forced to flow from these electrodes to other electrodes that may be in the borehole or placed in the ground near the top of the well. The electric logging instrument measures the current loss (resistance to flow) between two electrodes. Changes in electrical resistance of the entire circuit are recorded against depth to produce a graph or curve called an electric log or resistivity log. Many factors found in the subsurface can influence the resistivity of the formation including the physical properties of the drilling fluid, the rock formation chemistry, the presence of contamination, etc. All these factors must be taken into consideration when interpreting the resistivity log.

- **Spontaneous Potential Logs** Spontaneous potentials (SP) are naturally occurring electrical potentials (voltages) that result form chemical and physical changes at the contacts between different types of subsurface geologic materials. For example, a clay layer and an underlying sand layer will have a horizon of contact that marks their different potentials. These potentials become more pronounced when the pressure in the borehole greatly exceeds the pressure in the formation with depth. SP is measured by lowering an electrode into an uncased borehole filled with drilling fluid by means of a cable connected to one terminal of a millivolt meter and recorder. The other terminal of the instrument is connected to a ground terminal at the surface which is often placed in the mud pit. No external electricity is applied to the circuit. The downhole electrode is usually negative with respect to the surface electrode. As the electrode is moved up and down in the borehole, the meter registers variations in SP of the different formations. The SP log consists of a curve of these potentials plotted against depth. Different geologic materials demonstrate distinct curves as do formations containing saltwater or contaminants.

- **Gamma Logs** In gamma logging, measurements are made of naturally occurring radiation coming from the materials encountered in the borehole. The record of gamma radiation is used as a qualitative guide for stratigraphic correlation and permeability. In some areas, a direct relationship can be established between gamma radiation and permeability. Certain radioactive elements are naturally occurring in igneous and metamorphic rocks and as depositional particles in sedimentary rocks. As the gamma radiation is emitted from certain geologic materials, the materials become unstable and decay spontaneously into other more stable elements. Detection of gamma-ray emissions involves two random processes. First, the rays are given off at random intervals by the radioactive minerals. Second, these irregularly spaced pulses collide randomly with the detecting element in the logging probe. The collisions per unit time are then correlated with depth and a curve is generated called a gamma log.

- **Gamma-Gamma Logs** This type of logging uses an active source of gamma radiation (usually cesium-137 or cobalt-60) which is lowered into the borehole along with a detector that is shielded so it counts only the back-scattered gamma rays. The source and detector are placed up to 15 inches apart and are set against the borehole wall by mechanical arms. The gamma rays are directed into the formation surrounding the borehole. Because the amount of back-scattered radiation depends on the electron density of the formation, the recorded counts are approximately proportional to the bulk density. Density and porosity are inversely related. Thus, in general, the higher the density, the lower the porosity. The gamma-gamma log is sometimes referred to the density log. This log can be used to calculate the porosity of a formation when the fluid and grain densities are known.

- **Neutron Logs** are used primarily as an indicator of total porosity under saturated conditions. They are also used to measure the amount of moisture in unsaturated zones. The log is obtained by recording the number of neutrons impinging on a detector mounted some distance from a constant neutron source (americium-241 or beryllium) in the borehole. Before reaching the detector, many of the neutrons emitted from the source collide with various particles, lose energy, and eventually are captured. Most of the energy is lost in collisions with hydrogen ions. Because hydrogen is a principal component of water, the loss in energy indicates the amount of water present. If the energy loss is large, the amount of hydrogen in the formation must be high, and therefore the porosity is large.

- **Acoustic Logs** are useful in determining relative porosities of different formations and are widely used to verify how well the casing has been cemented to the formation. This log is called the cement bond log. The acoustic log is used to determine fracture patterns in the aquifer and thus is valuable in estimating where groundwater flow may be concentrated in semiconsolidated or consolidated rocks such as sandstone, conglomerates, and igneous rocks. The acoustic log measures travel time and the attenuation of an acoustic signal created by an electromechanical source in the borehole. A transmitter in the borehole converts electrical energy to acoustic energy which travels through the formation to one or more receivers. The receivers convert the acoustic wave back into an electrical impulse that can be measured.

