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Regulations on the Disposal of Arsenic Residuals from Drinking Water Treatment Plants

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Foreword

The U.S. Environmental Protection Agency is charged by Congress with protecting the Nation's land, air, and water resources. Under a mandate of national environmental laws, the Agency strives to formulate and implement actions leading to a compatible balance between human activities and the ability of natural systems to support and nurture life. To meet this mandate, EPA's research program is providing data and technical support for solving environmental problems today and building a science knowledge base necessary to manage our ecological resources wisely, understand how pollutants affect our health and prevent or reduce environmental risks in the future.

The National Risk Management Research Laboratory is the Agency's center for investigation of technological and management approaches for reducing risks from threats to human health and the environmental. The focus of the laboratory's research program is on methods for the prevention and control of pollution to air, land, water, and subsurface resources; protection of water quality in public water systems; remediation of contaminated sites and ground water; and prevention and control of indoor air. The goal of this research effort is to catalyze development and implementation of innovative, cost-effective environmental technologies; develop scientific and engineering information needed by EPA to support regulatory and policy decisions; and provide technical support and information transfer to ensure effective implementation of environmental regulations and strategies.

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Abstract

As with other production processes, water treatment systems produce a product and a residual of that product. With the passage of the various federal statues, restrictions have been placed on the discharge of residuals to water bodies and onto land. This report summarizes federal regulations and selected state regulations that govern the management of residuals produced by small drinking water treatment systems removing arsenic from drinking water.

Arsenic is a naturally occurring contaminant in ground water and many small water treatment facilities use ground water as their primary source of water. Under the Safe Drinking Water Act (SDWA), a maximum contaminant level (MCL) of 0.05 mg/L has been established for arsenic in drinking water. Under the 1996 SDWA Amendments, the EPA is required to develop a revised arsenic regulation by January 2001. Concerns have been raised as to the technical feasibility and regulatory implication of a more stringent arsenic MCL on the disposal of the residuals from arsenic removal processes.

This document reports on five water treatment processes known to be effective for arsenic removal from small ground water systems. The five processes are anion exchange, activated alumina adsorption, iron/manganese removal, media adsorption, and membrane processes. For each technology, a brief description is provided of the treatment process along with a discussion of the residual production characteristics.

An overview is provided of the federal regulations that apply to the management of residuals, with a focus on arsenic removal residuals. The purpose of this overview is to provide guidance to water suppliers on the federal regulatory requirements of residuals management to better evaluate compliance of existing practices and to plan for needed changes in treatment plant operations. Specific disposal methods are summarized by the form of the residuals including liquid residuals (direct discharges, indirect discharges, underground injection, and land disposal) and solid/sludge residuals (solid waste landfill, hazardous water landfill, lagoons, reuse of hazardous waste, reuse of solid waste, and off-site disposal) and the method in which the residuals are managed. Federal regulations summarized include the Clean Water Act (NPDES, Pretreatment), SDWA (Underground Injection Control and lagoons), and Resource Conservation and Recovery Act (Subtitles C/D).

In addition to the federal regulations that impact the management of arsenic drinking water treatment residuals, regulations imposed by seven states were also reviewed. The seven states (Arizona, California, Maine, Nebraska, New Mexico, Nevada, and Pennsylvania) were chosen based on arsenic occurrence and regional representation. The review of the state regulations also focused on characterizing the requirements that apply to different management options available for liquid and solid residuals generated by treatment systems that remove arsenic from drinking water. It was found that many components of the state regulatory programs were generally consistent with the federal minimum requirements. However, the state programs differed from federal program requirements and each other in several aspects including surface water quality standards applicable to control the amount of arsenic in direct discharges of liquid effluent, the local limits that specify how much arsenic may be discharged to a sanitary sewer system, the regulation of solid waste landfills, the protection of ground water resources, and the regulation of land application activities.

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Acronyms, Abbreviations, and Symbols

AA	Activated alumina
AAC	Arizona Administrative Code
As	Arsenic
BAT	Best available technology
BPJ	Best professional judgement
CESQG	Conditionally exempt small quantity generators
CFR	Code of Federal Regulations
CTR	California Toxics Rule
CWA	Clean Water Act
DEP	Department of Environment Protection
DWTP	Drinking water treatment plant
EPA	U.S. Environmental Protection Agency
Fe	Iron
GFH	Granular ferric hydroxide
HMTA	Hazardous Materials Transportation Act
LDR	Land disposal restrictions
LQG	Large quantity generators
LTU	Land treatment unit
MAHL	Maximum allowable headworks loading
MCL	Maximum contaminant level
Mn	Manganese
MSWLF	Municipal solid waste landfills
NAC	Nevada Administrative Code
NMAC	New Mexico Administrative Code
NPDES	National Pollutant Discharge Elimination System
PAC	Pennsylvania Administrative Code
PCBs	Polychlorinated biphenyls
PCS	Permit Compliance System
POTW	Publicly owned treatment works
psi	Pound per square inch
RCRA	Resource Conservation and Recovery Act
RWQCB	Regional Quality Control Board
SDWA	Safe Drinking Water Act
SIC	Standard industrial classification
SQG	Small quantity generators
SWRCB	State Water Resource Control Board
TCLP	Toxicity characteristics leaching procedure
TDS	Total dissolved solids
TFCH	Treated formerly characteristic hazardous wastes
TOC	Total organic carbon
TSDF	Treatment, storage, disposal facilities
UIC	Underground Injection Control
WET	Waste extraction test
WDR	Waste discharge requirements

1. Introduction

Water treatment systems, as with other production processes, create two types of materials – a product and residuals of that product. Historically, much of the technical and regulatory focus has been on the quality of the product, treated water, with little attention paid to residuals. This lack of attention was due, in part, to the general perception by the water industry of the innocuous nature of water treatment residuals and the lack of clear regulations regarding residuals disposal. Since the passage of the Clean Water Act (CWA) and other federal environmental statutes in the 1970s, restrictions have been placed on the discharge of residuals to water bodies and onto the land. Water quality standards are covering a greater number of contaminants and are being continuously reviewed for their sufficiency in protecting the environment. Therefore, water utilities and regulators need to continually evaluate and reconsider standard practices for managing residuals. To assist in this evaluation, this report has been developed to summarize federal regulations and selected state regulations that govern the management of residuals produced by treatment systems removing arsenic from drinking water. The focus of this report is on systems used primarily by small water facilities.

In 1975, U.S. Environmental Protection Agency (EPA) established a maximum contaminant level (MCL) for arsenic at 0.05 mg/L in drinking water. Since that time, reductions to the MCL have been considered, but no changes have been made. In 1996, amendments to the Safe Drinking Water Act (SDWA) required EPA to develop an arsenic research plan, a proposal to revise the MCL by January 2000, and a final rule by January 2001. In comments on the draft research plan, EPA's Board of Scientific Advisors raised concerns about both technical feasibility and regulatory implications of a more stringent arsenic MCL on the disposal of the residuals from arsenic removal treatment processes.

Many water treatment facilities, particularly small systems, use ground water as their primary source of drinking water. With arsenic being a common, naturally occurring contaminant in ground water, it is anticipated that many of these facilities will be installing arsenic removal processes after the arsenic MCL is revised. Of the processes that are known to be effective for arsenic removal, at least five are considered small ground water system processes: anion exchange, activated alumina absorption, iron/manganese removal, media adsorption, and membrane processes.

Section 2 of the report presents a brief summary of these five unit processes. The section includes brief descriptions of the treatment process, residual production, and existing schematics. Drawing upon this information, Section 3 summarizes federal regulatory requirements and includes a flow chart depicting major forms of residuals, management options, and associated regulations. Section 4 presents select state regulatory provisions that potentially affect the disposal and management of arsenic drinking water treatment residuals.

Recognizing the variability of levels of arsenic in source water and efficiencies at individual treatment plants, the report provides generalized comments on federal regulations that may apply. For example, the report does not provide specific guidance for each unit process discussed, but instead provides guidance based on residual form and management measure. It is recommended that management decisions be based on accurate and timely testing of residual materials.

2. Arsenic Removal Technologies for Small Systems

Arsenic can be found at varying levels in source waters, and has both natural and anthropogenic sources. Under certain conditions, high levels of arsenic can be caused by leaching of certain rock formations or geothermal activity. In addition, human activities such as nonferrous mining and smelting operations, wood preservative use, and contaminated pesticide manufacturing sites, can be the sources of elevated arsenic in drinking water. Another source of arsenic in drinking water supplies can result from extensive pesticide use (AWWA, ASCE, 1998). In a recent survey, it was projected that approximately 15 percent of the U.S. population is exposed to arsenic in drinking water at levels greater than 2 µg/L. Most of the high levels of arsenic (greater than 80 µg/L) are found in ground water sources, primarily within isolated areas in the western United States.

In water, arsenic typically occurs in one of two inorganic forms, the pentavalent arsenate, As(V), and the trivalent arsenite, As(III). Arsenic converts between these two valence states in response to the relative oxidative or reductive nature of the waters, with arsenite being more common in waters that are anaerobic or with low levels of dissolved oxygen. The difference in the charge between arsenate and arsenite has a significant effect on the ease of removing arsenic from drinking water, with arsenite, a weak acid, being generally more difficult to remove (USEPA, 1993).

The remaining portions of this chapter provide a brief overview of five small system unit processes used to remove arsenic. The processes include anion exchange, activated alumina treatment, iron/manganese removal, media adsorption, and membrane processes. The information is based on the removal of arsenate, As(V). Because As(V) is more readily removed from water than As(III), pretreatment using oxidants such as chlorine (Cl_2) or potassium permanganate ($KMnO_4$) to oxidize As(III) to As(V) will likely be necessary to ensure efficient arsenic removal when the source water contains predominantly As(III). Oxidation reactions using these oxidants occur rapidly and work well within a pH range of 6.5 to 9.5 (AWWA, 1990; AWWA, ASCE, 1998), as long as the concentration of other oxidizable substances such as total organic carbon (TOC) is low.

2.1 Anion Exchange

2.1.1 Process Description

Anion exchange is the term used to describe the ion exchange process which replaces undesirable ions in water, such as arsenate, with another ion of like charge in a chemically equivalent amount. To remove these soluble forms of arsenic, anionic exchange resins (salt-based resins or strongly basic resins) are used. For example, for arsenate anion exchange, a resin that is regenerated with sodium chloride can be used. The resin is packed into a column and as contaminated water is passed through the resin, the arsenate ions, As(V), are exchanged for chloride ions (Cl^-). Arsenite is generally not removed by ion exchange (AWWA, 1990; AWWA, ASCE, 1998). A simplified schematic of the ion exchange process with upflow regeneration is shown in Figure 2-1.

Anion exchange is currently an EPA-identified best available technology (BAT) for the removal of As(V). The removal efficiency of arsenic from influent water depends on many factors. Ideally, in anion exchange, a non-contaminant ion such as chloride or hydroxide is exchanged for a target contaminant. The effluent water from the ion exchange column will have a concentration of chloride ions equal to the concentration of all the anions replaced by the chloride including the sulfate and arsenate anions in the influent water (AWWA, 1990; AWWA, ASCE, 1998).

Sulfate has a stronger attraction to anion resins and is exchanged more readily than arsenic in any form (Hecht et al., 1993; Vagliasindi and Benjamin, 1997; ASCE, AWWA, 1998). Sulfate, as well as some negatively charged organic materials, reduce the arsenic exchange removal capacity and can cause resin fouling. Research has indicated that arsenate effluent concentrations of less than 2 µg/L can be achieved using ion exchange (Vagliasindi and Benjamin, 1997).

Because anion exchange is an adsorption process, the ion resin must be regenerated after its removal capacity has been exhausted. If the ion exchange process is operated beyond its resin capacity, the unwanted ions begin to leak through the resin (AWWA, ASCE, 1998). As the concentration of unwanted ions reach unacceptable levels, the

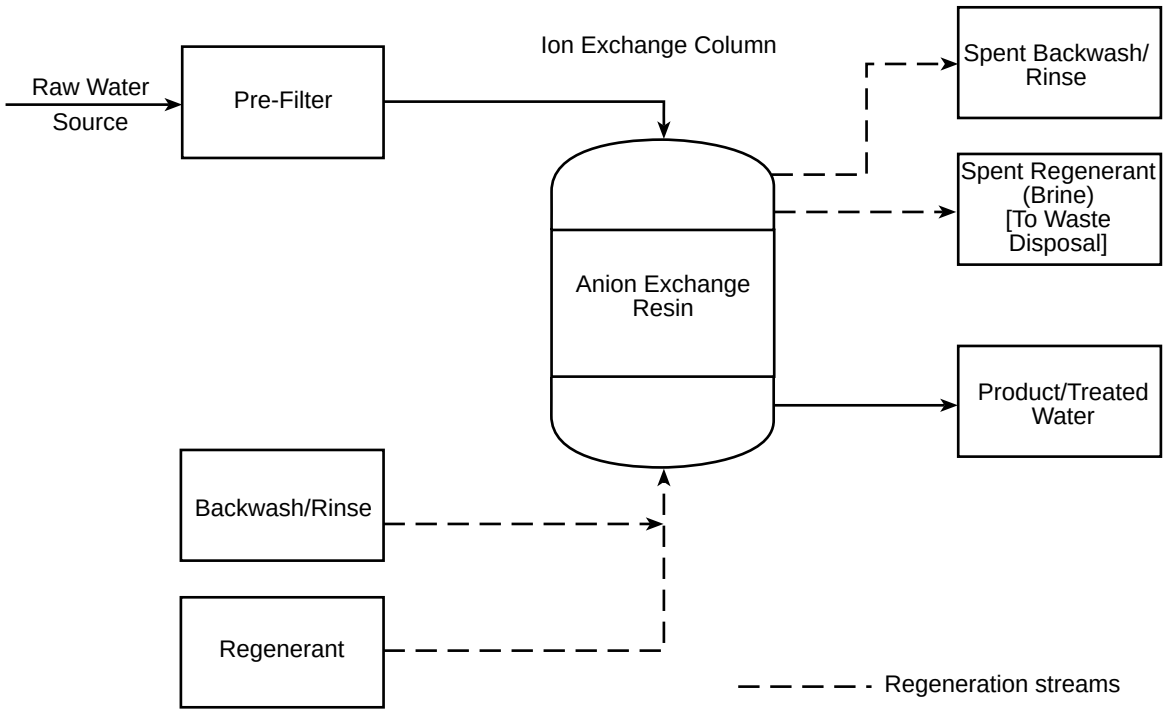

Figure 2-1. Schematic of ion exchange process with upflow regeneration.

resin must be regenerated. Regeneration of a resin occurs in a three step process – backwashing, regeneration with brine, and a final rinsing (slow and fast rinse).

Backwashing is an upflow rinse performed to expand the resin bed and remove any particles. The bed is then contacted by upflow or downflow stream with the regenerant solution. The flowrate of regenerant is lower than the flowrate of backwashing, and therefore the contact time is longer. The regenerant solution is generally sodium chloride. Finally, the column is rinsed upflow or downflow to displace the regenerant.

