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**Soil
Conservation
Service**

Agricultural
Waste Management
Field Handbook

Chapter 1 Laws, Regulations, Policy, and Water Quality Criteria

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651.0100 Federal laws

(a) Introduction

Many environmental laws enacted by Congress are enforced by the United States Environmental Protection Agency (EPA). EPA issues regulations for prevention of air and water pollution, protection of drinking water, proper solid waste management, and control of pesticide use. Their broad regulatory powers related to air and water pollution and solid waste management are of great interest to the agricultural producer and to agencies, such as the Soil Conservation Service (SCS), that provide technical assistance to producers. State public health and environmental control agencies generally are responsible for implementing Federal as well as State control programs.

Federal legislation aimed at control of water pollution over the past two decades illustrates the national commitment to develop and implement a strategy that leads to cleaner air and water.

(b) Air

The Air Pollution Act of 1955 authorized federally funded air pollution research. Later legislation included the Motor Vehicle Pollution Control Act of 1965, the Air Quality Act of 1967, and the Clean Air Act of 1970. The Clean Air Act provides for uniform air quality standards and control of emissions from existing facilities. It also prohibits construction of new facilities that violate or interfere with Federal or State regulations for air quality standards. Many of the State air quality requirements have been established as a direct result of Federal legislation. Most private citizen complaints and civil suits brought against livestock operators have been because of odor problems.

The Clean Air Act Amendment of 1990 (Public Law 101-549) has provisions of importance to producers of agricultural products. Goals of the law having an agricultural orientation are those for reduction of emissions that cause acid rain and those that target protection of stratospheric ozone. Ammonia volatilization from animal and other agricultural operations will most likely come under increased scrutiny and possible control as a source of soil and water acidification. Some states are starting to request atmospheric ammonia test results on air samples taken at the property lines of the animal operations.

Methane emissions from "rice and livestock production" and from "all forms of waste management . . . including storage, treatment, and disposal" are mentioned in the 1990 law as being of concern with regard to ozone depletion. These sources and others, both nationally and internationally, are to be evaluated by EPA jointly with the Secretaries of Agriculture and Energy, and control options will be developed that can be used to stop or reduce growth of methane concentrations in the atmosphere.

(c) Water

Federal legislation for protection of water quality began with the Rivers and Harbors Act of 1886 and 1889. In 1948, the Federal Water Pollution Prevention Act set a national policy for prevention, control, and abatement of water pollution. It was amended in 1956. The Federal role in water pollution control was expanded by the Water Quality Act of 1965, the Clear Water Restoration Act of 1966, and the Water Quality Improvement Act of 1970.

The Federal Water Pollution Control Act of 1972, Public Law 92-500, was passed so that the effectiveness and speed of implementation of water pollution control could be improved. This is to be accomplished by increasing Federal responsibility for establishing standards and providing greater involvement in their implementation and enforcement. The objective is to restore the chemical, physical, and biological integrity of the Nation's water. To achieve this objective, the law set a national goal of no discharge of pollutants into the Nation's water by 1985. Water of the United States is defined in the Code of Federal Regulations (CFR) 40, part 122, to include wetlands and intermittent streams as well as conventional lakes, ponds, rivers, streams, and the territorial seas.

The Clean Water Act of 1977, Public Law 95-217, changed the 1972 amendments by providing more easily attainable objectives and time schedules. It strengthened the 1972 law's basic requirement that operators of point source discharges, such as those from industrial and municipal facilities, feedlots, and other discrete significant sources, obtain a permit

specifying allowable amounts and constituents of effluents and a schedule for achieving compliance. The permits are known as National Pollutant Discharge Elimination System (NPDES) permits (see section 651.0101(a) of this chapter).

Other Federal actions of interest to agriculture:

The National Environmental Policy Act (NEPA) is the basic national charter for protection of the environment. NEPA establishes a process used during planning to produce better decisions for protection and enhancement of the environment. The process uses Environmental Assessments and Environmental Impact Statements to ensure that Federal agencies use "all practical means and measures" to protect and improve the environment. SCS procedures for environmental evaluations of proposed animal waste control facilities will meet the intent of NEPA.

Criteria for Classification of Solid Waste Disposal Facilities and Practices, Federal Register, Vol. 44, No. 179, September 13, 1979, defines requirements for land application of organic materials.

Water Quality Criteria, Federal Register, Vol. 45, No. 231, November 28, 1980, established the criteria for 64 waterborne constituents, which provided updated values for "Quality Criteria for Water" published by EPA.

The 1986 Amendments to the Safe Drinking Water Act, Public Law 99-339, established requirements for a new series of regulations covering such topics as filtration, disinfection, bacteria, and virus control. This law also set maximum contaminant levels for a large number of organic and inorganic chemicals including nitrates/nitrites, selenium, and many agricultural pesticides.

National Coastal and Marine Policy, January 1989, asserts that EPA will protect, restore, and maintain the Nation's coastal and marine water to protect human health and sustain living resources.

Criteria for Identifying Critical Aquifer Protection Areas — Final Rule — 40 CFR 149, Federal Register, Vol. 54, No. 29, February 14, 1989, among other things, defines a critical aquifer area as one that is vulnerable to contamination; contamination is reasonably foreseeable unless a control program is implemented; contamination would cause significant economic, environmental, or social costs; and all or part of a sole source aquifer.