- A **Temperature log** is obtained by lowering a temperature sensor down the water-filled borehole at a slow but constant rate. As water flows by the sensor, the temperature is recorded. The temperature probe should be slowly lowered through undisturbed formation water to ensure accuracy. In general, the geothermal gradient is greater in formations with high hydraulic conductivity than in formations with low hydraulic conductivity. This relationship is usually governed by the rate of groundwater flow. Thus, interpretation of thermal data can suggest the relative hydraulic conductivity of the formation in the borehole.

Temperature logs are also used to detect episodes of seasonal recharge because recharge upsets the usual temperature regime. They are valuable in identifying heat-pump recharge water, excess irrigation and industrial wastes.

Meteorological Factors

Site-specific meteorological data are used when conducting screening or model analyses. Collection of meteorological data in the field requires the design of a system that provides the necessary input information for dispersion modeling and takes into account the logistics of siting and operation of meteorological stations. The following meteorological parameters are typically measured in the field:

- **Horizontal wind speed sensors** (anemometers) are available in many shapes and sizes. The most common types are the rotational cup and the propeller anemometers. The cup sensors are generally more accurate. The design of the anemometer cups dictates the durability, sensitivity, accuracy, and response of the instrument. Three conical cups usually provide the best performance. Propeller anemometers revolume about a pivoted shaft that is oriented by a vane into the direction from which the wind is blowing. The number of blades normally varies from three to six. For most atmospheric dispersion studies, anemometers should have a starting threshold of 0.5 meters per second or less and a system accuracy of ± 0.2 meters/sec.

Most sensors for measuring horizontal wind direction consist of a vane rotating on a fulcrum. The shapes and designs of the vane surface vary, but are generally rectangular or curved. The vanes are designed to orient into the direction from which the wind is blowing. For atmospheric dispersion studies, wind vanes should have a starting threshold of less that or equal to 0.5 m/s and a system accuracy of ± 5 degrees.

- **Vertical wind speed and direction** can be measured with a vertical propeller anemometer, a UVW anemometer, or bivane. The vertical propeller anemometer has a propeller-type sensor mounted on a fixed vertical shaft. Since the propeller can reverse its direction, the sensor can indicate whether wind flows are directed upward or downward. The UVW anemometer is located on a vertical shaft at right angles to the first two shafts. This anemometer will measure the total (i.e., U and V are the horizontal wind components and W is the vertical wind component) wind vector. The UVW anemometer can be assembled to give real time data, including wind speed, azimuth, and elevation. The bivane consists of a vane with two flat plates perpendicular to each other and mounted so as to allow rotation horizontally and vertically. It only provides azimuth and elevation components of the wind direction and, therefore, must be complemented with a propeller anemometer.

The most common devices used to measure ambient temperature are resistive temperature detectors (RTDs) and thermistors. Thermistors are electronic semiconductors that are made from certain metallic oxides. The resistance of the thermistor varies inversely with its absolute temperature, so the electrical output through the sensor can provide an indication of the ambient temperature. The RTD, which functions in a similar manner, are made of different pure metals including silver, copper, nickel, or platinum. Normally, platinum provides the best material. The RTD measures the electrical resistance of a pure metal, which increases with temperature.

- **Cloud cover** is best determined from data collected at a representative National Weather Service (NWS) Station as there are trained observers available to provide this information. If representative NWS cloud cover data are not available, then the total amount of cloudiness above the apparent horizon should be estimated as a fraction (in tenths) by a visual observation.

- **Ceiling height** is defined as a layer of clouds that covers more than one-half of the sky. The height of a ceiling is best determined by experienced observers at NWS Stations. It can be estimated visually at the waste site by determining the height of the lowest layer of clouds that cover more that 50 percent of the sky. A pocket-sized cloud atlas may be a useful tool for the field observer.