2.1.2 Residual Generation and Disposal

A liquid and solid residual may be generated from an anion exchange system. The liquid residual consists of the backwash water, regenerant solution, and rinse water. These waters constitute 1.5 to 10 percent of the treated water volume depending on the feed water quality and type of ion exchange unit used (DPRA, 1993). The chemical composition of ion exchange brines varies as a function of regenerant dose and concentration, rinsing procedures, and exchange capacity of the resin (USEPA, 1996). The spent regenerant may contain high levels of arsenic or have a corrosive characteristic and therefore subject to stringent disposal and management requirements under CWA and the Resource Conservation and Recovery Act (RCRA).

Spent resin will be produced when the resin can no longer be regenerated, or when it becomes poisoned or contaminated. Spent resin for disposal may be subject to hazardous waste regulations depending upon the results of a Toxicity Characteristic Leaching Procedure (TCLP) test.

2.2 Activated Alumina

2.2.1 Process Description

Activated alumina (AA) is an inorganic sorbent that is used to remove arsenate and its arsenic adsorption capacity is pH dependent. In the activated alumina process, influent water is sent through a column packed with activated alumina where the arsenic ions are adsorbed onto the alumina. In this way, the activated alumina process is similar to the anion exchange process. Exhausted activated alumina may be regenerated on-site, much like ion exchange resins, or it may be used to exhaustion and replaced with new media.

The arsenic removal capacity of AA is dependent on the influent concentration of As(V), pH, and the flow rate through the contactor (AWWA, 1990). Activated alumina is available in different mesh sizes and its particle size affects the removal efficiency. Fine-mesh alumina can treat more bed volumes of water and have higher arsenic removal capacities and a more rapid uptake of As(V) than coarse-mesh alumina (Montgomery, 1985).

Regeneration of the treatment bed is required when the arsenic effluent concentrations reach unacceptable levels. Regeneration is a four-step process. During this process, the alumina bed is backwashed, regenerated, neutralized, and rinsed before being placed back in operation. Sodium hydroxide is the most common regenerant and sulfuric acid is typically used to neutralize or condition the bed (USEPA, 1993).

Backwashing is an upflow rinse performed to expand the activated alumina bed and remove particles. Then the bed is contacted in an upflow or downflow stream with a caustic solution, the regenerant, which is usually a sodium hydroxide solution. The flowrate of regenerant is lower than the flowrate of backwashing, and therefore the contact time is longer. The next step is neutralization, which is performed to return the bed to its operating pH (acidic condition). The bed is neutralized by rinsing out the excess caustic, then rinsing the bed column with an acid solution, and finally rinsing the bed again while monitoring the effluent pH until it returns to the desired level (Montgomery, 1985). A simplified schematic of the activated alumina process with regeneration is shown in Figure 2-2.

2.2.2 Residual Generation and Disposal

A liquid and/or solid residual may be produced from an AA system depending on the type of operation. If the system is regenerated, a liquid waste is produced from the backwash, caustic regeneration, neutralization, and rinse steps. In some instances, a sludge may be generated from the regeneration and neutralization streams because some alumina dissolves during the regeneration step and may be precipitated as aluminum hydroxide (AWWA, 1990; USEPA, 1993)

If an aluminum based sludge is produced because of lowering the pH of the liquid residual, this sludge will contain a high amount of arsenic because of its arsenic adsorption characteristics. This sludge and the remaining liquid fraction of the solution will require disposal. Because both residuals contain arsenic, their disposal may be subject to the disposal requirements under CWA and RCRA. When the AA has reached the end of its useful life, the media itself will also become a solid residual that must be disposed.

Because of its high arsenic removal capacity, an activated alumina system may be operated on a media throw-away basis rather than a media regeneration basis. When operated on a throw-away basis, the exhausted AA media will be the principal residual produced. This media has the potential of being classified as a hazardous waste because of its high arsenic content. A TCLP test is necessary, therefore, to determine its classification and ultimate disposal restrictions.

Because the AA media will filter out particulate material in the source water, the media bed will occasionally require backwashing. This backwash water will likely contain some arsenic attached to either the particulate material or the very fine AA material that is removed during backwashing. Consequently, the disposal of the backwash water may also be subject to the disposal requirements under the CWA and RCRA.

2.3 Media Adsorption

2.3.1 Process Description

During the past five years, several new adsorption media have been developed with effective arsenic removal efficiencies. Because these media have been recently developed, their implementation has been very limited to date. Operationally, media adsorption is very similar to anion exchange and activated alumina applications. Some media applications may be used on a one-time throw-away basis, while others may be regenerated.

With this technology, contaminated water is passed through a bed of the specially developed media, where arsenic is adsorbed and removed from the water. One study presented data using granular ferric hydroxide (GFH) as an adsorbent for arsenate As(V) removal. (Driehaus et al., 1998). The results of this study indicate that arsenate levels in the effluent were reduced to 10 μg/L from as high as 180 μg/L in the influent. The effective capacity of GFH will depend on pH and concentration of phosphate in the influent. This study suggests that the media may be regenerated but recommends disposal of spent GFH as a waste.

A proprietary technology from ADI International (Canada) uses ADI Media G2™ to remove arsenic, lead, copper, and uranium (see www.adi.ca/Limited/WTARS.HTM). This system utilizes a pressure vessel containing ADI Media G2™ where arsenic-bearing water passes downward through the filter where the media adsorbs arsenic and other metals. It performs over a pH range of 5.5 to 8.0 and is unaffected by high concentrations of sulfates or chlorides. The pressure drop through the vessel is typically less than 2 psi. According to the literature, this media can be regenerated; however, no operational details are provided. ADI states that the total regeneration volume is less than 0.1 percent of the volume of water treated. A simplified schematic of the media adsorption process is presented in Figure 2-3.

2.3.2 Residual Generation and Disposal

Two general types of residuals are potentially generated from media adsorption: spent media and regeneration solution(s). Spent media will be generated from systems that use the media on a one-time throw-away basis, or from systems where the media has become exhausted and can no longer be regenerated, or is no longer effective. In some cases, depending on manufacturer policy, spent media may be sent back to the vendor for reactivation, recovery, or disposal.

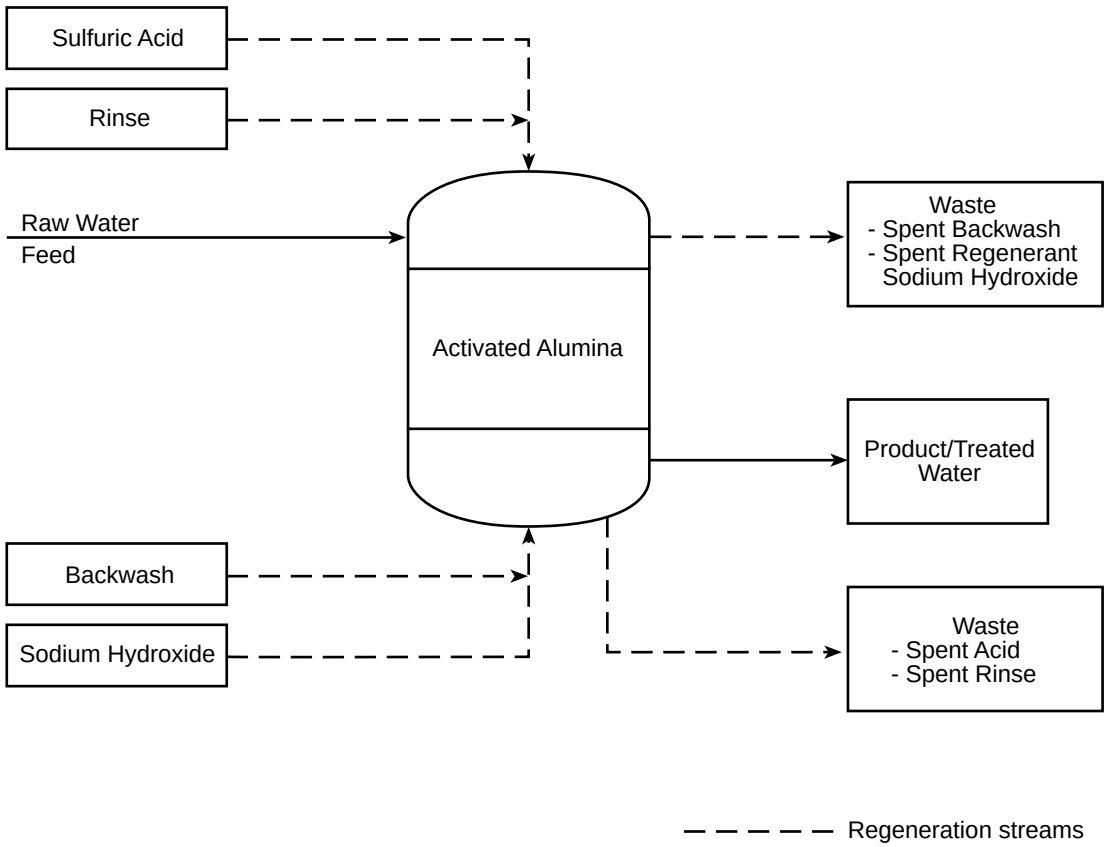

Figure 2-2. Schematic of activated alumina process with regeneration.

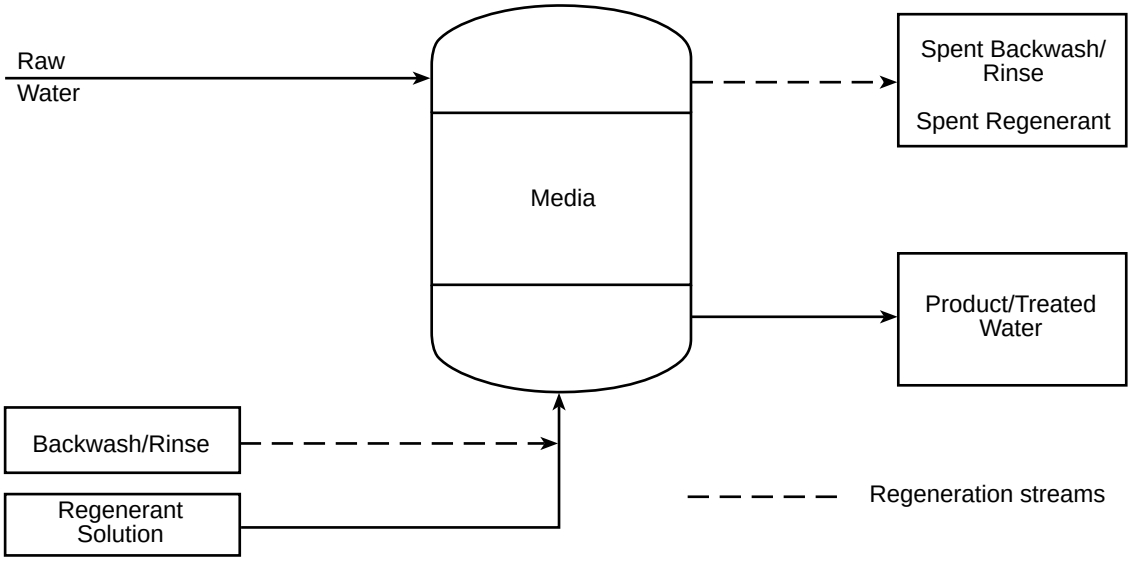

Figure 2-3. Schematic of media adsorption.

Although no details were provided for regeneration, it is assumed that the same steps as for ion exchange will be utilized: backwash, regeneration, and rinse. Each of these steps will generate an aqueous residual which will likely be combined. Some of the new adsorption media have such large arsenic removal capacities that periodic backwashing (with regeneration) is required to remove the particulate material that is filtered out during its treatment operation. This backwash water will likely contain some arsenic that is attached to the particulate material or any very fine adsorption media that is removed by the backwashing process. The waste stream is a residual that may be disposed of immediately at the time of backwashing or it may be held and disposed with the regeneration waste water. Depending on the concentration of arsenic in the influent and other factors, the disposal of the regeneration waste and the backwash water may be subject to the disposal requirements under CWA and RCRA.

2.4 Iron/Manganese Removal Methods

2.4.1 Process Description

Because arsenic, particularly arsenate, is readily adsorbed onto iron hydroxide, iron/manganese removal processes are known to be effective for arsenic removal. One study showed arsenate reductions from 200 μg/L to less than 5 μg/L (Lauf and Waer, 1993). Figure 2-4 presents a simplified schematic of a common air oxidation-filtration iron/manganese removal water treatment process. The oxidation step converts the soluble iron (ferrous) into the insoluble form (ferric) that is then removed by the filtration process, usually a granular media. Because air oxidation is not normally effective for oxidizing As(III) to As(V), chlorine or other oxidant may be required on source waters that contain As(III). When the filtration media reaches its filtering capacity, the media is backwashed producing a liquid residual (i.e., backwash water) for disposal.

The use of potassium permanganate, in conjunction with a manganese greensand filter, is also a widely used technology for removing iron and manganese from water. Potassium permanganate can be fed continuously ahead of the filter to oxidize As(III) to As(V) and the iron and manganese which are then adsorbed on the greensand. The potassium permanganate also regenerates the manganese greensand. Alternatively, the bed of greensand may be activated intermittently with permanganate to form an active coating of manganese dioxide. Because the arsenic removal process is adsorption onto the iron, the capacity for arsenic removal is dependent on the concentration of iron in the source water. The greensand filters also require periodic backwashing to remove excess solids. A simpli-

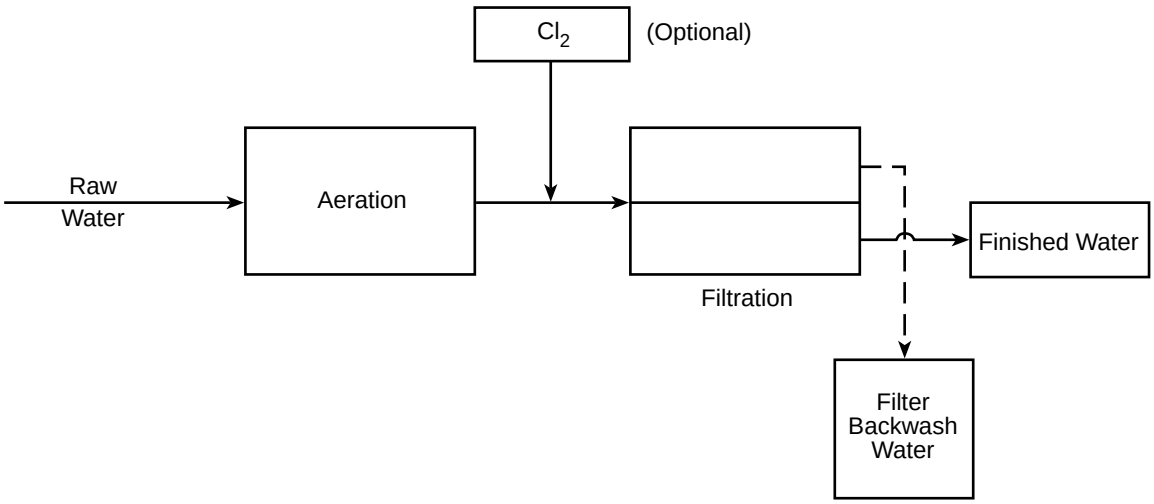

Figure 2-4. Schematic of oxidation-filtration Fe/Mn removal process.

fied schematic of a greensand filtration process is presented in Figure 2-5.