The 1987 Amendments to the Federal Water Pollution Control Act, Public Law 100-4, February 4, 1987, reflect the continued interest Congress has in assuring that water quality needs of the country are met. The Amendments added Section 319, "Nonpoint Source Management Programs," which requires States to assess water quality conditions and prepare and submit assessment reports to the EPA administrator. Based on state assessment reports, States are to prepare and implement water quality management plans that deal with problems in an orderly fashion. The major provisions of the section 319 amendment require state management programs to:

- Identify best management practices and measures to be undertaken to reduce pollutant loadings.
- Identify programs to achieve implementation of the best management practices.
- Schedule annual milestones for using program implementation methods and implementing the best management practices.
- Certify that State laws provide adequate authority to implement management programs.
- Assure that sources of funds and other types of assistance are available to carry out the management program.

Section 319 allows for demonstration projects and hydrologic unit areas to be selected for implementation. States are required to develop and implement management programs on a watershed basis to the maximum extent practicable.

The Coastal Zone Act Reauthorization Amendments of 1990 (in Public Law 101-508, Budget Reconciliation Act) amended the Coastal Zone Act of 1972 (16 USC 1455) by including requirements for States to develop programs for nonpoint source pollution control. Control programs are to be carried out by implementing a prescribed set of management measures. Programs are to "...serve as an update and expansion of State nonpoint source management program developed under section 319 of the Federal Water Pollution Control Act...."

651.0101 Federal regulations and rules

(a) National Pollutant Discharge Elimination System

EPA published policies and procedures for issuance of National Pollutant Discharge Elimination System (NPDES) permits on May 22, 1973, and final regulations on March 18, 1976. These regulations established conditions under which separate storm sewers and concentrated animal feeding operations are considered point sources of pollution subject to NPDES permit requirements. On June 18, 1976, final regulations were published for silvicultural activities. On July 12, 1976, final regulations were published for agricultural activities that, in effect, defined irrigation return flows as an agricultural point source of pollution. However, in 1977, this definition, was changed by Public Law 95-217, which specifically excluded irrigation return flows from NPDES regulation.

The NPDES permit requirements were consolidated with those of other EPA permit programs on May 19, 1980. They are included in parts 122, 123, 124, and 125 of Title 40, Code of Federal Regulations. Except for concentrated animal feeding operations, agricultural activities are not point sources of pollution subject to NPDES permits.

Most States have been granted full NPDES permitting authority by EPA with oversight of state operations provided by EPA. Where States do not have permitting authority, a variety of arrangements for permitting have been made. They range from EPA doing all permitting to EPA issuing permits for certain categories of pollutants (or operations) and the State issuing the permits for other categories.

(1) Concentrated animal feeding operations

Only an animal feeding operation defined as a "concentrated animal feeding operation" is subject to NPDES permit requirements. An animal feeding operation is a lot or facility without vegetation where animals are confined for 45 days or more a year. A concentrated animal feeding operation occurs where:

- More that 1,000 animal units are confined and the site has discharge of pollutants from storms smaller than the 25-year, 24-hour storm event.
- More than 300 animal units are confined and the site has discharge of pollutants from storms smaller than the 25-year, 24-hour storm event through a manmade device or directly into navigable waters flowing through a feedlot. The regional administrator of EPA or the director of the State program reserves the right to designate any feedlot in this size range as a point source of pollution after an onsite inspection.
- 300 animal units or less are confined and the regional administrator of EPA or the director of the State program, after onsite inspection, determines that pollutants are discharged into the water of the United States through a manmade device or directly into such water flowing through a feedlot.

Animal units are computed as the number of:

- Slaughter and feeder cattle multiplied by 1.0
- Mature dairy cattle multiplied by 1.4
- Swine weighing over 55 pounds multiplied by 0.4
- Sheep or lambs multiplied by 0.1
- Horses multiplied by 2.0
- Laying hens or broilers, with continuous overflow watering, multiplied by 0.01
- Laying hens or broilers, with liquid manure handling systems, multiplied by 0.0333
- Turkeys multiplied by 0.0182
- Ducks multiplied by 0.02

The number of animal units for an operation that has various kinds of animals is computed by adding the computed animal units for each kind.

Note: State regulations that are more stringent supersede the above criteria.

(2) Concentrated aquatic animal production facilities

Concentrated aquatic animal production facilities designated as point sources subject to NPDES permit requirements are hatcheries, fish farms, or other facilities that grow or hold aquatic animals of the following categories:

- Cold water fish species or other cold water aquatic animals in ponds, raceways, or similar structures that discharge at least 30 days per year, produce more than 20,000 pounds of aquatic animals per year, and receive more than 5,000 pounds of food during the month of maximum feeding.
- Warm water fish species or other warm water aquatic animals in ponds, raceways, or similar structures that discharge at least 30 days per year. Closed ponds that discharge only during periods of excess runoff or facilities that produce less than 100,000 pounds of aquatic animals per year are not point sources under this category.
- Facilities determined on a case-by-case basis by the permitting authority to be significant contributors of pollution to waters of the United States.

Note: State regulations that are more stringent supersede the above criteria.

(3) NPDES permits

Point sources of pollution can be regulated by individual or general permits. Owners or operators of most point sources are required to apply for individual permits. These include concentrated animal feeding operations, concentrated aquatic animal production facilities, and certain silvicultural activities.

Part 122, Title 40, Code of Federal Regulations established conditions and procedures whereby point sources can be regulated under a general permit. General permits can be made applicable to any category of point sources if the category has similar characteristics throughout the area covered by the general permit. Owners and operators are required to comply with the conditions of the general permit, but they do not have to apply for a permit.

Note: A permit is not required of any operation (concentrated animal feeding operation or otherwise) where runoff, wastewater, or polluted water of any kind is prevented from leaving the land owned or under the control of the producer, except during storms equaling or exceeding the 25-year, 24-hour storm event, and is used on that land for crop production, soil amendment, or any other beneficial purpose in a nonpolluting manner.