- **Mixing heights** are best determined from representative NWS Stations that record upper air (i.e., above the surface) data. Instrumentation packages called radiosondes are carried aloft twice daily (7:00 a.m. and 7:00 p.m. EST) throughout the United States by nontethered balloons. These packages measure wind speed and direction, temperature, and humidity as they ascend. Estimates of the mixing height can also be made at the site through the use of balloonsondes (tethered and nontethered balloons) and with remote sensors such as acoustic sounders. This equipment requires special expertise to use, to evaluate, and to apply the collected data.

- **Atmospheric stability** is determined in the field by using a number of alternative methods. These methods use the applicable meteorological parameters discussed above. The Pasquill-Turner method of classifying atmospheric stability uses the combination of wind speed, incoming solar radiation, cloud cover, and time of day.[4] The Pasquill-Turner equation is as follows:

$$\sigma_E = \sigma_W / US$$

Where σ_E = standard deviation of the vertical wind direction fluctuations
σ_W = standard deviation of the vertical wind speed fluctuations
US = scalar mean wind speed

It should be noted that σ_E in this discussion is in radian measure.

Streams and RiversContamination

Monitoring surface water contamination is accomplished through analysis of water samples collected from streams, lakes, or ponds. Baseline conditions, which provide a basis for comparison, can be determined by collecting samples from nearby or upstream surface waters that are known to be free of contaminants.Surface water samples are subjected to chemical analysis for constituents of interest, with temporal changes in the chemistry of a given location providing information regarding the contamination event. Evaluating changes in surface water chemistry requires knowledge of changes in related factors such as stream discharge, subsurface currents, water temperature, and water stratification.

Samples from shallow depths in rivers or streams can be collected by submerging the sample container. High waterproof boots can be worn by a technician when collecting a sample in small streams. A boat is required to collect samples in large rivers. The sample container is usually disposable or constructed of a nonreactive material such as glass, stainless steel, or Teflon. A weighted-bottle sampler is used to collect samples at any predetermined depth from lakes or reservoirs. The sampler consists of a glass bottle, a weighted sinker, a bottle stopper, and a line that is used to open the bottle and to lower and to raise the sampler during sampling. Teflon bailers have also been used where feasible to collect samples in deep bodies of water. Near-shore sampling may be performed using a pond sampler. A dipper can be used to collect grab samples from the top few inches of the water column. A Teflon or stainless steel dipper is used to collect a water sample, which is transferred to a sample bottle. Another method of sampling requires the use of a peristaltic pump. The pump can be attached to a long arm, allowing the sample to be pumped directly into the sample container. This system allows the operator to reach into the liquid body, sampling from depth, or sweeping the width of narrow streams.

pH Meters. The pH of a liquid can be determined in numerous ways. For scientific purposes, pH is always measured with a pH meter equipped with an appropriate electrode. These meters are generally accurate to 0.01 to 0.05 pH units. Another common method uses acid-base indicators that undergo color change over a rather narrow pH range. A universal indicator (pH paper), made by combining several acid-base indicators, may be used to determine pH (within one unit) of any liquid. Measurements of pH are also used in groundwater contamination studies.

Electrical Conductivity Meter The electrical conductance of a substance is its ability to conduct an electrical current. Current flows in ionized or mineralized water because the ions are electrically charged and move toward a current source that will neutralize them. The electrical conductivity meter uses a probe to measure this current flow. Liquids with greater conductivity usually indicate the presence of metals, salts, or other contaminants. Chemically pure water has a very low electrical conductance, indicating that it is a good insulator. Only a small amount of dissolved mineral matter will increase the conductance

of the water. Conductance is measured in the inverse of ohms (the unit of resistance). Conductivity units are recorded as mhos and water conductance is usually expressed as micromhos. Electrical conductivity is also measured in groundwater contamination studies.

A **Current Meters** is a mechanical device with a rotating element that, when submerged in a flowing stream, rotates at a speed proportional to the velocity of the flow at that point below the surface. The rotating element may be either a vertical shaft or a horizontal shaft. Meter manufacturers usually provide the user with calibration tables to translate rotation into linear speed in meters or feet per second. Current meters can also be electromagnetic sensors where the passage of fluids between two electrodes in a bulb-shaped probe causes a disturbance of the electromagnetic field surrounding the electrodes. This disturbance generates a small voltage that can be made proportional to fluid velocity by internal electronic circuitry. A direct readout of velocity in meters or feet per second is provided for the user.