Other promising technologies that utilize oxidation and precipitation/filtration include electrochemical iron addition and chemical oxidation (Brewster, 1992), and addition of ferrate to precipitate ferric arsenate (Johnson, undated).

2.4.2 Residual Generation and Disposal

Iron/manganese removal processes, both the oxidation/filtration and the potassium permanganate greensand techniques, produce a liquid residual from the filter backwashing step. Occasionally, the filter media or greensand will need to be replaced and this material also becomes a residual product that must be disposed. Similar to the backwash and regenerant solution from the ion exchange and activated alumina processes, the filter backwash water will contain arsenic, the concentration dependent upon the amount of arsenic removed and the quantity of backwash water. Although the liquid fraction of the backwash water will contain some soluble arsenic, most of the arsenic will be associated with the iron/manganese solids. Depending upon their arsenic concentration, the disposal of the backwash water residual and the spent solid media residual may be subject to the disposal requirements under CWA and RCRA.

2.5 Membrane Processes

2.5.1 Process Description

The four types of membrane processes used by small treatment systems are microfiltration, ultrafiltration, nanofiltration, and reverse osmosis, all of which are pressure driven. These membranes are categorized by the largest particle that can pass through them, and the molecular weight cutoffs. Microfiltration requires the lowest pressure and removes particles on the micron level, such as protozoa. Reverse osmosis uses the highest pressure and can remove particles at the ionic level, such as arsenic. Nanofiltration membranes can also remove dissolved arsenic (USEPA, 1998), at similar or a little lower efficiency than reverse osmosis. Of the four types considered, only reverse osmosis and nanofiltration can remove dissolved arsenic because of the small size of the target contaminant. A simplified schematic of membrane filtration is presented in Figure 2-6 (Waypa et al., 1997).

In reverse osmosis, pressure is used to reverse the osmotic flow of water molecules through a selectively permeable membrane while restricting dissolved and particulate matter. The removal efficiency for reverse osmosis is typically 95 percent for arsenic (SAIC and HDR, 1994). In these types of processes, it is important to note that the selection of the proper membrane achieves the desired removal efficiency. As target particle size decreases, the selectivity of the membrane must increase. Likewise, as membrane pore size decreases, so does the recovery rate of treated water. If desired results for reverse osmosis and nanofiltration are similar, nanofiltration is preferred because it is more economical and simpler to operate (SAIC and HDR, 1994).

2.5.2 Residual Generation and Disposal

All membrane processes produce a reject waste product containing the materials, including arsenic, rejected by the

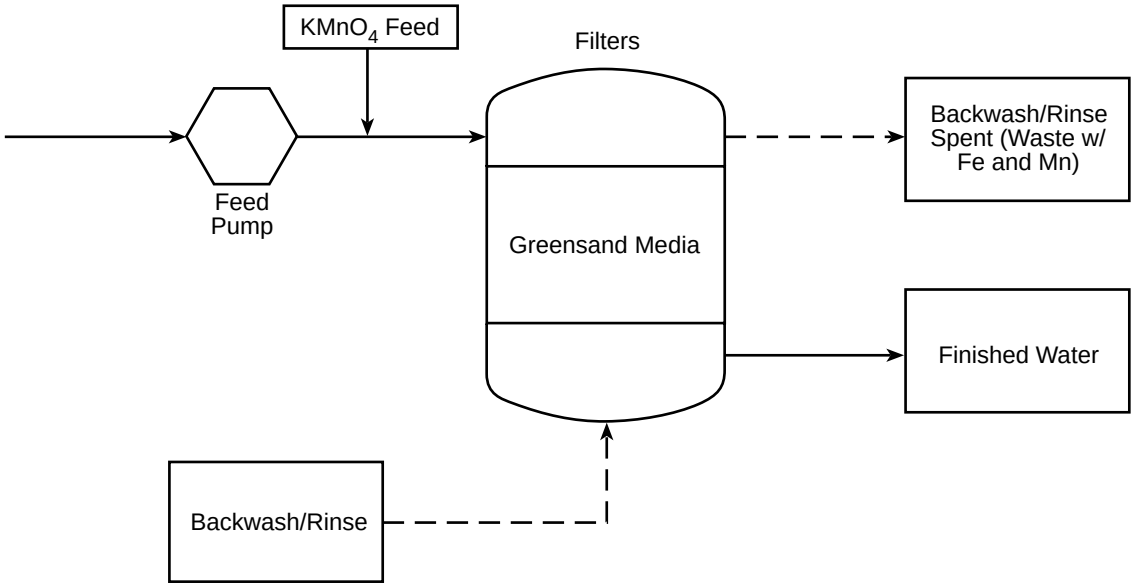

Figure 2-5. Schematic of greensand media treatment process.

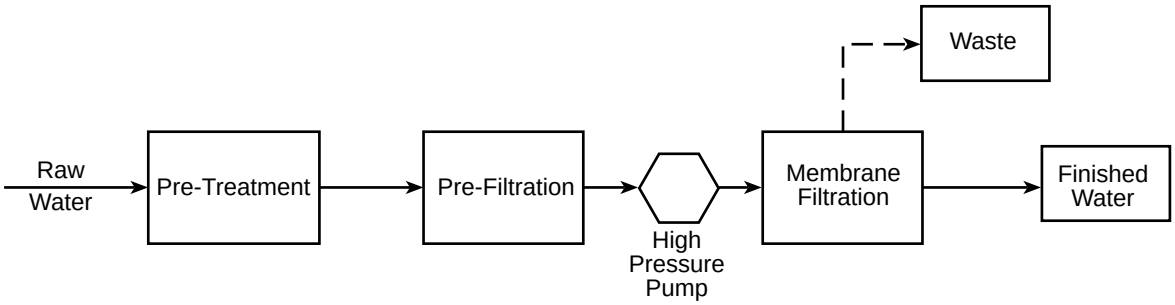

Figure 2-6. Schematic of membrane filtration process.

membrane. The reject water is generally high in total dissolved solids (DPRA, 1993). Depending on the concentration of the arsenic and other contaminants in the reject water, the disposal of this waste may be subject to the disposal requirements under CWA and RCRA.

2.6 Summary of Treatment Technologies

Each unit process described above differs in removal efficiencies, residual production, and traditional residual management options. Table 2-1 presents a summary of these five unit processes, the type of residual produced, and a list of possible disposal methods for the residuals.

Table 2-1. Summary of Residuals/Management Methods

Treatment Technology	Form of Residual	Type of Residual	Possible Disposal Methods
Anion Exchange	Liquid	Regeneration Streams --Spent Backwash --Spent Regenerant --Spent Rinse Stream	Sanitary Sewer Direct Discharge Evaporation Ponds/Lagoon
	Solid	Spent Resin	Landfill Hazardous Waste Landfill Return to Vendor
Activated Alumina	Liquid	Regeneration Streams --Spent Backwash --Spent Regenerant (Caustic) --Spent Neutralization (Acid) --Spent Rinse Liquid Filtrate (when brine streams are precipitated)	Sanitary Sewer Direct Discharge Evaporation Ponds/Lagoon
	Solid	Spent Alumina Sludge (when brine streams are precipitated)	Landfill Hazardous Waste Landfill Land Application
Media Adsorption	Liquid	Regeneration Streams --Spent Backwash --Spent Regenerant --Spent Rinse Stream	Sanitary Sewer Direct Discharge Evaporation Ponds/Lagoon
	Solid	Spent Media	Landfill Hazardous Waste Landfill
Iron and Manganese Removal Processes	Liquid	Filter Backwash	Direct Discharge Sanitary Sewer Evaporation Ponds/Lagoons
	Solid	Sludge (if separated from backwash water) Spent Media	Sanitary Sewer Land Application Landfill Landfill Hazardous Waste Landfill
Membrane Processes	Liquid	Brine (reject and backwash streams)	Direct Discharge Sanitary Sewer Deep Well Injection Evaporation Ponds/Lagoon

3. Federal Statutory and Regulatory Requirements

Over the past few decades, federal and state environmental regulations have increased in scope and stringency such that today these regulations potentially apply to an increasing number of drinking water contaminants once those contaminants are removed from source waters. At the same time, EPA is revisiting existing drinking water quality standards and evaluating the need to establish additional or more stringent standards. In response, water suppliers are periodically reviewing and reevaluating their residual management practices, and in some cases, reevaluating unit processes used to treat their water supply.

The purpose of this section is to provide an overview of the federal regulations that apply to the management of residuals, with a focus on arsenic removal residuals. It is intended to provide guidance to water suppliers on the federal regulatory requirements of residuals management so that they can better evaluate compliance of existing practices, and to better plan for needed changes in their treatment plant operations.

3.1 Key Factors in Identifying Applicable Federal Regulations

Three factors determine which federal regulations apply to residual management practices. These are 1) the physical form of the residual; 2) how it is managed; and 3) its chemical make-up. The basic inquiry regarding physical form is whether the residual is a liquid or solid (including sludge). With regard to residual management, the key question is what method or methods are used to manage the residual. Finally, the chemical make-up of the residual will determine whether the residual constitutes a hazardous waste or a nonhazardous waste as defined under RCRA. Figure 3-1 depicts how these three variables can be used to determine which federal regulations apply to the management of arsenic residuals. Current data on the rate of use of each residual management method are not available for arsenic treatment processes.[1] Therefore, the discussion below focuses on those possible disposal methods identified in Table 2-1 (see Section 2).

The discussion below is organized with regard to the form of the residual (liquid versus solid) and the way in which it is managed. Issues associated with the chemical make-up of the residual are addressed, as appropriate, within the discussion. The management of liquid residuals is discussed first, followed by discussion of the management of solid/sludge residuals.

3.2 Liquid Residuals

Liquid residuals from drinking water treatment plants (DWTP) typically occur in the form of brines, caustics, filter backwash, or reject waters generated as a residual from the treatment process. Typically, such liquids are disposed through either direct discharge to a waterbody, or through indirect discharge via a sanitary sewer system; that is, a publicly owned treatment works (POTW). Other methods of management include underground injection, management in lagoons, and possibly land disposal or land application. Each of these management methods is discussed below, including a discussion of relevant federal regulations.

The CWA, 33 USC § 1251 et seq., regulates both the direct and indirect discharge of pollutants. Direct discharges of pollutants to surface waters are prohibited except in compliance with a National Pollutant Discharge Elimination System (NPDES) permit. Indirect discharges must comply with the requirements of the federal pretreatment program. Other generally relevant federal regulatory programs include the RCRA and SDWA.

3.2.1 Direct Discharge: CWA NPDES

A direct discharger includes any DWTP that adds any pollutant via a discrete conveyance (e.g., pipe) to practically any surface water body (including wetlands). The term pollutant is broadly defined[2] and includes chemicals used in the treatment process.

[1]To provide some context regarding residual management, for conventional treatment systems (i.e., large drinking water systems), the most commonly used management methods for drinking water treatment residual disposal are co-disposal (i.e., the landfilling of the residual with other wastes), land application and direct discharge to a waterbody (Koorse, 1993). Note that these residual management methods may not reflect the management methods used by arsenic treatment systems since arsenic systems are typically small and may be remotely located.

[2]Under CWA § 502, the term pollutant includes dredged spoil, solid waste, incinerator residue, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt and industrial, municipal, and agricultural waste discharged into water.

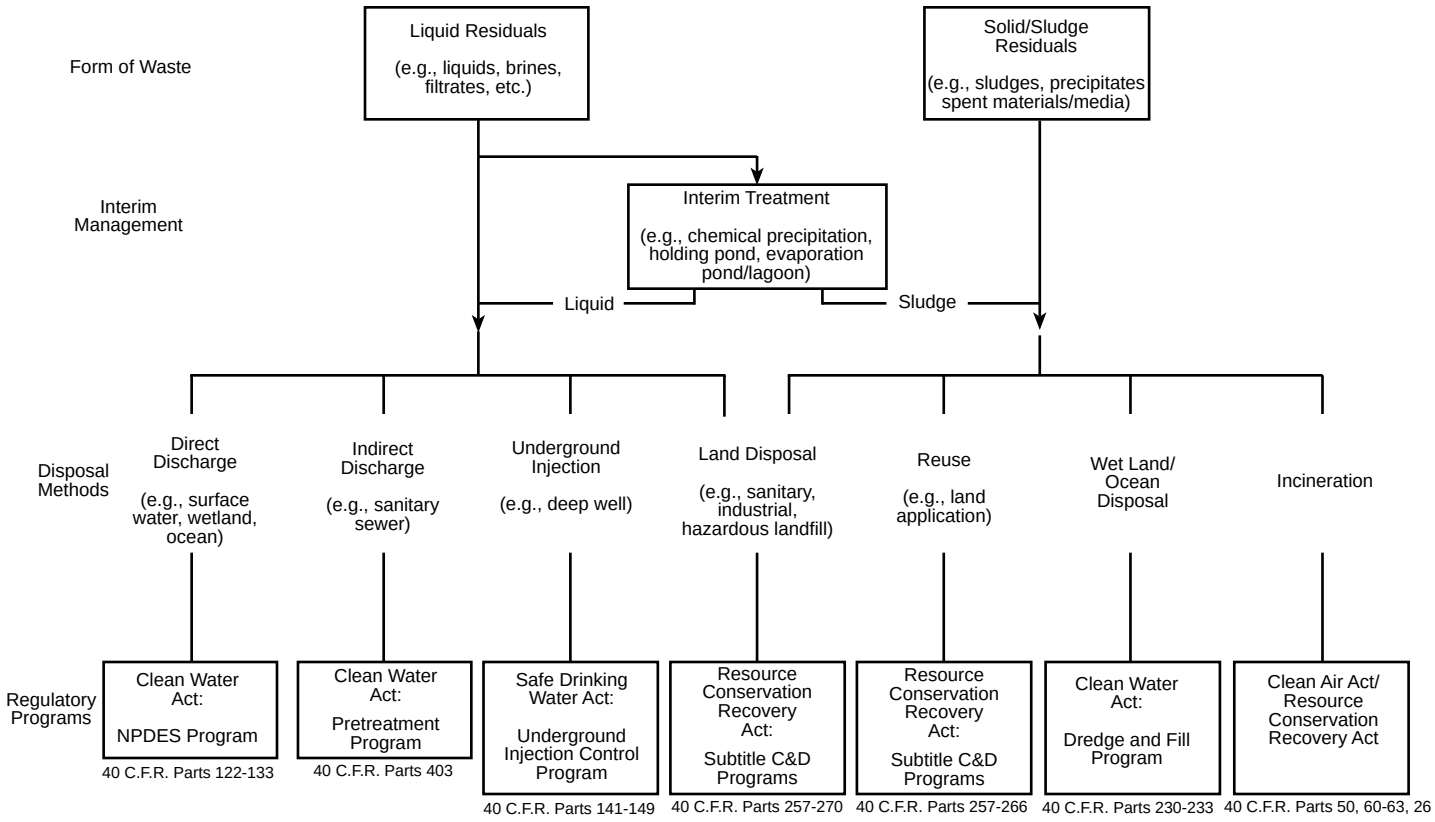

Figure 3-1. Federal regulations governing the disposal of residuals.