(4) Nonpoint source pollution

While concentrated animal facilities are considered point sources of pollution, other potential agricultural sources of water pollution are considered to be nonpoint sources.

Each State's comprehensive water quality plan includes controls for point sources (PS) and nonpoint sources (NPS) of water pollution. Features of point and nonpoint sources of water pollution are shown in table 1–1.

The prescribed approach used for control of NPS is often different from that used for PS. PS controls generally rely on collection and treatment of potential pollutants. NPS control methods, on the other hand, are typically based on management of potential pollutants including such practices as land application of manure.

Individual States have been given the responsibility by EPA to formulate a comprehensive water quality plan for control of various pollutants and specific steps for selecting systems of practices. The choice of particular practices from those approved by the state depends on the site specific conditions. The selection of practices for a particular case is related to the pollutant or pollutants that need to be controlled, type of agricultural activity contributing the pollutant or pollutants, and site specific characteristics.

Water pollution laws form the foundation for a control program by specifying broad objectives and providing mechanisms to obtain them. However, legislation cannot define the important details and methods of implementation for programs that are conducted by such natural resource management agencies as the NRCS. Legislation can specify goals, standards, criteria, and other guidelines, but each program must be individually developed at the local level.

651.0102 State responsibilities

All State laws dealing with air and water quality and disposal of solid wastes must meet the minimum requirements of the Federal laws. Most States have such laws. Many have laws, rules, or regulations specifically addressing management of agricultural wastes in terms of surface and ground water quality requirements, management facilities, and land application. Many of the State laws, rules, and regulations are more stringent than those promulgated by the Federal Government. In the absence of State requirements, EPA assumes enforcement.

651.0103 State laws and regulations

Each State should supplement this section with information on State laws and regulations or reference where this information is located (see 450-GM, Part 405.03).

Table 1–1 Typical features of point and nonpoint sources of water pollution

Point sources	Nonpoint sources
Relatively steady flow over time	Flows usually occur at random and intermittent intervals following rain, snow melt, or ground thaw events
Adverse impacts most severe during periods of low stream flow or cumulative in lakes	Adverse impacts most severe during or following storm events or cumulative in lakes
Pollutants enter watercourses at identifiable points	Pollutants enter watercourses at many, often unidentifiable, points

651.0104 Owner/producer responsibilities

All work in which SCS assists must meet the minimum requirements of Federal, State, and local laws, rules, and regulations. Landowners, producers, and operators are responsible for obtaining required approvals and permits and for operating facilities in accordance with these laws, rules, and regulations.

651.0105 Safety

Safety is an important aspect of planning, design, construction, and operation of an agricultural waste management system (AWMS). SCS policy as it pertains to an AWMS includes:

- Notification of utility companies when utilities are in the vicinity of engineering investigations or construction activities (National Engineering Manual (NEM), part 503).
- Incorporating safety measures into structures (NEM, part 503).
- Informing decisionmaker and contractor of safety requirements at preconstruction conferences (NEM, part 512.13).
- Safety requirements for construction activities under formal SCS contracting (Federal Acquisition Regulations, Clause 52.236-13, and Code of Federal Regulations, 29 CFR 1910 & 1926).
- Safety requirements for construction contracts under locally awarded contracts (120-V-CGCAM (National Contracts, Grants, and Cooperative Agreements Manual, part 516).
- Safety requirements for construction by informal contracting acquired by the decisionmaker (110-GM (General Manual), part 402.4).
- Withdrawing SCS assistance if unsafe construction conditions are not corrected (110-GM, part 402.13).

651.0106 Policies — USDA and SCS

The policies that guide involvement of USDA agencies in pollution abatement activities are in the following documents:

(a) USDA nonpoint source water quality policy

This policy (Department regulation 9500-7, December 5, 1986) gives the key instructions for agencies of the USDA to follow concerning nonpoint source pollution. Some of the instructions are:

- Ensure that actions and programs conform with the nonpoint source water quality plans adopted by State and local governments.
- Coordinate water quality activities with appropriate public and private institutions.
- Promote the improvement, protection, restoration, and the maintenance of water quality to support beneficial uses.
- Integrate water quality concepts, considerations, and management techniques into appropriate programs, research, and modes of assistance to landowners and land users.
- Provide Federal assistance in accordance with overall environmental policy and other procedural directives developed by USDA.
- Encourage the use of best management practices as the mechanism to meet Federal, State, and local water quality requirements for agricultural and silvicultural lands.
- Train agency personnel in surface water and ground water quality concepts to a level commensurate with their responsibility.

(b) USDA policy for ground water quality

The foundation of this policy, Department Regulation No. 9500-8, November 9, 1987, is in support of "prudent use and careful management of nutrients and other agricultural chemicals" and in advocating and fostering programs, activities, and practices to avoid ground water contamination. To bolster this position, USDA agencies will continue to conduct research, monitoring, assessment, and evaluation of chemical management; provide information, education, and technical assistance to private landowners in using practices that minimize risks; and provide information and education to people and communities in rural areas about protecting wells from pathogens and nutrients and other agricultural chemicals.

(c) SCS water quality policy

General Manual (GM), title 460, part 401, subpart A, establishes responsibilities in support of implementing water quality activities from the SCS Chief through the various national office levels to the SCS state conservationists. Some of the more important requirements are that the state conservationists have the responsibility to:

- Assist local soil and water conservation districts, other Federal and State Government agencies, and the private sector to identify and treat nonpoint source pollution problems;
- Ensure that actions, investments, and programs conform with water quality nonpoint source pollution programs by State and local governments;
- Incorporate Best Management Practices (BMP's) as part of Resource Management Systems (RMS's), which are the most effective and practical means of preventing or controlling pollutants from nonpoint sources;
- Encourage landowners and land users to treat each acre within its capability and according to its needs for both surface and ground water quality protection and improvement;
- Cooperate with local conservation districts in developing conservation plans that use RMS's to minimize pollution problems from animal wastes, nutrients, pesticides, salts, sediments, and related pollutants; and
- Maintain adequately trained personnel in surface water and ground water quality concepts and management techniques.