Stage Gauges Where repeated measurements of a volumetric flowrate at a certain cross-sectional area are required, it is best to install a permanent stage gauge along the stream's side wall to facilitate measurement of the depth. The gauge is usually made of rigid rod or board, with graduated markings on it and firmly mounted with the streambed serving as a possible reference point. Discharge rating curves can be used to define the relationship between stage and stream discharge, and to allow conversion of stage hydrographs to discharge hydrographs.

Weirs are commonly used flow measurement devices. They are relatively easy to install and inexpensive to construct. All weirs are deliberate restrictions inserted into an open channel or partially full pipe to obstruct flow by forcing the water through a calibrated cross section. The weir causes water to back up and create a higher level (head) than the level below the barrier. The height of that head is a function of the velocity of the flow. Standard tables and nomographs are available for many different types of weirs, based on different general equations for each type. The three most common weir configurations are triangular (or V-notch), rectangular, and Cipolletti (or trapezoidal).

Soil and Sediment Contamination

Sediments near shore or above the waterline are most easily collected using simple tools, such as polypropylene scoops, trowels, or dippers. Other alternatives for small semi-solid sediments include wooden tongue depressors or stainless steel tablespoons. For stream bottom sediment samples, vertical pipe or core samplers (hand corers, gravity corers) are driven into a stream bed to any selected depth. Ponar grab samplers are a clamshell-type scoop activated by a counter-lever system. The shell is opened, latched in place, and slowly lowered to the bottom. When tension is released on the lowering cable, the latch releases and the lifting action of the cable on the level system closes the clamshell.

Split-spoon and thin-walled (Shelby tube) samplers are used to collect intact samples of unconsolidated materials. Both techniques provide a continuous sample that is amenable to lab testing for permeability, density, and other parameters. Split-spoon samplers are attached to the end of a drill stem and are driven into the base of an open, clean borehole by a series of blows. Thin-walled samplers are similar, but are pressed into the subsurface using the weight of the drill rig to collect a less disturbed sample. Split-spoon and thin-walled samplers commonly are used in conjunction with hollow-stem augers.

Soil gas samples can be collected by either burying an adsorbent (e.g., activated charcoal) which remains undisturbed for a period of days to weeks. The adsorbent is retrieved and thermally or chemically desorbed, with the organic contaminants analyzed by mass spectrometry or gas chromatography. Soil gas grab samples can be taken by inserting a hollow metal probe into the vadose zone and withdrawing gas using a pump. Samples are analyzed on-site using portable instruments, providing real-time data.

Organic soil-gas analyzers are used to detect contaminant plumes transported with shallow groundwater. Organic compounds with high vapor pressures and low water solubilities will volatilize as a contaminant plume migrates, leaving detectable traces in vadose zone soils. Measurements of soil-gas can be made using a probe mounted on a truck, in situ (leaving a sampler in place), or by collecting a soil sample from which the gas is removed. The gas is analyzed using an organic vapor analyzer, photoionization detector, or gas chromatograph either with field instruments, in a mobile field lab, or in a fixed remote lab.

Soil resistivity surveys can provide information about aquifer boundaries, depth to water or bedrock, changes in soil type, and levels of contamination. The survey is conducted by driving a series of metal stakes (electrodes) into the ground at fixed spacing and in a straight line and supplying current to two electrodes using a battery or small generator (the current is measured with a current meter). The voltage between the other electrodes is measured with a voltage meter and the resistivity computed from these values.

Permeameters are used to measure the permeability of soil or rock samples in the lab. The devices have a sample chamber (typically cylindrical), a mechanism for forcing water through the sample, a device to measure hydraulic head, and a meter to determine discharge. Hydraulic conductivity is computed from a modification of Darcy's law. Two types of devices are used: constant head permeameters commonly are used for nonconsolidated or poorly cohesive samples, whereas falling head permeameters typically are used for cohesive sediments.