A DWTP that is a direct discharger must hold a NPDES permit and may only discharge pollutants in conformance with the terms of that permit (i.e., the DWTP is responsible for treatment of its wastewater to the levels described in its permit prior to discharge). For example, a preliminary scan of EPA's Permit Compliance System (PCS) database indicates that 2,101 facilities in Standard Industrial Classification (SIC) 4941[3] hold NPDES permits, and that at least 25 facilities have some permit limit or condition addressing arsenic.

Generally, each NPDES permit must include technology-based effluent limits if such limits have been developed for the industry, and water quality-based effluent limits if application of the technology-based limits is insufficient to achieve compliance with the water quality standards that apply to the receiving water (water-quality based effluent limits are discussed in greater detail in Section 4). To date, EPA has not developed technology-based effluent limits for water treatment plants. Therefore, such permit limits are generally based on best professional judgement (BPJ).

Where BPJ-based limits are used to address arsenic, additional water quality-based effluent limits may be necessary if the BPJ-based limits are not sufficient to ensure compliance with applicable water quality standards. Under CWA § 1317 and 40 CFR § 401.15, arsenic is specifically identified as a toxic pollutant. Thus, if arsenic occurs in the effluent at levels of concern a BPJ-based effluent limit must be developed and incorporated as a condition in the facility's NPDES permit.

It is immaterial whether the liquid waste stream would constitute a hazardous waste under RCRA if the waste is discharged in compliance with a valid NPDES permit. This is because under RCRA (40 CFR § 261.4(a)), industrial wastewater discharges that are point source discharges subject to regulation under § 1342 of the CWA are excluded from the RCRA definition of solid waste (and hence, are also excluded from the definition of hazardous waste). Therefore, even if the residuals contain hazardous levels of arsenic, if the facility has a NPDES permit, the disposal of such residuals will occur pursuant to the requirements of the CWA.

Finally, any direct discharge to the territorial seas, contiguous zone, or ocean is subject to additional restrictions.

[3]Water Supply. Establishments primarily engaged in distributing water for domestic, commercial, and industrial use.

Generally, no such discharges may be allowed pursuant to a NPDES permit unless the permittee complies with special criteria. The discharge must be deemed to be in the public interest and cannot cause unreasonable degradation of the marine environment (see 33 USC § 1343 and 40 CFR § 125.123).

3.2.2 Indirect Discharge: CWA Pretreatment

Liquid residuals[4] generated by DWTPs may also be discharged to sanitary sewer systems connected to POTWs. Such discharges known as indirect discharges do not require a NPDES permit, but must comply with applicable pretreatment program requirements (see 40 CFR § 403). These requirements, which are generally implemented at the local level of government by a sewer authority or POTW with approval from EPA, include compliance with national general standards, national categorical standards for existing and new sources, and local limits. National general standards include minimum requirements which are intended, among other things, to prevent the introduction into POTWs of pollutants which will interfere or be incompatible with the treatment works. Categorical standards impose industry-specific requirements designed to protect the integrity of the POTW's operation and ensure that it can meet its NPDES permit conditions. To date, no categorical standards have been developed for DWTPs. Finally, local limits allow indirect discharge restrictions to be tailored to local needs and conditions.

Where an approved pretreatment program exists, general and categorical standards and local limits are implemented through a control mechanism, which may be a permit, license, local ordinance, or other agreement. Currently, approximately 1,600 approved pretreatment programs are operational in the United States. Where an approved program does not exist, both the general and categorical standards apply to indirect dischargers directly. Hence, a DWTP with an indirect discharge must ensure compliance with the general pretreatment standards (40 CFR § 403) and any applicable local limits

In the case of a DWTP that discharges a wastewater containing arsenic, the sewer control authority will make the determination as to the quantity and concentration of arsenic that the treatment system can tolerate (i.e., the local limit). If it is determined that the DWTP's wastewater contains levels of arsenic or other contaminants that the treatment system cannot safely treat, then the sewer authority can require that the DWTP treat its wastewater prior to discharge to the POTW. Whether a DWTP is required to treat its wastewater prior to discharge to a POTW is wholly dependent on the quantity of arsenic the POTW can safely treat and the amount of arsenic discharged by the DWTP and other dischargers.

Local limits vary significantly and can depend upon a great number of factors. These include, but are not limited to, the size of the POTW, the amount of arsenic from other sources, and the efficiency of the treatment system. Moreover, DWTPs exhibit a great deal of variance in the amount of arsenic in their intake waters and in the effectiveness of the treatment systems in removing the arsenic and concentrating it in the waste stream. Because of these factors, it is difficult to state with certainty what requirements may be placed upon a facility discharging its residual to a POTW. Each case must be individually evaluated taking into account the aforementioned factors.

3.2.3 Underground Injection: SDWA UIC

Liquid treatment residuals[5] may be disposed via underground injection, although this practice is less common than direct or indirect discharge. Federal regulations addressing underground injection control (UIC) have been developed by the EPA pursuant to the SDWA. Under this program, states may assume responsibility to implement the UIC program provided they meet minimum federal standards.

Federal UIC regulations prohibit the subsurface discharge of fluid through a well or hole whose depth is greater than its width without a permit. UIC regulations may affect some septic tanks, if they are used by a community or regional system for the injection of residuals. Individual and single family residential systems are exempt, as are nonresidential septic systems used only for sanitary wastes and with the capacity to serve fewer than 20 persons per day (see 40 CFR § 144.1).

UIC permits generally include standard permit conditions as well as substantive conditions addressing areas such as construction, operation, corrective action, monitoring and reporting, mechanical integrity, and financial responsibility. Permit-by-rule is authorized in certain instances (i.e., a permit is deemed to be issued if the "permittee" operates in compliance with specified regulatory conditions). The federal UIC regulations establish five classes of injection wells. UIC wells used for liquid residuals generated by DWTPs are likely to be Class V (other) wells.[6] Underground injection is prohibited where it would cause any under-

[4]Federal pretreatment regulations do not define the term "liquid." However, these regulations prohibit the indirect discharge of "solid or viscous pollutants in amounts which will cause obstruction to the flow in the POTW resulting in interference" (40 CFR § 403.5(b)(3)). In addition, states or localities may further define the criteria that a material must meet to qualify for indirect discharge (e.g., pass through 3/8-inch mesh).

[5]Federal UIC regulations define the term "fluid" as "any material or substance which flows or moves whether in a semisolid, liquid, sludge, gas, or any other form or state" (40 CFR § 144.3).

[6]This assumes that the substance being injected is not a hazardous waste. Injection of hazardous waste is subject to Class I well requirements.

ground source of drinking water to exceed any SDWA-mandated drinking water standard (i.e., MCL) or otherwise affect public health.

3.2.4 Land Disposal: RCRA Subtitles C/D

Bulk liquids generated by DWTPs are generally not land disposed through landfilling due to the regulation of such disposal, the costs of transport and disposal, and the availability of more reasonable and environmentally benign management alternatives. This is true for both nonhazardous and hazardous liquid wastes. For example, under 40 CFR § 258.28, municipal solid waste landfills (MSWLFs) generally may not accept bulk or noncontainerized liquid wastes. Similarly, nonhazardous industrial landfills are often subject to similar state restrictions. Liquid residuals that constitute a hazardous waste are generally subject to comprehensive generator, transport, storage, treatment and land disposal restriction requirements.

Liquids generated by DWTPs that are reused through land application (e.g., being sprayed on crops or other land) are subject to very limited federal regulation provided that the liquid is not a RCRA hazardous waste (such wastes are generally subject to comprehensive regulation). The criteria in 40 CFR Part 257 establish basic provisions that define those practices that constitute open dumping, which is prohibited under § 4005 of RCRA. These provisions, which are predominantly implemented and enforced by the states, include requirements addressing location in a floodplain; protection of endangered species; protection of surface water (e.g., waste management practices shall not cause a point source discharge in violation of CWA § 402, or a nonpoint source discharge in violation of applicable legal requirements) and ground water (e.g., waste management practices shall not contaminate an underground drinking water source); land application to food chain crops (e.g., cadmium and PCB restrictions); minimizing disease vectors; protection of air quality; and limits on explosive gases. Thus, reuse through land application should be consistent with these requirements and corresponding state provisions.

The regulations applicable to the management of liquid residuals in lagoons (i.e., surface impoundments and evaporation ponds) are discussed in Section 3.3.4, Lagoons.

3.3 Solid/Sludge Residuals

Solid residuals from DWTPs typically occur in the form of sludges (or precipitates) generated as residuals from the treatment process. They may also include spent resins and filter media that can no longer be used as part of the treatment process. Typically, sludges are disposed through either landfilling, in municipal or industrial landfills, or through land application. Interim management may also include storage in lagoons. Spent resins and filter media when not disposed, may be sent back to the vendor for reactivation, recovery, or disposal. Although no specific studies were identified that examine whether arsenic treatment residuals typically constitute a hazardous waste (i.e., exhibit the hazardous characteristic of toxicity), none of the literature reviewed suggests that significant quantities of arsenic (or other drinking water) treatment residuals typically constitute hazardous waste. Rather, it appears that currently federal regulation of solid and sludge arsenic treatment residuals occurs predominantly under RCRA Subtitle D (nonhazardous waste). Nevertheless, since arsenic treatment residuals can constitute a hazardous waste they must be evaluated on a case-by-case basis and, where they do exhibit a hazardous characteristic, the residual must be managed pursuant to the requirements of RCRA Subtitle C (hazardous waste).

3.3.1 Solid Waste Landfill: RCRA Subtitle D

Depending upon the type of treatment technology employed, a DWTP may generate a solid residual in the form of a sludge. Once a facility has determined that its solid residual is not a hazardous waste per 40 CFR § 261.24 (toxicity characteristic) (see also 40 CFR § 262.11(c)(2)), then the residual may be disposed in a municipal or industrial landfill. Municipal landfills must meet minimum requirements established under 40 CFR Part 258. Under Part 258, MSWLFs must comply with requirements addressing location, operation, design, ground water monitoring, corrective action, closure and post-closure care, and financial assurance. The ground water monitoring requirements include mandatory detection monitoring for arsenic (among other constituents) followed by assessment monitoring where a statistically significant increase over background is identified. It is noteworthy that although the requirements imposed under Part 258 have been developed at the federal level, these provisions are implemented under state and local solid waste programs (i.e., the Part 258 provisions are only imposed to the extent required by state laws and regulations).

Industrial landfills, which may include monofills (landfills designed and dedicated to the disposal of a single type of waste), are typically regulated under state and local laws. Such laws generally impose requirements addressing location, design, operation, permeability (i.e., requirements for the use of liners), run-on/runoff controls, and cover. Many industrial landfills and monofills are located on-site of the residual generator.

Finally, it is important to keep in mind that under no circumstances may sludges be disposed of in navigable waters (streams, rivers, lakes, or oceans) and care must be taken that sludges do not enter navigable waters as a consequence of transfer operations. Also, DWTPs are considered to be industrial facilities for purposes of the Phase I storm water regulations (40 CFR § 122.26) and if a plant

elects to store or dispose of sludge on-site that facility may have to comply with CWA storm water regulations.

3.3.2 Hazardous Waste Landfill: RCRA Subtitle C

Sludges generated from DWTPs may, in some instances, constitute a hazardous waste[7] if they exhibit the hazardous characteristic of toxicity.[8] For arsenic, a solid waste constitutes a hazardous waste if the extract from a representative sample of the solid waste (using a TCLP Test Method 1311, as described in EPA publication SW-846) contains equal to or greater than 5.0 mg/L. Note that other constituents may also render a solid waste a hazardous waste (see 40 CFR § 261.24). Any person who generates a solid waste (i.e., DWTPs that generate a liquid, solid, or sludge waste) must determine whether that residual constitutes a hazardous waste. For DWTPs, this encompasses either testing a sample of the residual as described above, or making a judgement (i.e., "applying knowledge"), based on the materials and processes used to generate the residual, as to whether it exhibits the characteristic of toxicity (see 40 CFR § 262.11; § 261.10(a)(2)(ii)). Most DWTP sludges do not exhibit the characteristic of toxicity and, thus, are not hazardous wastes (USEPA, 1996).

If a residual is a hazardous waste, it must be managed in compliance with the following requirements:

- *Hazardous Waste Generator* - Hazardous waste generators must obtain an EPA identification number, as well as comply with packaging, marking, manifesting, accumulation and storage, record keeping and reporting, and land disposal restriction (LDR) requirements. Note that the technical standards applicable to the management of hazardous waste vary depending on how much waste is generated per month. A DWTP that generates residuals that must be managed as hazardous waste may be subject to the hazardous waste generator requirements.

- *Hazardous Waste Transporter* - Hazardous waste transporters must obtain an EPA identification number, as well as comply with manifest and spill clean-up/reporting requirements.

- *Hazardous Waste Treatment, Storage, Disposal Facilities (TSDFs)* - Hazardous waste TSDFs must obtain an EPA identification number, as well as comply with general facility standards, preparedness and prevention, permitting, contingency plans and emergency procedures, manifest, record keeping and reporting, release, closure and post-closure, financial, corrective action, land disposal restriction, and management unit specific (e.g., surface impoundments, waste piles, and landfills) requirements. A DWTP could be subject to TSDF requirements if it decides to accumulate hazardous waste for greater than 90 days or to treat or dispose of its hazardous waste on-site.

To manage the universe of hazardous waste generators, EPA has classified hazardous waste generators on the basis of the quantity of waste produced. These classes are as follows: 1) Large Quantity Generators (LQG) are those facilities that produce over 1,000 kilograms per month of hazardous waste (weight is determined based on the condition of the waste as disposed); 2) Small Quantity Generators (SQG) are those facilities that produce greater than 100 kilograms per month of hazardous waste but less than 1,000 kilograms per month, and accumulate less than 6,000 kilograms at any one time; and 3) Conditionally Exempt Small Quantity Generators (CESQG) are those facilities that generate less than 100 kilograms per month of hazardous waste. There are also restrictions on the amount of waste a CESQG may accumulate. LQGs are subject to full regulation. SQGs are subject to reduced regulation. CESQGs are generally exempt from Subtitle C regulation provided they appropriately manage their waste in permitted or licensed state municipal or industrial landfills.

Any hazardous waste that will be disposed or placed on the land must comply with the land disposal restriction (LDR) regulations. Land disposal includes disposal or placement in landfills, land treatment, surface impoundments, waste piles, or injection wells (40 CFR Part 268.2(c)). These regulations establish treatment standards for each hazardous waste. The waste must meet the standard prior to land disposal. Compliance with the LDR requirements may force DWTPs to treat their waste prior to land disposal.