(d) SCS planning policy on control of pollutants

The National Conservation Planning Manual, part 506, establishes the level of SCS involvement in pollution abatement activities. Subpart C Appendix, Section 507.31, "Guide to SCS Technical Assistance in Control of Pollutants," gives the appropriate levels of assistance that can be provided for managing such activities as livestock waste, food processing waste, pesticides, and municipal wastewater and sludge. Technical assistance should always be provided within the limits of knowledge and ability of the available personnel.

Livestock waste—Inventory (I), planning (P), and application (A) assistance may be provided for agricultural waste management systems if the wastes are to be used for a beneficial purpose, such as use of water, nutrients, and organic material. P and A do not apply to systems used strictly for disposal.

Food processing waste—I, P, and A may be provided to farmers, ranchers, and food processors for waste management systems that include beneficial use of water, nutrients, and organic material. SCS doesn't often provide P and A to large corporate food processors. Traditionally, I, P, and A have been provided to smaller, family owned and operated food processing companies that grow the products that they process.

Pesticides—I and P can be provided for a wide range of activities related to use and management of pesticides and waste pesticides. Application according to label, equipment operator protection, spill cleanup, equipment cleaning, container disposal, storage and transport, and filling and mixing areas are included. The use and management of pesticide waste should be carried out using guidelines and procedures jointly developed with the Cooperative Extension Service, experiment stations, and the pesticide industry.

Municipal wastewater and sewage sludge—The SCS policy establishes I, P, and A for farmers and ranchers who accept sludge, septage, and wastewater for beneficial agricultural purposes. P and A are not to be provided where wastewater or sludge is applied to land owned or controlled by a municipality or industry or where land applications are used strictly for disposal. (Sludge from municipal wastewater treatment facilities is solid waste, which comes under the purview of Public Law 580, Solid Waste Disposal Act, or Resource Conservation and Recovery Act of 1976.)

(e) Policy on land application of municipal sewage sludge

The Federal Policy for Use of Municipal Sewage Sludge for the Production of Fruits and Vegetables was published in January 1981. It was jointly developed by the USDA, EPA, and Food and Drug Administration (FDA). SCS technical assistance must be provided in conformance with the guidelines established in this document. The policy was an outgrowth of the EPA regulations, "Criteria for Classification of Solid Waste Disposal Facilities" [Federal Register, Vol. 44, No. 179 (40 CFR, Part 257), 9/13/79]. The regulation addresses land application of municipal wastewater sludges for food chain crop production. It states that through use of high quality sludges coupled with proper management procedures, the consumer should be protected from contaminated crops, and potential adverse environmental effects will be minimized.

(f) Field Office Technical Guide policy

General Manual, Section 450, Part 401, establishes the need to develop resource management plans that deal with agricultural wastes. This is supported by entries in the Field Office Technical Guide (FOTG) "Waste Disposal Interpretations," Section II, Soil and Site Information, 401.3(b)(2), and "Animal Wastes and Agri-Chemical Management," Section III, Resource Management Systems, 401.3(b)(3).

Resource Management Systems and Best Management Practices are similar, but they have some fundamental differences. Their differences are indicated by the following definitions:

Resource management systems are a combination of conservation practices and management identified by primary use of land or water that, if installed, will at a minimum protect the resource base by maintaining acceptable ecological and management levels for the five resource concerns in accordance with the FOTG.

Best management practices, as defined in 40 CFR, Part 130, are a practice or combination of practices determined by a State after problem assessment, examination of alternative practices and appropriate public participation, to be the most effective, practicable means of preventing or reducing the amount of pollution generated by nonpoint sources to a level compatible with water quality goals. BMP's address one or more resource concerns.

(g) SCS flood plain and wetland policy

SCS environmental policy in 190-GM, part 410, applies when waste management facilities on flood plains or wetlands are being planned. This policy restricts or requires special provision for certain agricultural waste management structures or activities within flood plains and wetlands. It is SCS policy that flood plains be, to the extent practical, conserved, preserved, and restored to existing natural and beneficial value on base (100 year) flood plains as a part of technical and financial assistance in programs SCS administers. A permit may be necessary to comply with the Clean Water Act, section 404(b)(1), if earth is filled or removed on the flood plain. If AWMS facilities encroach on a flood plain, a building permit may be required by local agencies. It is also SCS policy to aid in protecting, maintaining, managing, and restoring wetlands.

(h) Agricultural waste management practice standards

National standards for agricultural waste management are in the National Handbook of Conservation Practice Standards. The field office standards are in section IV of the Field Office Technical Guide. Conservation practice standards establish the minimum level of quality with which these practices are planned, designed, installed, operated, and maintained. SCS conservation practice standards can be used to address specific waste management needs of producers. Some examples are:

Waste Management System (Code 312)—The purpose of this system practice is to use the necessary practices in a systems approach such that wastes are properly managed and the degradation of air, animal, water, plant, or soil resources is prevented.

Waste Storage Structure (Code 313)—A fabricated facility for the temporary storage of animal or other agricultural wastes. The purpose of the practice is to store waste until it can be safely and effectively used.

Waste Treatment Lagoon (Code 359)—An impoundment made by excavation or earthfill for biological treatment of animal or other agricultural wastes. The purpose of the practice is to reduce the strength of the waste.