Wildlife Contamination

General collection of terrestrial **vertebrates** will document the presence of species and can be used to estimate population sizes. Vertebrate collection can be used to gather tissue for pollutant analysis.

Live traps are preferred to collect sensitive species when lethal traps or hunting are inappropriate. Population sizes can be estimated using live traps in a mark-and-recapture context. A list of species present on the site can be generated. The size of the range can be estimated using marking or radiotelemetry after capture and release. Animals can also be trapped alive to collect tissue (especially blood) for analysis.

Lethal trapping can be used to establish which species are present on a site and to collect tissue-donor specimens for analysis of pollutants.

Hunting allows the documentation of species present on the site and is suitable for collecting tissues for analysis. It is most useful on medium- to large-sized species and may be best for species not susceptible to trapping.

Ecological analysis provides an integrated analysis of the habitat values on a site. The impact of the pollution on the site's most important habitat values can be assessed by using an uncontaminated comparison area or information on a polluted site before it was polluted.

Macroinvertebrates can be sampled using sediment grabs, core samplers, shovels, box sieves, surber samplers, invertebrate drift nets, traps (i.e., lake bottoms for crayfish), artificial substrates, in-situ bioassays, and other miscellaneous methods (i.e, hands, hand tools, dip nets, plankton nets).

Methods for collecting fish samples include trawls, electrofishing, seining (large net fishing), hook and line, and miscellaneous (e.g., gill, nets, trammel nets, fyke nets, or rotenone) methods.

b. Describe the requirements of the following documents as they relate to environmental monitoring:

- 10 CFR 61.53, Environmental Monitoring
- Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)
- Resource Conservation and Recovery Act (RCRA)
- National Environmental Policy Act (NEPA)
- 40 CFR 136, Analytical Test Procedures

10 CFR 61.53, Environmental Monitoring

10 CFR Part 61 establishes the requirements and procedures to be followed in the land disposal of radioactive wastes. 10 CFR 61.53, Environmental Monitoring, requires pre-operational monitoring of basic environmental conditions at a disposal site for the acquisition of data regarding ecology, meteorology, climate, hydrology, geology, geochemistry, and seismic characteristics. If a characteristic of these items is subject to seasonal variation, monitoring must be performed over a 12 month period.

During the construction, operation, and post-operational phases of a radioactive land disposal site, the permittee must maintain surveillance of the site utilizing a warning system capable of detecting the release of radionuclides before they migrate beyond the site boundary.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)

CERCLA environmental monitoring requirements are as follows. Section 104(b) authorizes the investigation, monitoring, surveying, testing, and other information gathering activities by EPA in any actual or potential CERCLA action. During the remedial investigation, the site is subject to sampling, monitoring, exposure assessment, and any other information gathering activity required to assess the release, or potential release, that could affect human health or the environment. Further, during field assessments, monitoring takes place to determine the physical characteristics (soils, hydrology, ecology, etc.) of the site, including its air, surface water, and groundwater characteristics.

Under CERCLA, injury determination of natural resource damages (43 CFR 11.14) require determination of an adverse change in chemical or physical quality or viability of the physical resource, attributable to a release. Damage assessment monitoring involves measuring specific criteria that pertain to surface water, groundwater, air, geologic, and biological resources. Injury to surface water can be demonstrated if the concentration of a hazardous substance exceeds drinking water standards (as measured in relation to prerelease monitoring data).

Resource Conservation and Recovery Act (RCRA)

RCRA requires environmental monitoring under numerous instances, of which a sampling appears below. For treatment, storage and disposal (TSD) facilities, the general groundwater monitoring requirements are set forth in 40 CFR 264.97. This section details the requirements for the construction of monitoring wells and their placement, sampling requirements, analysis, statistical methods, and recordkeeping. Section 264.98 establishes the requirements for the TSD detection monitoring program, which requires the owner or operator of a TSD facility to monitor for indicator parameters, waste constituents, and their reaction products to determine the presence of hazardous substances in the

groundwater [40 CFR 264.98(a)]. This section also describes the determination of pertinent parameters, point of compliance, well placement, sampling frequency, and other factors.