Finally, any DWTP that generates a hazardous waste must be careful regarding whether that waste is mixed with other solid wastes. Under 40 CFR § 261.3, a mixture of a characteristic hazardous waste and a solid waste is a hazardous waste unless the resultant mixture does not exhibit any characteristic of hazardous waste. Facilities may not mix characteristic hazardous waste with other wastes to dilute the characteristic unless it is a necessary step in the treatment process.

3.3.3 Lagoons: SDWA

Some DWTPs may choose to manage some dilute sludges in lagoons to allow concentration of the sludge and

[7]A hazardous waste is defined under RCRA as a solid waste or combination of solid wastes which because of its quantity, concentration, or physical, chemical, or infectious characteristics may 1) cause, or significantly contribute to an increase in mortality or an increase in serious irreversible, or incapacitating reversible, illness; or 2) pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, or disposed of, or otherwise managed (42 USC § 6903(5), RCRA 1004(5)). EPA has more specifically defined hazardous wastes pursuant to regulation at 40 CFR § 261, Subparts C and D. Note that under RCRA, liquids can meet the definition of solid wastes and sludges from DWTP are specifically identified as solid wastes (see, 42 USC § 6903(27)).

[8]A solid waste may be a hazardous waste if it is specifically listed in 40 CFR §§ 261.31 - 261.33 (Subpart D), or if it exhibits a hazardous characteristic, as identified in 40 CFR §§ 261.21-24 (Subpart C). Such characteristics include ignitability, corrosivity, reactivity, and toxicity. Wastes generated by DWTPs are not listed in Subpart D.

provide for short-term storage. Generally, this form of management is contingent on the availability of on-site land and the size of the treatment plant (Koorse, 1993). Where the residuals are not a hazardous waste, on-site sludge lagoons are regulated minimally at the federal level under SDWA and RCRA. The SDWA requires that states establish programs to protect "wellhead" areas (i.e., areas surrounding a water well or wellfield supplying a public water system) from contaminants that may pose adverse effects on human health. In addition, under RCRA, EPA has established criteria that prohibit practices that contaminate surface water or ground water (see 40 CFR § 257.3-4). Beyond these federal requirements, contamination of ground water is generally regulated at the state level. If such residuals do constitute a hazardous waste, RCRA regulations establish comprehensive design and operation standards applicable to surface impoundments (40 CFR Part 264, Subpart K).

3.3.4 Reuse of Hazardous Waste: RCRA Subtitle C

DWTP sludges that do constitute a hazardous waste may be reused through land application if they meet the RCRA exemption for recyclable materials applied to the land (see 40 CFR § 266.20(b)). Under this exemption, a product that contains hazardous materials must have undergone a chemical reaction such that the hazardous material is rendered physically inseparable, and the product must meet the applicable RCRA LDR standards. EPA has also developed an exemption for commercial fertilizers produced from recyclable hazardous materials provided the fertilizer meets all applicable LDR standards.

3.3.5 Reuse of Solid Waste: RCRA Subtitle D

Nonhazardous sludges from DWTPs may be reclaimed or reused, typically through some form of application to the land (this may involve mixing, or co-use, with other materials including other sludges). Where the DWTP sludge is not a hazardous waste, there are very few federal regulations that apply to such reuse. The criteria in 40 CFR Part 257 establish some provisions that define those practices that constitute open dumping, which is prohibited under § 4005 of RCRA. As discussed above, these provisions, which are predominantly implemented by the states, include requirements addressing location in a floodplain; protection of endangered species; protection of surface water and ground water; land application to food chain crops; minimizing disease vectors; protection of air quality; and limits on explosive gases. Thus, reuse should be consistent with these requirements. It is also worth noting that DWTP sludges are not regulated under the sewage sludge management regulations imposed under the CWA, as 40 CFR § 503.6(i)(e) specifically excludes drinking water treatment sludges from this regulatory scheme. However, state and local laws generally address such waste management.

3.3.6 Off-Site Disposal

DWTPs that transport treatment residuals off-site are subject to federal regulation if the residuals are a hazardous waste, pursuant to RCRA, or if they constitute a hazardous material, pursuant to the Hazardous Materials Transportation Act (HMTA).

If the residual is a hazardous waste (i.e., exhibits the characteristic of toxicity), it may only be transported if accompanied by a hazardous waste manifest. In addition, off-site disposal of such material is subject to packaging, labeling, marking, placarding, record keeping, and reporting requirements (see 40 CFR Parts 262 and 263). If the residual is a hazardous material, it is subject to regulation developed under HMTA addressing material classification, packaging, marking, labeling, and transport.

4. Select State Regulatory Requirements

In addition to reviewing federal regulations that potentially affect the management of arsenic drinking water treatment residuals, this document also examines similar regulations imposed by the following seven states: Arizona, California, Maine, Nebraska, New Mexico, Nevada, and Pennsylvania. The review of select state regulations parallels the examination of federal regulations, focusing on characterizing the requirements that may apply to the different management options available for liquid and solid residuals generated by treatment systems that remove arsenic from drinking water. The seven states selected were chosen primarily based on arsenic occurrence and, secondarily, to obtain some degree of regional representation.

Given the structure of the relevant federal environmental programs which typically delegate program implementation authority to states that adopt consistent programs, it is not surprising that many components of these seven state regulatory programs are generally consistent with the federal minimum requirements described in Section 3. This is true with regard to the approach to surface water regulation; controlling indirect discharges to sanitary sewer systems (i.e., POTWs); underground injection control; and the approach to hazardous waste regulation, including the arsenic threshold under the toxicity characteristic, which determines when a waste constitutes a hazardous waste based on its arsenic content.

Nevertheless, state programs differ from federal program requirements and each other in several important aspects. These differences include the actual surface water quality standards applicable to control the amount of arsenic in direct discharges of liquid effluent, the local limits that specify how much arsenic may be discharged to a sanitary sewer system, the regulation of solid waste landfills, the protection of ground water resources, and the regulation of land application activities. The discussion below summarizes important aspects of the state regulations reviewed. Additional discussion is provided in the individual state subsections that follow.

4.1 Liquid Residuals

4.1.1 Direct Discharge to Surface Waters

As discussed in Section 3.2.1, EPA has not promulgated national technology-based effluent limitation guidelines for drinking water treatment facilities. As a result, technology-based NPDES permit limits are based on best professional judgement (BPJ) and, where BPJ may not be sufficient to ensure compliance with state water quality standards, on water quality-based effluent limits. Such water quality-based effluent limits are calculated to ensure compliance with state water quality standards. Thus, for purposes of assessing state regulations that may impact direct discharges to surface waters, the most relevant state standards are state water quality standards.

State water quality standards generally include surface water use classifications, numeric and/or narrative water quality criteria, and an antidegradation policy. The use classification identifies surface water uses that should be protected (e.g., public water supply, recreation, and propagation of fish and wildlife),[9] the numeric and narrative standards identify the level of water quality deemed sufficient to support such uses, and the antidegradation policy prevents degradation to water quality.[10] The summary information presented in this section focuses on the relevant state numeric and narrative water quality criteria (hereinafter, the state numeric and narrative water quality criteria are generally referred to as state water quality standards).

Table 4-1 presents a summary of the state numeric surface water quality standards for arsenic. It also presents the recommended national numeric water quality criteria for arsenic developed by EPA. These national criteria provide guidance for states and tribes as they adopt water quality standards pursuant to § 303(c) of the CWA. Generally, states must develop numeric surface water quality standards for arsenic (or other priority pollutants) where a discharge or the presence of the pollutant could reasonably be expected to interfere with the designated uses of a waterbody. As a result, not all states have established numeric water quality standards for arsenic for all uses or all waterbodies.

Among the state surface water quality standards, two points are noteworthy. First, the standards imposed for public/domestic water supplies generally reflect the current drinking

[9]States may expand these classifications or add to them.

[10]For purposes of this document, antidegradation provisions are not highly relevant and, therefore, are not discussed.

Table 4-1. Summary of Federal Recommended and Select State Surface Water Quality Standards for Arsenic

State	Domestic Water	Fish Consumption	Full Body Contact	Partial Body Contact	Livestock	Irrigation
Recommended Federal Criteria for Arsenic	Freshwater: Acute - 0.34 mg/L; Chronic - 0.15 mg/L Saltwater: Acute - 0.069 mg/L; Chronic - 0.036 mg/L					
Arizona	0.05 mg/L	1.45 mg/L	0.05 mg/L	0.05 mg/L	0.2 mg/L	2.0 mg/L
California[1]	Freshwater: Acute - 0.34 mg/L; Chronic - 0.15 mg/L Saltwater: Acute - 0.069 mg/L; Chronic - 0.036 mg/L					
Maine[2]	Freshwater: Acute - 0.34 mg/L; Chronic - 0.15 mg/L Saltwater: Acute - 0.069 mg/L; Chronic - 0.036 mg/L					
Nebraska	0.05 mg/L	Varies	NA	NA	NA	NA
New Mexico	0.05 mg/L	NA	NA	NA	0.2 mg/L	0.1 mg/L
Nevada	0.05 mg/L	NA	NA	NA	0.2 mg/L	0.1 mg/L
Pennsylvania	Freshwater: Acute - 0.36 mg/L; Chronic - 0.19 mg/L					

[1] Standards proposed under California Toxics Rule (62 *Federal Register* 42160; August 5, 1997).
[2] Adopts federal water quality criteria.

water MCL. This is likely a result of the states adopting the MCL in lieu of independently developing a risk-based standard and the fact that some state laws specifically prohibit degradation of drinking water sources beyond current drinking water standards. It also suggests that a change in the MCL may result in a change in water quality standards of these states. Second, three states adopted the federal criteria; however, California is expected to revert back to its somewhat unique regional implementation of water quality standards in time.

Three of the states reviewed, Arizona, Maine, and New Mexico, are not currently authorized to implement the NPDES program. In these states, the appropriate EPA regional office is responsible for issuing NPDES permits for any direct discharge of pollutants from a point source to a surface water. The respective states must certify that the EPA-issued permit complies with applicable state water quality standards. In states not authorized to issue NPDES permits, the state may also impose state permit requirements that apply in addition to any NPDES permit. For example, Maine requires that direct dischargers obtain both an NPDES and a state permit, with the state permit based on both assimilative capacity and designated uses of the waterbody.

4.1.2 Indirect Discharges to a Sanitary Sewer System

Where a DWTP may discharge effluent to a sanitary sewer system, the key regulatory standard is the local limit imposed by the local pretreatment authority. Such local limits determine the amount of arsenic that may be indirectly discharged to the POTW. Examples of such limits from the seven states reviewed are presented in Table 4-2. As discussed in Section 3, local limits are implemented through the relevant control mechanism (e.g., permit, license, local ordinance, or agreement).

In addition to any relevant local limit, DWTPs must also understand the potential for indirect discharges to affect the quality of sewage sludge generated by a POTW, because reuse and disposal of sewage sludge is regulated, including being subject to numeric standards for arsenic, under 40 CFR Part 503.[11] If the indirect discharge of a liquid residual to a sanitary sewer system causes the sewage sludge generated by the receiving POTW to exceed the applicable sewage sludge standard for arsenic, the control authority is likely to impose restrictions on the indirect discharge of arsenic to the POTW. Two of the states examined explicitly address this in their regulations. Nebraska provides that pretreatment permits must ensure compliance with sewage sludge requirements. Similarly, Pennsylvania provides that local limits must ensure compliance with the POTW's NPDES permit and sludge use

[11] Under 40 CFR Part 503, no land application of sewage sludge may cause the arsenic level to exceed 75 mg/kg. In addition, where sewage sludge is applied in bulk, cumulative arsenic loading may not exceed 41 kg/hectare or 41 mg/kg monthly average (40 CFR § 503.13).

Table 4-2. Examples of Arsenic Local Limits for Selected States

State	Local Jurisdiction	Local Arsenic Limit
Arizona	Phoenix	0.1 mg/L
California	Tijuana International Plant	0.27 lbs/Mgal (based on sludge contamination)
Maine	NA	NA
Nebraska	NA (under development)	NA
New Mexico	Albuquerque	0.051 mg/L
	Farmington	1.07 mg/L (proposed limit of 6.60 mg/L)
	Las Cruces	0.66 mg/L (proposed limit of 0.06 mg/L)
	Santa Fe	2.74 mg/L
Nevada	NA	NA
Pennsylvania	NA	NA

NA - Not identified. This does not necessarily mean such limits do not exist.

or disposal practices. Nevertheless, because the Part 503 requirements apply to all the states examined, sewage sludge contamination is a potential issue for all seven states.

4.1.3 Underground Injection

The underground injection provisions of the states examined are generally consistent with the federal requirements as described in Section 3. Five of the states examined are authorized to implement the UIC program. In Arizona and Pennsylvania, the EPA regional office implements the program. Generally, the state UIC programs do not focus on arsenic contamination except in the context of prohibiting contamination of drinking water sources and protecting ground water and surface water in general (e.g., Arizona, Nebraska, and New Mexico have ground water standards for arsenic). New Mexico prohibits the injection of fluids into ground water with low total dissolved solids (TDS) (10,000 mg/L or less TDS) unless such an aquifer is designated for the injection of contaminants, and then the state imposes an arsenic ground water quality standard of 0.1 mg/L.

4.1.4 Land Disposal

All of the states examined except Arizona restrict or prohibit the disposal of bulk or noncontainerized liquids in their general municipal landfills. These requirements are generally a result of similar restrictions imposed under 40 CFR Part 258, which has been adopted in at least 40 states. The states that impose these restrictions generally provide some limited exceptions. Arizona does not explicitly restrict the management of liquids in landfills, but does provide that landfills must be located and managed so that seepage will not create a health hazard, nuisance, or cause pollution of any surface or ground water in the state. California is somewhat unique in that in addition to adopting the Part 258 requirements restricting liquids disposal, California also has adopted provisions that specifically address the disposal of DWTP sludge at landfills. These provisions specify a minimum percent solids (15 percent), solids-to-liquid ratio (5:1), and certain design parameters (leachate collection and removal system) for landfills that accept DWTP sludge. No other state examined addresses DWTP residuals at this level of detail.

4.2 Solid/Sludge Residuals

4.2.1 Solid Waste Landfills

The provisions imposed under 40 CFR Part 258 require municipal solid waste landfills to comply with ground water monitoring requirements (including monitoring for arsenic) and other design and operating provisions as described in Section 3. These requirements are implemented at the state level and, as noted, have been adopted by at least 40 states. All of the states examined require some form of comparable ground water monitoring except Arizona and Nebraska. Both Arizona and Nebraska impose basic landfill requirements and also impose ground water quality standards for arsenic to ensure adequate environmental protection. California, as discussed above, implements the Part 258 requirements on a regional basis and has developed specific landfill requirements that apply to DWTP residuals (i.e., 15 percent minimum solids, 5:1 solids to liquid ratio, and mandatory leachate collection and removal system).