Waste Storage Pond (Code 425)—An impoundment made by excavation or earthfill for temporary storage of animal or other agricultural wastes. The purpose of the practice is to store waste until it can be safely and effectively used.

Waste Utilization (Code 633)—Using animal or other agricultural wastes on land in an environmentally acceptable manner while maintaining or improving soil and plant resources. The purpose of the practice is to safely recycle waste materials back through the soil-plant system.

Filter Strips (Code 393)—A designed area or strip of vegetation for removing sediment, organic matter, and other pollutants from runoff and wastewater. The primary purpose of this practice is to improve or maintain offsite water quality. To meet conservation objectives and offsite water quality goals for lands adjacent to cultivated agricultural land or other land that is periodically disturbed, other practices generally must be installed in the areas contributing runoff to the filter strip. Consequently, a filter strip will not often be a stand-alone practice.

Roof Runoff Management (Code 558)—A facility for collecting, controlling, and disposing of runoff from roofs. The purpose of this practice is to divert noncontaminated runoff away from areas where waste accumulates to areas where clean water can be disposed of safely.

Nutrient Management (Code 590)—Managing the amount, form, placement, and timing of application of plant nutrients. The purpose of this standard is to assure that all sources of plant nutrients, including

livestock waste, are included in a fertility program designed to supply plant nutrients for optimum yields, yet minimize nutrient losses to surface and ground water.

Pest Management (Code 595)—Managing agricultural pest infestations (including weeds, insects, and diseases) to reduce adverse effects on plant growth, crop production, and environmental resources. The purpose of this practice in the context of this handbook is to properly manage waste chemicals for environmental protection.

Many other practice standards are used to support those listed, such as those for irrigation and tillage and cropping systems. Others will be developed for constructed wetlands for wastewater treatment, pesticide containment facility, and riparian zone buffer strips. Until a conservation practice and other technical support documents are available, the technical requirements for constructed wetlands for wastewater treatment issued by SCS should be used.

651.0107 Water quality criteria and standards

Water quality objectives, criteria, and standards are interrelated but different from one another. A water quality **objective** is a goal toward which a control program is aimed. For example, an objective of Public Law 92-500 was to eliminate discharge of all pollutants into navigable streams by 1985. Objectives often represent an ideal condition.

Water quality **criteria**, on the other hand, represent specific, though not necessarily precise, quality characteristics that research and experience indicate are generally necessary to support various water uses. They provide a measure of suitability of water quality for a particular use and what magnitude of change is needed to make it suitable.

Water quality **standards** differ from objectives and criteria in that they represent measures required by laws or regulations. They tend to be rigid and absolute and are either met or violated. Standards provide the "teeth" for water quality legislation and also the yardstick by which performance can be evaluated. Water quality standards generally are related directly to the specific quality criteria for uses to be protected.

(a) Water quality criteria

Water quality criteria provide the best estimate, based on available research and experience, of the characteristics necessary for various uses of water. These criteria provide a basis for determining if a specific body of water is suitable for a particular purpose. Unfortunately, because of the variability in factors that influence water quality criteria, they tend to be imprecise. Nevertheless, the criteria are based on the best information available and thus should be adhered to unless State or local guidelines based on the specific local situation suggest differently.

Generally, if water quality criteria, such as those published by EPA, are met by a particular water source for a specific use, that source for that use will be safe over a fairly large range of circumstances.

Water that does not meet a particular criteria may be suitable for a specific use, but the margin of safety for that use is reduced.

In some cases, local information and experience allow criteria to be adjusted. Because water quality criteria are not legally binding, they can be modified by State or local agencies if experience suggests criteria different from those of EPA are more appropriate for local conditions.

Water quality criteria are continually changing, so the summary of EPA criteria given in table 1–2 may change as new and better information becomes available. For a more complete listing of water quality criteria, refer to the EPA publication "Quality Criteria for Water" published in 1986.

Table 1–2 Water quality criteria (EPA 1986)

Color:	1) For aesthetic purposes, water shall be virtually free from substances producing objectionable color; 2) The source of the color should not exceed 75 color units in the standard platinum-cobalt scale for domestic water supply; and 3) Increased color (in combination with turbidity) should not reduce the depth of the zone of effective photosynthetic oxygen production by more than 10 percent from the seasonally established norm for aquatic life.
Dissolved oxygen:	1) Water should contain sufficient dissolved oxygen to maintain aerobic conditions in the water column and, except as affected by natural phenomena, at the sediment-water interface for aesthetic purposes; and 2) A minimum concentration of dissolved oxygen to maintain good fish populations is 5 mg/L.
Fecal coliform bacteria:	1) For bathing, swimming, and other body contact water recreation based on a minimum of five samples taken over 30 days, the fecal coliform bacteria should not exceed a log mean of 200 per 100 ml, nor should more than 10 percent of the total samples taken during any 30-day period exceed 400 per 100 ml; and 2) The median fecal coliform bacteria concentration should not exceed 14 MPN (most probable number) per 100 ml with not more than 10 percent of samples exceeding 43 MPN per 100 ml for the harvesting of shellfish.
Nitrate (NO_3):	For health reasons domestic water supplies should not have nitrate nitrogen concentrations exceeding 10 mg/L (for humans).
Nitrite (NO_2):	For heath reasons domestic water supplies to be used by infants should not have nitrite nitrogen concentrations exceeding 1 mg/L.
Phosphorus:	Criteria for phosphorus from the EPA 1986 reference is explained in chapter 3 of this handbook. See 651.0302(a)(2)(ii), Effects of phosphorus in the aquatic environment.
Solids and turbidity:	For freshwater fish and other aquatic life, settleable and suspended solids should not reduce the depth of the zone of photosynthetic oxygen production by more than 10 percent from the seasonally established norm.