In RCRA Subpart M - Land Treatment, unsaturated zone monitoring is required in compliance with 40 CFR 264.278. Subpart O - Incinerators (Section 264.347) requires monitoring of carbon monoxide during the incineration of hazardous wastes, and may require the sampling and analysis of incinerator waste and emissions (if specified by the Regional Administrator). Subpart X - Miscellaneous Units (Section 264.60 Environmental Performance Standards) requires detection and monitoring of hazardous constituents as necessary to protect human health and the environment during the operating and post-operational periods, and as necessary to prevent migration of these hazardous substances.

40 CFR Part 266 - Standards for Materials Being Recycled/Reused includes numerous monitoring requirements. For example, Section 266.102(e)(8) sets the monitoring requirements for burners of hazardous waste, and requires the monitoring of emissions as specified under the permit (i.e. hydrocarbons, carbon monoxide, and oxygen). Part 266 includes other standards for monitoring and control of various emissions and discharges from a variety of sources.

National Environmental Policy Act (NEPA)

NEPA requires an environmental impact statement (EIS) from Federal agencies during their decision making process for major actions that may impact the quality of the environment. Prior to generation of an EIS, an environmental assessment (EA) is performed. Data gathered (including environmental monitoring data) during the EA are incorporated into the EIS. Although no specific data are delineated, monitoring of any medium may be required to provide baseline information.

40 CFR 136, Analytical Test Procedures

40 CFR 136, Analytical Test Procedures, establishes the methods for measurement and evaluation of pollutants under the Clean Water Act, and includes tables delineating the approved test methods and procedures for specific pollutants. Sections 136.4 and 136.5 specify the process required for application and approval of adoption of an alternate test procedure.

c. Describe the various quality assurance and quality control programs used to enhance data quality. Include in your discussion programs both internal and external to the Department.

Two primary factors affect environmental data quality: measurement uncertainty and sample uncertainty. Implementing quality control measures and quality assurance

procedures can minimize the concerns associated with each factor.[1] Quality control measures include the adoption of good laboratory habits and practices, institution of standard sampling procedures, and the use of sound sample preparation and analytical procedures. Sampling protocols should be developed specifically for the problem under consideration and should be strictly followed.[1] Sample collection technicians must be properly trained in the approved procedures, sampling equipment must be calibrated per established schedules, samples must be protected from destabilization, sample containers must be properly identified, and chain-of-custody procedures must be precisely followed.[1]

Quality assessment requires monitoring of the sampling and analysis process, and is best accomplished through continuous auditing. Sampling protocols should be carefully examined on a periodic basis. The EPA requires a quality assurance project plan (QAPP) and the inclusion of five data quality indicators (DQIs) (precision, bias, representativeness, completeness, and comparability) to control data quality. Data quality objectives (DQOs) are derived from the QAPP (and its objectives for DQIs), and indicate the level of uncertainty that is acceptable based on the intended use of the data.

Specific information relating to DOE quality programs is found in Section 3.2 of this study guide.

d. Given a sampling parameter/equipment, describe the standard sampling methods and protocols.

This is a demonstration skill. An individual will actually be performing the activity rather than acknowledging comprehension. U.S. EPA OSWER, SW-846, Test Methods for Evaluation of Solid Wastes, vols. 1A-1C provides an extensive listing of sampling methods and protocols as approved by EPA.

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[1] Keith, Lawrence H. (Editor), *Principles of Environmental Sampling*, Salem, MA, American Chemical Society, 1988.
[2] Godish, T., *Air Quality*, 2nd Edition, Lewis Publishers, Chelsea, MI, 1991.
[3] Driscoll, F., *Groundwater and Wells*, 2nd ed., Johnson Division, St. Paul, MN, 1986.
[4] *U.S. EPA, Evaluation Guidelines for Toxic Air Emissions from Land Disposal Facilities*. Washington DC, Office of Solid Waste, August 1981.