4.2.2 Hazardous Waste Landfills

All of the states examined define a waste that exhibits the characteristic of toxicity as a hazardous waste. These states all adopt the federal arsenic standard for purposes of the toxicity characteristic (i.e., 5.0 mg/L). If the extract from a representative sample of the waste (based on use of the TCLP) exceeds this threshold, the waste is regulated as a hazardous waste. California also has developed an additional leaching test known as the waste extraction test (WET). Based on the WET, California defines as a hazardous waste those wastes that have an arsenic soluble limit threshold concentration of 5.0 mg/L, and those wastes that have a total arsenic threshold limit concentration of 500 mg/kg.

4.2.3 Lagoons

The seven states regulate the use of lagoons (which are defined here to include surface impoundments and evaporation ponds) both directly and through the imposition of

ground water (or aquifer protection) standards. Most of the states examined impose general design and operation standards for lagoons. Arizona goes so far as to require aquifer protection permits that include discharge limits and best management technologies. Some states, such as New Mexico, rely on the imposition of ground water quality protection standards to ensure that lagoons do not pollute ground waters. In contrast, California requires facilities to detect, characterize, and respond to releases to surface and ground waters, but implements these requirements on a site-specific basis (and regional plans may be more stringent). Finally, pursuant to federal regulations as adopted in RCRA-authorized states, all lagoons that manage hazardous waste are subject to comprehensive regulations (e.g., liners, leachate collection, ground water monitoring, etc.).

The second type of state requirement that may affect the use of lagoons, as well as other waste management activities, is the imposition of ground water (or aquifer protection) standards. Table 4-3 summarizes the ground water standards identified for the states that were examined. These states may use numeric, narrative, or classifications to protect ground water or may address the issue on a case-by-case basis.

4.2.4 Reuse (Land Application)

The land application of DWTP sludge appears regulated primarily on a case-by-case basis. Under their respective state regulations, California, Maine, and Nevada develop and impose requirements for the land application of DWTP sludge on a case-by-case basis. Each state requires that an approval be obtained for land application, and each focuses on ensuring that such application is performed at agronomic rates and in such a manner as to minimize environmental impacts. Arizona, New Mexico, and Pennsylvania have adopted regulations consistent with the federal sewage sludge land application standards (40 CFR Part 503), including the numeric limits for arsenic. In each of these states, however, these provisions do not apply to the land application of DWTP sludge. Rather, such land application is likely regulated on a case-by-case basis. Note that the federal sewage sludge standards for arsenic may or may not be used as guidance by these states. Nebraska's sludge land application regulations expressly apply to DWTP sludge. The state requires that such land application be conducted pursuant to a permit that includes basic operating, reporting and recordkeeping requirements, but Nebraska has not developed any numeric standard for arsenic concentration or loading. Table 4-4 summarizes the state regulations affecting land application.

None of the seven states examined are authorized to implement the 40 CFR Part 503 standards applicable to the land application of sewage sludge. Therefore, the respective EPA regional offices implement this program within these states. Under the federal regulations, sewage sludge does not include DWTP sludge (unless mixed).

4.2.5 Off-Site Disposal

All seven states have either adopted in regulation or adopted by reference the federal hazardous waste transportation regulations and the basic provisions imposed by the U.S. Department of Transportation under the Hazardous Materials Transportation Act (HMTA). Thus, DWTPs that transport treatment residuals off-site are subject to regulation if the residuals are a hazardous waste, or if they constitute a hazardous material. Generally, the transport of such residuals will be regulated as hazardous waste if at all, since the hazardous material requirements focus on acute toxicity, which is not likely to be present in drinking water treatment residuals.

If a residual is a hazardous waste (i.e., exhibits the characteristic of toxicity), it may only be transported if accompanied by a hazardous waste manifest. In addition, off-site disposal of such material is subject to packaging, labeling, marking, placarding, recordkeeping, and reporting requirements. If the residual is a hazardous material, it is subject to regulations developed under HMTA addressing material classification, packaging, marking, labeling, and transport.

The remaining subsections provide a more in-depth discussion of each state's relevant regulations.

4.3 Arizona

4.3.1 Liquid Residuals

Direct Discharge to Surface Water

Arizona is not currently authorized to implement the NPDES program. Nevertheless, through agreements with EPA Region 9, Arizona does administer some aspects of the NPDES program. These include permit processing for those entities that directly discharge pollutants to surface waters within Arizona (including development of the requisite technology-based and water quality-based effluent limits), preparation of permit compliance monitoring reports, and reporting noncompliance. EPA Region 9 issues and enforces the NPDES permits in Arizona. When EPA issues the NPDES permit the State of Arizona must certify that the permit will meet Arizona water quality standards for surface waters before the final NPDES permit may be issued.

Arizona has developed numeric arsenic water-quality standards applicable to surface waters.[12] These standards[13] are

[12]These standards are developed by the Arizona Department of Environmental Quality, Office of Water Quality.

[13]Arizona Administrative Code Title 18, Chapter 11, Article 1, Appendix A.

Table 4.3. Select State Arsenic Ground Water Quality Standards

State	Ground Water/ Aquifer Protection Standard	Comment
Arizona	0.05 mg/L	Applies to aquifers classified for drinking water protected use. State also imposes narrative aquifer water quality standards (see state discussion).
California	Varies	Developed as needed and on a site-specific basis. Regional plans may also establish such standards.
Maine	Narrative ground water classifications	Two classifications (see state discussion).
Nebraska	0.05 mg/L	Applies to any activity that could impact ground water. Implemented either through existing regulatory programs or applied directly. State also has narrative ground water quality standards (see state discussion).
New Mexico	0.1 mg/L	Applicable to ground water with 10,000 mg/L TDS or less. Discharge of effluent or leachate into ground water only allowed subject to approved plan.
Nevada	NA	Ground water protection and mining reclamation section (DCNR) focuses on ground water protection.
Pennsylvania	NA	Persons must prevent polluting substances from reaching waters of the state. Impoundments must be impermeable.

presented in Table 4-5.[14] These surface water quality standards vary based on the designated use of each water body within the state (e.g., domestic consumption, fish consumption, contact recreation, agriculture, etc.).[15] Each surface water that is assigned each of the designated uses described in Table 4-5 should meet the corresponding arsenic limit specified. To ensure this occurs, each NPDES permit issued to each direct discharger in the state must ensure that the effluent discharged by that facility does not cause a violation of the corresponding arsenic standard at the point of discharge or in a mixing zone in reasonable proximity to the discharge. Typically, facilities employ effluent treatment to achieve compliance with NPDES permit limits.

Arizona also provides that certain surface waters may be designated as unique waters where the waterbody is of exceptional recreational or ecological value. Only one surface water, Peeples Canyon Creek, a tributary to the Santa Maria River, is currently classified as a unique water with an arsenic limit (0.020 mg/L) (R18-11-112). This limit preempts the numeric standards listed above for this waterbody.

In addition to the numeric surface water quality standards, Arizona also imposes narrative surface water quality standards that provide that such waters must be free from pollutants in amounts that:

- Are toxic to humans, animals, plants, or other organisms
- Cause or contribute to a violation of an aquifer water quality standard (R18-11-405/406).[16]

Any discharge of an arsenic residual that is deemed to violate these standards would be prohibited or limited through NPDES permit conditions.

Indirect Discharge to a Sanitary Sewer System

Arizona does not establish state limits for indirect discharges (i.e., discharges to public sanitary sewer systems and treatment works). Local limits may be established by

[14]Note: These state water quality standards do not apply to waste treatment systems (including impoundments, ponds, lagoons that are part of such systems) (R18-11-102).

[15]Designated uses for the state's water bodies are listed in Title 18, Chapter 11, Article 1, Appendix B.

[16]Note: Only relevant narrative standards are included here.

Table 4-4. Select State Land Application Standards for DWTP Sludge

State	Land Application	Comment
Arizona	State biosolids land application standards are the same as federal sewage sludge standards.	State biosolids standards do not apply to DWTP sludge (unless DWTP sludge is mixed with biosolids).
California	No state sludge land application program. Upon application, State Water Resource Control Board (SWRCB) or regional boards must prescribe requirements. State also has land treatment unit (LTU) regulations.	State requires land application at agronomic rates, mitigation of environmental impacts and hazards, and consultation with other state agencies. Regional boards may impose additional requirements. LTU provisions specify development of waste discharge requirements (i.e., specific elements of land treatment programs).
Maine	Land application of municipal and industrial sludge prohibited unless pursuant to state approval.	Requirements based on crop or soil requirements. Cannot pollute waters of state or violate drinking water standards. State regulations do not specify arsenic land application standard.
Nebraska	State has both sludge and sewage sludge regulations. Sludge regulations expressly apply to DWTP solid, semisolid, and liquid wastes.	Permit required for land application of sludge, including compliance requirements and duration, schedule, reporting and recordkeeping provisions. No arsenic standard specified. Sewage sludge standards do not apply to DWTP residuals.
New Mexico	State sewage sludge land application standards are the same as federal sewage sludge standards.	State sewage sludge standards do not apply to DWTP sludge (unless DWTP sludge is mixed with sewage sludge).
Nevada	Special waste disposal subject to approved plan and approval of solid waste management authority.	Special wastes include sewage sludge but do not mention DWTP or other commercial or industrial sludges. DWTP sludge probably addressed on case-by-case basis.
Pennsylvania	State sewage sludge land application standards are the same as federal sewage sludge standards.	No explicit requirements that apply to DWTP sludge.

local sewer authorities or POTWs that administer pretreatment programs. For example, Phoenix imposes a local limit for arsenic of 0.1 mg/L (although this limit is being reconsidered). Indirect discharges remain subject to the national general pretreatment standards (e.g., restrictions designed to prevent the introduction into POTWs of pollutants which will interfere with or pass through the treatment works).

Arizona does have a regulatory program that addresses the land application of biosolids generated by POTWs (see discussion under Solid/Sludge Residuals, Reuse). If the indirect discharge of a liquid residual to a sewer system causes the biosolids generated by the receiving POTW to exceed the applicable biosolids standards for arsenic, the POTW is likely to impose restrictions on the indirect discharge of arsenic.

Underground Injection

EPA Region 9 administers the UIC program in Arizona (40 CFR § 147.151). The program consists of the requirements specified in 40 CFR Parts 124 (Procedures for Decisionmaking), 144 (UIC Program), 146 (UIC Criteria and Standards), and 148 (Hazardous Waste Injection Re-

Table 4-5. Arizona's Designated Use Numeric Arsenic Surface Water Quality Standards

Domestic Water Source	Fish Consumption	Full Body Contact	Partial Body Contact	Agricultural Irrigation	Agricultural Livestock Watering
0.05 mg/L (total)	1.45 mg/L	0.050 mg/L	0.050 mg/L	2.0 mg/L	0.2 mg/L

strictions). Thus, the UIC requirements imposed in Arizona are the same as those described previously in Section 3.2.3. Arizona also imposes aquifer water quality standards that may affect UIC disposal. These requirements are described below under Solid/Sludge Residuals, Lagoons.

Land Disposal

Arizona has not adopted the federal municipal solid waste landfill criteria (40 CFR Part 258). Thus, the state does not explicitly ban disposal of bulk liquids in landfills. However, the state does provide that landfills must be located so that seepage will not create a health hazard, nuisance, or cause pollution of any watercourse or water bearing strata.

4.3.2 Solid/Sludge Residuals

Solid Waste Landfills

As discussed above, Arizona has not adopted the federal municipal solid waste landfill criteria (40 CFR Part 258). Rather, Arizona imposes very basic landfill requirements, including provisions addressing location (to prevent seepage), surface drainage, litter control, fire control, vector control, a prohibition on burning, access roads, proper equipment, and cover and compaction. Solid waste landfills located in Arizona are not required to monitor ground water under and around the landfill for releases of arsenic. However, Arizona does have aquifer water quality standards that indirectly restrict the amount of arsenic that can be discharged from a landfill (R18-8-512). The aquifer water quality standards are discussed under Lagoons.

Arizona also has developed regulations that address special wastes (i.e., solid wastes that are not hazardous wastes but that require special handling and management to protect public health or the environment); however, these regulations do not explicitly apply to arsenic residuals.[17]

Hazardous Waste Landfills

Arizona is authorized to implement the federal RCRA program. The state incorporates the federal hazardous waste regulations by reference with limited exceptions (R18-8-260). Thus, Arizona imposes the same toxicity characteristic standard as imposed under federal regulations (i.e., 5.0 mg/L). One area where Arizona is more stringent than the corresponding federal requirements is reporting. Arizona requires annual reports of the amount and types of hazardous waste generated, whereas, federal regulations require biannual waste reports. In addition, Arizona may require reports of any conditionally exempt small quantity generator or group of conditionally exempt small quantity generators regarding the treatment, storage, transportation, disposal, or management of hazardous waste if such hazardous waste poses a substantial present or potential hazard to human health or the environment when it is improperly managed. Arizona law also requires businesses and state agencies to develop and implement pollution prevention plans to minimize the generation of hazardous waste.

Lagoons

Arizona has established a ground water protection program that includes requirements for aquifer protection permits and establishes aquifer water quality standards. Aquifer protection permits are required for all persons that conduct activities that result in a discharge to an aquifer (e.g., such as the management of a liquid or sludge in an unlined lagoon). Individual and general permit coverage is available, and permits generally include discharge limits and require use of the best available control technologies to avoid or control discharges. Permits may impose monitoring and reporting requirements among their various permit conditions. Permit applications must demonstrate that the activity will not cause or contribute to a violation of an aquifer water quality standard.

Aquifer water quality standards function to protect Arizona's aquifers from contamination. These standards include numeric and narrative aquifer water quality standards. The numeric aquifer water quality standards apply to aquifers classified for drinking water protected use. The numeric aquifer water quality standard for arsenic is 0.05 mg/L (R18-11-406).

The narrative aquifer water quality standards provide:

- A discharge [to ground water] shall not cause a pollutant to be present in an aquifer classified for a drinking water protected use in a concentration which endangers human health.

- A discharge [to ground water] shall not cause or contribute to a violation of a water quality standard established for a navigable water of the state (note: this stan-

[17]The state currently designates waste that contains petroleum contaminated soils, waste from shredding motor vehicles, and certain asbestos wastes as special wastes.

dard focuses on the contamination of ground water that may influence surface water quality through some form of hydrological connection).

- A discharge [to ground water] shall not cause a pollutant to be present in an aquifer which impairs existing or reasonably foreseeable uses of water in an aquifer (R18-11-405).

No arsenic treatment residuals, whether liquid, solid, or semisolid, may be managed in a manner likely to cause a violation of either the numeric or narrative standards described above. Implementation is likely to involve imposition of specific design and operation requirements for new waste management units (e.g., lagoons), and monitoring for existing waste management units located such that they could impact drinking water sources. Note: the land application of biosolids in compliance with Arizona Administrative Code (AAC) 13, Article 15 is exempt from the aquifer permit program requirements.