(b) National water quality standards

Water quality standards are legally enforceable and set maximum allowable limits of concentration for various pollutant constituents or minimum limits of favorable constituents. Typically, standards relate to water quality in a receiving stream, for example, concentration of Biochemical Oxygen Demand (BOD). However, technology-based standards are established for use of the most effective control or treatment technologies available to prevent water pollution.

The early water quality standards, which related to health, were aimed at improving domestic drinking water supplies. If a particular water source was used for drinking, it had to meet the quality standards or be treated in some fashion so that it would meet those standards. Responsibility for meeting the standards has typically been assigned to the user. In general, the burden of meeting standards is now moving from the water user to the potential water polluter. Water quality standards are now aimed at control of potential pollutants at the source. This change in focus, in part, has resulted in the use of standards for point sources based not only on pollutant concentrations in water, but also on the **best available technologies** for control of water pollution.

Standards for confinement feedlots and agricultural NPS of pollution are technology-based and specify particular design or procedural practices. For example, NPDES permits required for confinement feedlots specify design and operation standards.

Design standards are also necessary in the definition of NPS water pollution control practices, particularly if they are structural. Procedural standards for pollution control may, for example, include such management practices as proper manure spreading or fertilizer management.

The provisions of section 303 of the 1972 Federal Water Pollution Control Act Amendments require that the State agency designated responsibility for water pollution control adopt water quality standards that have been submitted to EPA for approval.

State water quality standards are established for water uses for specific watercourses. The identification of specific water uses for watercourses is often referred to as stream classification. Stream classification is carried out by the States following State-defined procedures. The procedures generally consider:

- Needs and desires of the public
- Present and future demands on the watercourse
- Cost of maintaining different stream qualities
- Benefits expected under different control alternatives

Not all streams are classified, and those that are may not be classified in a straightforward manner. Wide variations in classification can occur along the same stream. Classification is done not only for streams, but for all natural watercourses.

Table 1–3 gives an example of a designated area classification system. Classification systems vary from State to State.

Table 1–3 Example of a designated area classification system

Class	Water uses
I	Sources of water supply for drinking or food processing purposes, requiring principally disinfection. Any other usage requiring water of lower quality.
II	Sources of water supply for drinking or food processing purposes, requiring treatment in addition to disinfection. Any other usage requiring water of lower quality.
III	Sources not used for drinking or food processing purposes, but used for swimming or other body contact recreation. Any other usage requiring water of lower quality.
IV	Sources not used for drinking or food processing purposes or body contact recreation, but used for fishing or other nonbody contact recreation. Any other usage requiring water of lower quality.
V	Sources used only for agriculture or industrial supplies, fish survival, or navigation.

Each water use classification requires a specific quality of water. Therefore, once a designated area is classified for specific uses by the State agency responsible for water pollution control, water quality standards are defined for that area. In some cases the pollutant assimilative capacity, water quality requirements, and other stream characteristics are not directly used in determining standards. In such cases, technology-based effluent standards are used. An example of these is the NPDES permits required of feedlot operations.

651.0108 Agricultural impacts on the use of water

(a) Agricultural waste and its impact on water use

The value of water lies in its usefulness for a wide variety of purposes, and the quality determines its acceptability for a particular use. Therefore, a quality problem occurs when water is contaminated to a level where it is no longer acceptable for a particular use. Water quality criteria are often used to determine acceptability. Potential water pollutants derived from agricultural waste can be classified as (a) nutrients, (b) oxygen-demanding materials, (c) bacteria that indicate potential presence of pathogens, (d) sediment, suspended or dissolved materials, and (e) agrichemicals and other organic and inorganic materials.

For water quality parameters to have meaning, they must be related to one or more beneficial uses of water. The uses include (1) domestic, industrial, and agricultural water supplies; (2) swimming, fishing, boating, and other forms of recreational use; and (3) commercial navigation. Agricultural wastes are not likely to adversely affect commercial navigation.

(b) Impacts on domestic water supplies

Although only a very small amount of the water taken for domestic purposes is used for drinking, it is because of this use that domestic water is of the utmost concern and has the most stringent quality requirements.

Water withdrawn from surface watercourses for domestic or municipal supply is almost always treated to some degree to remove contaminants. In the case of individual home water supplies, this treatment might only involve chlorination to destroy pathogens or other organisms. Municipal water supplies are generally treated more extensively. Water quality concerns for domestic supplies should never be taken lightly. Failure of supplies to meet standards for even short periods of time can result in serious illness.

Quality requirements for domestic drinking water are determined by the EPA and, in some instances, include modifications and additions from the State health department. Water quality regulations for domestic supplies can be divided into two categories: primary standards related to health concerns and secondary standards pertaining to aesthetic interests.

Health associated regulations often relate to toxic levels of manmade and natural substances. Under the 1986 amendments to the Safe Drinking Water Act, EPA set primary standards for 83 contaminants. Some of the substances that are associated with agriculture include nitrate, bacteria, selenium, lindane, toxaphene, 2-4,D, aldicarb, alachlor, carbofuran, simazine, atrazine, picloram, dalapon, diquat, and dinoseb. Those regulations aimed primarily at aesthetics include such substances as foaming agents, pH, and total dissolved solids.

The primary and secondary standards for drinking water for specific constituents are listed in table 1–4.

Surface water, especially streams, often contains many complex mixes of pollutants that are difficult to remove because levels vary widely over time. Therefore, the 1986 Safe Drinking Water Act Amendments require that all public drinking supplies from surface water undergo filtration and disinfection treatment.