Reuse (Land Application)

Arizona has in place a regulatory program for the land application of biosolids. Biosolids are defined to include sewage sludge, but exclude sludge generated during the treatment of either surface water or ground water used for drinking. Note: if sewage sludge is mixed with drinking water treatment residual sludge such a mixture may be subject to biosolids regulation.[18]

Under Arizona's biosolids program, persons applying bulk biosolids (over 1 metric ton) must register with the state and must follow specified management practices. In addition, Arizona has established site restriction, vector attraction reduction, off-site disposal, self-monitoring, recordkeeping, reporting, and enforcement requirements for biosolids application. Arizona also has developed the following restrictions on the concentrations of arsenic allowed in biosolids applied to the land:

- Biosolids being land applied may not contain arsenic levels that exceed 75.0 mg/kg.
- The monthly average arsenic concentration for exceptional quality biosolids applied to the land may not exceed 41.0 mg/kg.
- Annual arsenic loadings from bulk biosolids applied to the land may not exceed 2.0 kg/hectare.
- Cumulative arsenic loadings from bulk biosolids applied to the land may not exceed 41.0 kg/hectare (R18-13-1505).

[18]States may also use their biosolids or sewage sludge standards as default standards for DWTP sludge land application where no other standard exists to guide such residual management.

These standards are generally consistent with the federal sewage sludge land application standards established under 40 CFR Part 503. Arizona's biosolids program is not currently authorized by EPA pursuant to 40 CFR Part 501. Therefore, EPA remains responsible for permitting facilities managing sewage sludge. Any state requirements applicable to DWTP sludge would apply in addition to these federal requirements.

4.4 California

4.4.1 Liquid Residuals

Direct Discharge to Surface Waters

California is authorized to administer the NPDES program through its State Water Resource Control Board (SWRCB). Under the SWRCB, there are nine Regional Water Quality Control Boards (RWQCBs) which have the authority to adopt regional water quality control plans, prescribe waste discharge requirements, and perform other water quality control functions within their respective regions. These regional boards develop regional basin plans, which include designations for surface water beneficial uses to be protected, surface water quality objectives to protect those uses, and a program of implementation needed for achieving the objectives for all surface waters covered by the plans. These beneficial uses and their corresponding water quality objectives, combined with water quality criteria imposed under three statewide surface water quality plans, normally serve as California's water quality standards. In addition, regional basin plans can adopt specific water quality standards. However, due to litigation in California State court, most of the surface water quality standards imposed under the statewide plans have been struck down, and will be preempted by the proposed California Toxics Rule (CTR). This rule, when final, will establish water quality standards for much of California.

Table 4-6 presents the proposed numeric surface water quality standards under the CTR. Table 4-7 presents the numeric surface water quality standards that are imposed under the regional basin plans. Once the CTR requirements are final, they will establish the minimum standards until the state reissues its statewide surface water plans (i.e., regional basin plan requirements could be more stringent but not less).

Under the proposed CTR, no human health criteria were established. Rather, EPA suggested that state permitting authorities rely on existing narrative water quality criteria to establish effluent limits as necessary for arsenic.

These regional basin plans also include narrative water quality standards (described as narrative objectives). An example of a narrative standard, found in the Colorado River Basin Plan, is the following provision:

- No individual chemical or combination of chemicals shall be present in concentrations that adversely af-

Table 4-6. California Toxics Rule Proposed Surface Water Quality Standards[19]

Contaminant	Freshwater - Acute	Freshwater - Chronic	Saltwater - Acute	Saltwater - Chronic
Arsenic	0.34 mg/L	0.15 mg/L	0.069 mg/L	0.036 mg/L

Table 4-7. Arsenic Surface Water Quality Standards in California Regional Basin Plans

Rule or Regional Basin Plans	Domestic or Municipal Supply	Irrigation/Livestock	Marine
Central Coast	0.05 mg/L	0.1 mg/L 0.2 mg/L	0.008 mg/L - 6-month median 0.032 mg/L - daily maximum 0.080 mg/L - instantaneous maximum[1]
Colorado River Basin	0.05 mg/L	NA	NA
Central Valley	0.01 mg/L[2]	NA	NA
Los Angeles	0.05 mg/L[3]	NA	NA
Lahontan	0.05 mg/L[4]	NA	NA
North Coast (Water Quality Control Plan)	0.01 mg/L	NA	0.008 mg/L - 6-month median 0.032 mg/L - daily maximum 0.080 mg/L - instantaneous maximum
Santa Ana River Basin	0.05 mg/L	NA	NA
San Diego	0.05 mg/L	NA	NA
San Francisco	NA	NA	NA

[1]These standards are the same as those included in the SWRCB California Ocean Plan (1990).
[2]Applicable inland surface waters: Sacramento River from Keswick Dam to the I Street Bridge at City of Sacramento; American River from Folsom Dam to the Sacramento River; Folsom Lake; and the Sacramento-San Joaquin Delta.
[3]Numerous waters are listed on state's CWA § 303(d) list as impaired for arsenic, but their priority low.
[4]Bryant Creek Basin.

fect beneficial uses. There shall be no increase in hazardous chemical concentrations found in bottom sediments or aquatic life.

Any discharge of an arsenic residual that is deemed to violate any applicable narrative surface water quality standard would be prohibited or limited through NPDES permit conditions.

California also imposes general requirements that provide that surface and ground water must be protected from siltation and pollutants which may diminish water quality as required by the federal CWA, the California Porter-Cologne Act, county anti-siltation ordinances, the RWQCB or the SWRCB.

Indirect Discharges to a Sanitary Sewer System

California does not establish state limits for indirect discharges (i.e., discharges to public sanitary sewer systems and treatment works), but does establish general pretreatment requirements in its regional basin plans. These provisions describe when pretreatment requirements are applicable, the objectives of the pretreatment program (e.g., preventing the introduction into POTWs of pollutants which will interfere with or pass through the treatment works), the basic elements of a pretreatment program, and may identify which municipalities are required to develop and implement a pretreatment program. Local limits that address arsenic may be established by local sewer authorities or POTWs that administer pretreatment programs

[19]Acute limits may not be exceeded for 1 hour in any 3-year period. Chronic limits may not be exceeded for any 96-hour (4-day) period in any 3-year period.

where such limits are needed to achieve program objectives. For example, San Diego had a local limit for arsenic, but was allowed to delete this local limit based on a determination that there was no need to retain it. The Tijuana International Plant has a maximum allowable headworks loading (MAHL) of 0.27 lbs/Mgal based on sludge contamination.

Underground Injection

California administers their federal UIC program, except on Indian Lands (40 CFR § 147.250). Program requirements include filing, notification, operating, and testing requirements for underground injection projects, similar to federal requirements. Approval must be obtained from the state before any subsurface injection or disposal project can begin.

Land Disposal

California has adopted the federal municipal solid waste landfill criteria (40 CFR Part 258) and provides that the regional control boards must implement these requirements. Thus, California prohibits the disposal of bulk liquids in solid waste (i.e., Class III) landfills. At Class II landfills (designated wastes), California also provides that wastes that contain liquids in excess of the moisture holding capacity of the waste in the landfill must be managed in a surface impoundment or an equally protective waste management unit. California also has developed specific requirements applicable to the management of sewage sludge or water treatment sludge in Class III landfills. These provisions are discussed below under Solid/Sludge Residuals, Solid Waste Landfills.

4.4.2 Solid/Sludge Residuals

Solid Waste Landfills

Municipal solid waste is generally managed in Class III landfills. As noted above, California has adopted the federal municipal solid waste landfill criteria (40 CFR Part 258) and provides that the regional control boards must implement these requirements (the 40 CFR Part 258 criteria are also deemed to supplement state requirements). These regional boards regulate all the active waste management units. Waste management units must be sited in an area where the depth to ground water is very great or where natural geologic features will provide containment. A Class III waste management unit must also have a clay or synthetic liner with a leachate collection and removal system, if there is a possibility that ground water could be impacted by leakage from the unit. Ground water monitoring is required for solid waste landfills, including monitoring for arsenic. Where detection monitoring reveals an increase in arsenic levels, evaluation and corrective action monitoring may be required.

California State regulations explicitly provide that water treatment sludge (i.e., DWTP sludge) may be discharged at a Class III landfill under the following conditions, unless the state determines that the waste must be managed as hazardous waste:

- The landfill is equipped with a leachate collection and removal system.
- The sludge contains at least 15 percent solids.
- A minimum solids-to-liquid ratio of 5:1 by weight shall be maintained to ensure that the co-disposal will not exceed the initial moisture-holding capacity of the non-hazardous solid waste. The actual ratio required by the regional water quality control boards is to be based on site-specific conditions.

Hazardous Waste Landfills

California is authorized to implement the federal RCRA program and provides that hazardous waste must be disposed in Class I landfills. California incorporates the federal hazardous waste regulations in conjunction with some of its own regulatory requirements. California imposes the same toxicity characteristic standard as imposed under federal regulations (i.e., 5.0 mg/L) (based on the TCLP extraction test, which is the extraction test specified under federal regulations). In addition, California has developed its own waste extraction test (WET). Based on the WET test, California also defines as hazardous waste those wastes that have an arsenic soluble limit threshold concentration of 5.0 mg/L, and those wastes that have a total arsenic threshold limit concentration of 500 mg/kg. Finally, California has identified certain specific hazardous wastes which the state subjects to land disposal restrictions. As of January 1, 1984, liquid hazardous wastes, including free liquids associated with any solid or sludge, containing arsenic and/or arsenic compounds (as As) in concentrations greater than or equal to 500 mg/L are prohibited from land disposal, even in hazardous waste land disposal units.

Lagoons

California regulations provide that owners or operators of facilities that treat, store, or dispose of waste in a surface impoundment, waste pile, landfill, or land treatment unit must comply with state regulations for detecting, characterizing, and responding to releases of pollutants to ground water, surface water, or the unsaturated zone. For surface impoundments, these requirements are implemented through the development of a site-specific list of constituents of concern, relevant standards for those constituents, and a plan for monitoring for any exceedance of those standards. Regional basin plans may impose more specific requirements with regard to protecting ground water quality (e.g., the Lahontan Regional Basin Plan imposes specific ground water protection and management provisions). California also has regulations that require that Class II

surface impoundments must have a liner system designed in accordance with state regulations.

Reuse (Land Application)

California has not developed a state sludge program, but provides that the SWRCB or a regional board, upon receipt of applications for waste discharge requirements for discharges of dewatered, treated, or chemically fixed sewage sludge and other biological solids, must prescribe general waste discharge requirements for that sludge and those other solids. The general waste discharge requirements must include minimum standards for agronomic applications of sewage sludge and other biological solids and the use of that sludge and those other solids as a soil amendment or fertilizer in agriculture, forestry, and surface mining reclamation. The requirements must include provisions to mitigate significant environmental impacts, potential soil erosion, odors, the degradation of surface water quality or fish or wildlife habitat, the accidental release of hazardous substances, and any potential hazard to the public health or safety. In developing these requirements, the relevant board must consult with the State Air Resources Board, the Department of Food and Agriculture, and the California Integrated Waste Management Board. California is not authorized to implement the NPDES Part 503 sludge program. Thus, EPA Region 9 implements these requirements in California.

California also has regulations that address the management of waste in land treatment units (LTUs).[20] Dischargers who treat or dispose of wastes in LTUs must demonstrate, prior to application of the waste, that waste can be completely degraded, transformed, or immobilized in the treatment zone (through use of a test plot followed by sampling during full scale operation). The regional water quality control boards specify in waste discharge requirements (WDRs) the elements of the land treatment program including the dimensions of the treatment zone. The maximum depth of the treatment zone shall not exceed 5 feet from the initial soil surface.

4.5 Maine

4.5.1 Liquid Residuals

Direct Discharge to Surface Water

Maine is not currently authorized to implement the federal NPDES program. EPA Region 1 administers the NPDES program in Maine. EPA Region 1 develops all NPDES permits for direct discharges to surface waters within Maine (including the requisite technology-based and water quality-based effluent limits). When EPA develops the NPDES permit, Maine must certify that the permit will meet state surface water quality standards before the permit may be issued. In addition, direct discharge facilities must also obtain discharge permits from the state (such permits are in addition to federal NPDES permits). Such state permits focus on protecting the quality of Maine surface waters (as reflected in Maine's surface water classifications).

Maine adopts the federal water quality criteria as its numeric standards for the maximum arsenic levels deemed to be acceptable in surface waters.[21] These levels, which are summarized in Table 4-8, vary based on the character of the waterbody as well as on the acute or chronic nature of the water quality impact.[22] Each fresh and salt water surface water within Maine should meet the corresponding arsenic limit specified. To ensure this occurs, each NPDES permit issued for a direct discharge to surface waters in Maine must ensure that the effluent discharged by that facility does not cause a violation of the corresponding arsenic standard at the point of discharge or in a mixing zone in reasonable proximity to the discharge. Typically, facilities employ effluent treatment to achieve compliance with NPDES permit limits.

Maine also requires that direct discharge facilities obtain a discharge permit from the state. These state permits are intended to ensure, through limiting discharges to the assimilative capacity of the waterbody, that streams and lakes can meet their use classifications (classifications exist for freshwaters and marine/estuarine waters, and include four freshwater and three saltwater classifications based on existing water quality and the ability of the water to support distinct uses). Any standards or conditions imposed under these state permits appear to be developed on a case-by-case basis.

In addition to the numeric surface water quality standards and Maine permit requirements, Maine also imposes narrative surface water quality standards that provide that:

- Except as naturally occurs, surface waters must be free of pollutants in concentrations which impart toxicity and cause those waters to be unsuitable for the existing and designated uses of the waterbody.

Any discharge of an arsenic residual that is deemed to violate this narrative standard would be prohibited or limited through NPDES permit conditions.

Indirect Discharge to a Sanitary Sewer System

Maine does not establish state limits for indirect discharges (i.e., discharges to public sanitary sewer systems and treat-

[20]A waste management unit at which liquid and solid waste are discharged to, or incorporated into, soil for degradation, transformation, or immobilization within the treatment zone.

[21]Maine accepts background exceedances from such criteria.

[22]Maine allows for the adoption of alternative statewide water quality criteria provided such criteria are as protective of the designated uses assigned to the waters within the state as the EPA criteria.

Table 4-8. Maine's Numeric Arsenic Surface Water Quality Standards[23]

Contaminant	Freshwater - Acute	Freshwater - Chronic	Saltwater - Acute	Saltwater - Chronic
Arsenic (total)	0.34 mg/L	0.15 mg/L	0.069 mg/L	0.036 mg/L

ment works). Although local limits may be established by local sewer authorities or POTWs that administer pretreatment programs, no such limits currently exist. Indirect discharges remain subject to the national general pretreatment standards (e.g., restrictions designed to prevent the introduction into POTWs of pollutants which will interfere with or pass through the treatment works).