Ground water, however, tends to maintain a quality that remains relatively constant over time, and some substances are not present or occur only at low levels. Soil filtration removes most turbidity, color, and micro-organisms, and some chemicals can be absorbed by the soil. Because of the natural purification of water as it percolates through soil, ground water is often used as a domestic supply with little treatment. However, ground water monitoring programs have recently increased because of the growing concern that this water supply source may not always be as safe as previously assumed. One of the primary problems of using ground water for domestic purposes is the lack of localized water quality information. Furthermore, localized ground water quality can be radically affected by a local source of contaminant, such as nitrate from confined livestock or other NPS.

Some of the constituents in deep ground water aquifers are associated with agricultural chemicals, but generally not livestock waste. Nitrate is the primary constituent that can pollute ground water and have manure as its source. Water contaminated by nitrate can be treated with an ion exchange process to remove the contaminant, but this can be an expensive process and is not practical for many areas.

Under certain situations livestock waste can be a source of ground water pollution other than nitrate contamination. For example, shallow aquifers that supply dug wells can be contaminated by animal waste. Aquifers overlain by porous materials, such as gravel or some types of limestone, allow pollutants to be easily transported to the ground water. In some

Table 1–4 Selected primary and secondary drinking water standards as specified by the EPA

Constituent	Maximum allowed
Primary Standards	
Inorganic chemicals	
Nitrate-nitrogen	10 mg/L
Selenium	0.045 mg/L*
Synthetic organic chemicals	
Lindane	0.0002 mg/L*
Toxaphene	zero*
Alachlor	zero*
Aldicarb	0.009 mg/L*
Carbofuran	0.036 mg/L*
Total coliform bacteria	Total coliform no more than 1 coliform-positive sample/month for systems that analyze fewer than 40 samples/month, and no more than 5% of samples positive if system analyzes more than 40 samples/month
Fecal coliform bacteria	zero*
Secondary Standards	
Color	15 units
Foaming agents	0.5 mg/L
Odor numbers	3 threshold odor
Total dissolved solids	500 mg/L

* EPA units under 1986 Safe Drinking Water Act Amendments.

cases, poorly designed or constructed wells or earthen manure storage ponds can be the cause of ground water contamination from livestock waste.

(c) Impacts on industrial water supplies

Industry uses water for a wide variety of purposes, so it is not surprising that water quality requirements for industry also vary widely. Several broad categories of industrial water uses include (1) separation processes, (2) transport of materials, (3) cooling, (4) chemical reactions, and (5) product washing.

Food processing industries are of particular concern because water used to wash food influences the quality of the final product. Water quality of the supply source, however, is less important for most industrial uses than for domestic or other uses because industry possesses the technology to treat water to acceptable levels. Because this treatment can be quite expensive, however, guidelines for upper limits or concentrations of selected constituents in water supplies for some industrial uses are identified. This allows industries to treat only to the acceptable level. Table 1–5 lists the maximum allowable concentrations of constituents in raw water supplies for several industrial operations as determined by the National Academy of Sciences (1974).

(d) Impacts on agricultural uses

Farms require a domestic water supply in addition to water used for a variety of other purposes. Livestock farmers are especially concerned with water quality for health and product quality reasons (especially milk).

A water supply that is both potable (safe to drink) and palatable (nice to drink) is most desirable for livestock consumption, although the water generally does not need to be as pure as that for human consumption. Livestock farmers must be particularly careful that the farm water supply does not become contaminated by the livestock waste. Surface ponds or tanks to which livestock have ready access are always potential candidates for contamination.

The quality of water needed for livestock consumption varies with the type and age of animals. In general, young animals are less tolerant of water that has high nitrate or fecal coliform levels. Some animals, primarily lactating ones, have a relatively high daily intake of water as compared to their body weight. The daily intake for lactating cows, for instance, may be 25 to 35 gallons of water. High water intake increases the risk of health problems resulting from poor water quality. Table 1–6 gives recommended limits of concentrations of some potentially toxic substances in drinking water for livestock. Those substances that originate on livestock farms and that often contaminate livestock water supplies include nitrates, bacteria, organic materials, and suspended solids.

Table 1–5 Maximum allowable concentrations of selected constituents in raw water supplies for industrial use (mg/L)

Constituent	Petroleum	Chemical	Paper	Textile	Cooling water
Ammonia	40	—	—	—	—
Nitrate	8	—	—	—	30
Dissolved solids	3,500	2,500	1,000	150	1,000
Suspended solids	5,000	10,000	—	1,000	5,000
Color	25	500	360	—	—-

Nitrate-nitrogen standard for human consumption is 10 mg/L. No standards for livestock are established, but it is generally accepted that nitrate-nitrogen levels of over 100 mg/L can adversely affect the growth and health of livestock. Most young animals should be given water in which the nitrate level is much lower than 100 mg/L. The size of the animal generally affects their sensitivity to nitrate-nitrogen. For example, poultry are less tolerant to nitrate-nitrogen than swine, which are less tolerant than cattle.

Fecal coliform count should be essentially zero for calves and less than 10/100 ml for adult animals. A high level of suspended solids and objectionable taste, odor, and color in water can cause animals to drink less than they should. Refer to tables 1–6, 1–7, and 1–8 for specific guidance.

Water used to wash food products or food handling equipment at the farmstead, including dairy utensils, must be contaminant free (potable water appropriate for domestic supply).

Irrigation, the largest consumptive use of water nationally, requires a water supply that does not contain substances that adversely affect plant growth. Typically, livestock waste is not the source of any waterborne substances that would harm crop growth unless

Table 1–6 Recommended limits of concentration of some potentially toxic substances in drinking water for livestock (based on Carson 1981)

Substance	Safe upper limit of concentration (mg/L) USEPA*	NAS**
Aluminum	5.0	
Arsenic	0.02 (0.05)	0.2
Barium	(1.0)	***
Beryllium	No limit	
Boron	5.0	
Cadmium	0.05 (0.01)	0.05
Chromium	1.0 (0.05)	1.0
Cobalt	1.0	1.0
Copper	0.5 (1.0)	0.5
Fluoride	2.0	2.0
Iron	No limit (0.3)	***
Lead	0.1 (0.05)	0.1
Manganese	No limit (0.05)	***
Mercury	0.001 (0.000144)	0.01
Molybdenum	No limit	***
Nickel	(0.6)	1.0
Nitrate - N	100 (10.0)	100.0
Nitrite - N		10.0
Selenium	0.05 (0.01)	
Vanadium	0.1	0.1
Zinc	25.0 (5.0)	25.0

* U.S. Environmental Protection Agency (standards for human drinking water are shown in parenthesis).

** National Academy of Sciences.

*** Not established/no limit. Experimental data available are not sufficient to make definite recommendations.

Table 1–7 Desired and potential problem levels of pollutants in livestock water supplies*

Substances	Desired range	Problem range
Total bacterial/ 100 ml	< 200	> 1,000,000
Fecal coliform/ 100 ml	< 1	> 1 for young animals > 10 for older animals
Fecal strep/ 100 ml	< 1	> 3 for young animals > 30 for older animals
pH	6.8 – 7.5	< 5.5 or > 8.5
Dissolved solids mg/L	< 500	> 3,000
Total alkalinity mg/L	< 400	> 5,000
Sulfate mg/L	< 250	> 2,000
Phosphate mg/L	< 1	**
Turbidity Jackson units	< 30	**

* Based on research literature and field experience in Northeastern United States.

** Not established.

excessive amounts of wastes are applied. Manure provides nutrients needed for plant growth. Very high levels of nitrate (100 to 500 mg/L) can cause quality problems for certain crops that are irrigated by sprinkler systems. High coliform concentrations in water applied to fruits or vegetables to be marketed without further processing can also be a problem. Livestock can be the source of suspended matter and, indirectly, algae, both of which can interfere with the operation of sprinkler and trickle irrigation systems. In arid regions, soils that are already high in salts can have this condition aggravated by land application of livestock waste.

(e) Impacts on recreation

Kinds of water-based recreation vary, and each has slightly different water quality requirements. For example, swimmers generally prefer crystal clear water, but fishermen prefer that the water have some plant and algae growth, which promotes fish production. Many water quality requirements for recreational uses are highly qualitative and vary from one use to another and even from one user to another. Water-based recreation can be broadly separated into contact and noncontact activities. Obviously, the contact activities present greater health concerns, which relate primarily to disease-causing microbes. Requirements for noncontact recreational activities are similar to those for promotion of aquatic life and aesthetic considerations.

Typically, the acceptability of water for contact recreation is determined by measuring the level of an "indicator organism," such as fecal coliform bacteria, that denotes the likely presence or absence of other potentially harmful organisms. The degree of risk involved is associated with the level at which the organisms are present. Indicator organisms are used because the actual disease-causing organisms are extremely difficult to routinely measure. See table 1-2 for criteria for fecal coliform bacteria.

Table 1–8 Effect of salinity of drinking water on livestock and poultry (Water Quality Criteria 1972)

Soluble salt (mg/L)	Effect
<1,000	Low level of salinity; present no serious burden to any class of livestock or poultry.
1,000 to 2,999	Satisfactory for all classes of livestock and poultry; may cause temporary, mild diarrhea in livestock; and water droppings in poultry at higher levels; no effect on health or performance.
3,000 to 4,999	Satisfactory for livestock; may cause temporary diarrhea or be refused by animals not accustomed to it; poor water for poultry causing watery feces and, at high levels, increased mortality and decreased growth (especially in turkeys).
5,000 to 6,999	Reasonable safety for dairy and beef cattle, sheep, swine, and horses; avoid use for pregnant or lactating animals; not acceptable for poultry, causes decreased growth and production or increased mortality.
7,000 to 10,000	Unfit for poultry and swine; risk in using for pregnant or lactating cows, horses, sheep, the young of these species, or animals subjected to heavy heat stress or water loss; use should be avoided, although older ruminants, horses, poultry, and swine may subsist for long periods under conditions of low stress.
>10,000	Risks are great; cannot be recommended for use under any conditions.

Surveys for E. coli and enterococci bacteria can be conducted if more rigorously investigated bacterial status of bathing waters is desired. For freshwater bathing, the geometric mean of bacterial densities for E. coli should not exceed 126 per 100 ml, or 33 per 100 ml for enterococci. For marine water bathing, the geometric mean of enterococci bacteria densities should not exceed 35 per 100 ml. Sufficient numbers of samples, generally not less than five spaced equally over a 30-day period, should be gathered and a confidence level applied to the test results according to the intensity of use of the water. This should be accomplished before making a final judgment about the acceptability of the water for bathing purposes.

(f) Impacts on aesthetics

Manure and other waste associated with livestock production can be important sources of aesthetic degradation. For example, they can be the source of objectionable deposits, floating scum, bad odors, and nutrients that promote growth of nuisance aquatic life. Local regulations are often aimed at maintenance of aesthetic quality of watercourses.

To maintain aesthetic water quality, all water should be free from substances that:

- Settle to form objectionable deposits
- Float as debris, scum, or other matter to form nuisances
- Produce objectionable odor, color, taste, or turbidity
- Injure, are toxic, or produce adverse physiological responses in humans, animals, or plants
- Produce undesirable or nuisance aquatic life

651.0109 References

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