Underground Injection

Maine administers the UIC program within the state, except for on Indian lands. EPA Region 1 administers the program on Indian lands (see 40 CFR § 147 Subpart U). Maine regulations provide that Class I wells (deep well injection), Class II wells (injection of fluids associated with oil and gas production), and Class III wells (injection of fluids associated with solution mining of minerals) are regulated in a manner consistent with federal requirements (Maine adopts the applicable federal regulations by reference). New Class IV wells (injection of hazardous waste or radioactive waste into or above water-bearing formation) are prohibited and those in existence are required to be closed. All other types of discharge by well injection are subject to licensing under 38 MRSA, § 413(1-B) and must be consistent with other applicable statutes and regulations administered by the state. Any subsurface discharge into or through a Class V well that would cause or allow the movement of fluid into an underground source of drinking water that may result in a violation of any Maine Primary Drinking Water Standard, or which may otherwise adversely affect human health, is prohibited.

Land Disposal

Maine regulations provide that landfills may not accept liquid wastes for disposal.

4.5.2 Solid/Sludge Residuals

Solid Waste Landfill

Maine imposes landfill operating requirements for municipal solid waste disposal facilities. A component of the state landfill operating requirements is proper leachate management. Landfill operators must conduct quarterly monitoring of leachate leak detection systems and leachate quality. In addition, landfills must conduct semiannual baseline monitoring for arsenic (and other compounds) in ground water and surface water, as well as compliance monitoring (to characterize contamination) where there has been a significant increase in arsenic levels in ground water. Corrective action is required where contaminants (including arsenic) exceed target levels, which are determined on a site-specific basis.

Hazardous Waste Landfill

Maine is authorized to implement the federal RCRA program. As such, Maine imposes the same toxicity characteristic standard as is imposed under federal regulations (i.e., 5.0 mg/L). With regard to some provisions, Maine imposes requirements that are more stringent than the federal requirements. Most notably, Maine requires that anyone who generates more than 100 kilograms of hazardous waste (per month) must manage that waste in conformance with Maine hazardous waste rules (i.e., Maine does not reduce these requirements for small quantity generators). In addition, Maine provides that hazardous waste generators that generate less than 100 kilograms of waste (per month) must comply with manifest, transport, labeling, packaging, and disposal (requires use of a licensed facility) requirements.

Lagoons

Maine does not explicitly regulate the use of lagoons to manage nonhazardous wastes (such requirements are likely determined on a site-specific basis). Maine does impose requirements applicable to the discontinued use of lagoons. These provisions include notice, reclamation, and discharge requirements. In addition, Maine has two ground water quality classifications, GW-A and GW-B. Class GW-A is defined as the highest classification and must be of such quality that it can be used for public water supplies. These waters must be free of radioactive matter or any matter that imparts color, turbidity, taste or odor which would impair usage of these waters, other than that occurring from natural phenomena. Class GW-B is defined as suitable for all usages other than public water supplies. Lagoons or surface impoundments cannot cause violations of these classifications.

Hazardous waste surface impoundments must meet the federally applicable design standards (i.e., 40 CFR Part 264) as well as following performance standards: no impounded hazardous waste or constituent or derivative may

[23]Acute limits may not be exceeded for 1 hour in any 3-year period. Chronic limits may not be exceeded for any 96-hour (4-day) period in any 3-year period.

appear in ground or surface water at a concentration above background level or above current Maine public health drinking water standards (including either the maximum exposure guidelines, or standards for aquatic toxicity, whichever is most stringent); a leachate detection, collection, and removal system must be installed; and air, ground water, and surface water monitoring must be conducted in accordance with state requirements.

Reuse (Land Application)

Maine regulates the land application and composting of municipal and industrial sludge and residuals. Land application of sludge and residuals is prohibited unless an approval has been obtained from the Maine Department of Environmental Protection. Sludge is defined as the semisolid or liquid residual generated from a municipal, commercial, or industrial wastewater treatment plant. Land application requirements are based on crop (or soil) requirements (i.e., utilization), the characteristics of the soil at the application site, and sludge and residual quality. Residuals, such as municipal wastewater treatment plant sludge, must undergo initial chemical analysis prior to submittal of an application for land spreading. Arsenic is not one of the minimum parameters that must be measured during the initial chemical analysis of sludge; however, it can be added based on an assessment of the sludge or residual. Nor is arsenic included in the maximum concentration standards established for the land application of sludges and residuals. Land application of sludge cannot pollute any waters of the state or result in violation of Maine's primary and secondary drinking water standards. Land application cannot occur over significant ground water aquifers or primary sand and gravel recharge areas. Maine's program for the land application of sewage sludge is not currently authorized by EPA pursuant to 40 CFR Part 501. Therefore, EPA remains responsible for permitting facilities managing sewage sludge.

4.6 Nebraska

4.6.1 Liquid Residuals

Direct Discharge to Surface Waters

Nebraska is authorized to implement all aspects of the NPDES program except for the sewage sludge program. Nebraska has developed designated use numeric water-quality standards that limit the amount of arsenic that may be discharged to surface waters.[24] These standards are presented in Table 4-9. Each surface water in Nebraska that is designated for each of the designated uses[25] described in Table 4-9 must meet the corresponding arsenic limit specified (discharges that cause a violation are prohibited). Thus, each NPDES permit issued to a DWTP that directly discharges pollutants to surface waters in Nebraska must ensure that the effluent discharged by that facility does not cause a violation of the corresponding arsenic standard.

In addition to these numeric water quality standards, Nebraska also imposes narrative water quality standards applicable to surface waters in the state. Under these standards:

- Surface waters shall be free from toxic substances, alone or in combination with other substances, in concentrations that result in acute or chronic toxicity to aquatic life.
- Toxic substances shall not be present in concentrations that result in objectionable tastes or significant bioaccumulation or biomagnification in aquatic organisms which renders them unsuitable or unsafe for consumption.
- Wastes or toxic substances introduced directly or indirectly into public drinking water supplies by human activity in concentrations that would degrade the use (i.e., would produce undesirable physiological effects in humans) shall not be allowed.

Any discharge of an arsenic residual that is deemed to violate these narrative standards would be prohibited or limited through NPDES permit conditions.

Nebraska also establishes ground water quality standards and use classifications, which may be implemented through various environmental programs or applied directly. These are discussed under Solid/Sludge Residuals, Lagoons.

Indirect Discharge to a Sanitary Sewer System

Nebraska does not establish state limits for indirect discharges to surface waters (i.e., discharges to public sewer systems and treatment works). Nor have any local limits to arsenic been developed to date. Local limits may be established by local sewer authorities or POTWs that administer pretreatment programs, and some such limits are under development. Nebraska regulations provide that no pretreatment permit may be issued for any indirect discharge from an industrial user (i.e., non-domestic discharger of pollutants to a POTW) which does not assure compliance with applicable pretreatment standards or requirements and which will otherwise interfere with, pass through, or be incompatible with a POTW's treatment processes, including contamination of sewage sludge. Thus, indirect discharges of liquid residuals that cause the sew-

[24]Standards are developed by the Water Quality Division of the Nebraska Department of Environmental Quality.

[25]Designated uses for the state's waterbodies are listed in Title 117, Chapter 6. All streams are assigned designated uses of aquatic life, agricultural water supply, and aesthetics. Other designations (i.e., state resource waters, recreation, drinking water supply (after treatment), and industrial water supply) apply to selected segments only.

Table 4-9. Nebraska's Designated Use Numeric Arsenic Surface Water Quality Standards[26]

Contaminant	Protection of Aquatic Life/ Fish Consumption - Acute	Protection of Aquatic Life/ Fish Consumption - Chronic	Public Water Supply
Arsenic III	0.36 mg/L	0.19 mg/L	0.05 mg/L (total)
Arsenic V	0.85 mg/L	0.048 mg/L	

age sludge generated by the receiving POTW to exceed the applicable standards are effectively prohibited.

Underground Injection

Nebraska administers the UIC program within the state, except for on Indian lands. EPA Region 7 administers the program on Indian lands (see 40 CFR § 147 Subpart CC). Consistent with the federal UIC requirements, Nebraska prohibits underground injection that is not conducted pursuant to a permit, and prohibits activity that "allows the movement of fluid containing any contaminant into underground sources of drinking water, if the presence of that contaminant may cause a violation of any primary drinking water regulation or the Nebraska Ground Water Protection Standards, or may otherwise adversely affect the health of persons" (122-2-001; 122-4-001). Nebraska UIC provisions include construction, mechanical integrity, operating, monitoring, and reporting requirements, as well as permitting procedures. Thus, activities that would cause the violation of any primary drinking water regulation, or violation of Nebraska ground water quality standards, are prohibited.

Nebraska also has a septic tank permitting program. Under this program, septic tank systems must obtain construction and operating permits, although standard systems for dwellings (i.e., residences) that meet basic setback and other criteria are authorized by rule (no separate permit is required) provided such systems conform to Nebraska regulations and do not endanger human health or cause pollution. Nebraska regulations prohibit surface water discharges from a septic tank or its soil absorption system, and require that the state, in implementing these regulations, must protect the quality of surface and ground waters in the immediate vicinity of any proposed septic tank system (Title 124).

Land Disposal

Nebraska prohibits the disposal of bulk or noncontainerized liquid wastes in a solid waste disposal area unless the waste is household waste other than septic waste; the waste is leachate or gas condensate derived from the solid waste disposal area and the solid waste disposal area is designed with a composite liner and leachate collection system; or the special waste has been approved for disposal. In addition, under Nebraska regulations, containers holding liquid waste may not be placed in a solid waste disposal area unless the container is a small container similar in size to that normally found in household waste; the container is designed to hold liquids for use other than storage; or the waste is household waste (Title 132-3-004). Nebraska also will consider proposals to apply treated wastewater for irrigation purposes (Title 121-11). The state has established guidelines for such projects, which must be approved on a case-by-case basis. The guidelines for wastewater irrigation proposals include a recommendation that arsenic levels in any such project not exceed 0.1 mg/L.

4.6.2 Solid/Sludge Residuals

Solid Waste Landfill

Nebraska requires that solid waste management facilities must hold a permit issued by the state (Title 132-2-001). Such disposal facilities must be designed and operated at all times so as to not constitute a hazard, or a threat to human health or the environment. Nebraska requires that no solid waste disposal area may cause a discharge of pollutants into waters of the state, including wetlands, that violates any Nebraska NPDES requirement. Nor can such facilities cause the discharge of a nonpoint source of pollution to waters of the state that violates any requirement of an area-wide or statewide water quality management plan that has been approved under section 208 or 319 of the CWA.

For solid waste landfills meeting the standard Nebraska landfill liner requirements, ground water protection is not required under landfill regulations. However, Nebraska's ground water protection standards do apply to landfill management of waste and, thus, solid waste landfills may not cause the ground water arsenic level to exceed 0.05 mg/L. In addition, Nebraska establishes the same ground water standard for arsenic (0.05 mg/L) where a landfill is using an alternative liner at a new or expanding landfill. Where an alternative liner is used, Nebraska provides that the facility must ensure that the concentration of arsenic will not exceed 0.05 mg/L in the uppermost aquifer at the relevant point of compliance (i.e., no more than one hundred and fifty (150) meters from the solid waste disposal area unit boundary and shall be located on land owned by the owner of the solid waste disposal area) (Title 132-3).

[26]Acute limits may not be exceeded for 1 hour in any 3-year period. Chronic limits may not be exceeded for any 96-hour (4-day) period in any 3-year period.

Nebraska also has established regulations governing the management of special waste, which is defined as including wastes that require special management to ensure protection of public health, safety, or the environment due to the physical, chemical, or biological properties of the waste (designations are made on a case-by-case basis). No person may dispose of a special waste at any place except a permitted facility which is operated and maintained in compliance with Nebraska regulations and authorizations, and which has received written approval from the state for the disposal of the specific special wastes (Title 132-13-001). In addition, where special waste is being land applied on a regular basis for treatment or disposal, construction and design plans must also include specific measures that will be taken to protect ground water quality.

Hazardous Waste Landfill

Nebraska's hazardous waste rules generally mirror the federal regulations. For example, Nebraska adopts the federal toxicity characteristic of 5.0 mg/L for arsenic (Title 128-3-10). Nebraska also adopts the basic federal requirements applicable to hazardous waste generators, transporters, and TSDFs, as well as for land disposal restriction standards.

Lagoons

Nebraska imposes regulations applicable to waste lagoons (Title 125), as well as ground water protection standards (Title 118). Nebraska defines waste lagoons as units comprised of a shallow body of water in which organic wastes are decomposed by bacteria in the presence of free oxygen. Such units must be designed for complete retention of the waste. Nebraska also imposes location, run-on, access, minimum location area (3 acres), and closure requirements.

With regard to ground water protection standards, Nebraska imposes both numeric and narrative ground water quality standards. For arsenic, Nebraska provides that substances introduced by human activity shall not be allowed to enter ground water if such substances would cause the ground water arsenic level to exceed 0.05 mg/L. The ground water quality standards are intended to be the foundation for other regulatory programs that may impact ground water. As such these standards must be implemented in conjunction with other regulatory programs if such programs could impact ground water, and may be implemented alone as the basis for remedial action of ground water contamination if other regulatory programs do not exist. These standards apply to all ground waters within Nebraska that are, or have the potential to be, used as a public or private drinking water source.[27]

Nebraska also imposes narrative ground water standards that function to protect ground water quality (Title 118-4-001). The following narrative standards apply to ground waters in Nebraska:

- Wastes, toxic substances, or any other pollutant (alone or in combination with other pollutants) introduced directly or indirectly by human activity shall not be allowed to enter ground water:

  If beneficial uses of ground water would be impaired or public health and welfare would be threatened.

  If beneficial uses of hydrologically connected ground waters or assigned uses of surface waters would be impaired.

- Any pollutant introduced directly or indirectly by human activity that would impair beneficial uses of ground water due to unacceptable color, corrosivity, odor, or any other aesthetic characteristic shall not be allowed.

Nebraska also provides for the regulation of potential direct (i.e., point source) discharges of pollutants that may impact ground water quality. Nebraska rules provide that in determining regulatory requirements that may be placed on potential point sources, the state must consider the ground water classification, vulnerability of the ground water to pollution, beneficial uses of ground water, characteristics of the potential point source, technical and socioeconomic factors, and other site-specific factors, as necessary (Title 118-09-001). These requirements apply to all potential point sources for which the Nebraska Department of Environmental Quality has regulatory authority, including but not limited to NPDES, UIC, POTWs, septic tanks, lagoons, pretreatment facilities, hazardous waste TSDFs, and licensed landfills. Remedial action is required if Nebraska ground water quality standards are violated due to point source discharges.

Reuse (Land Application)

Nebraska has both sludge and sewage sludge regulations. Nebraska defines the term "sludge" as including (but not limited to) solid, semisolid, and liquid wastes generated from water supply treatment plants (Title 126-1-041). Nebraska requires all persons who land apply sludge or manage wastewater treatment facility grit and screenings to obtain a waste management permit. Such permits must establish compliance with local, state, and federal requirements, duration, compliance schedule, and reporting and recordkeeping requirements, as well as require commencement of operations within two years after issuance of the permit.

Nebraska also has in place regulations that address sewage sludge management. These rules, which require a permit where sewage sludge disposal may result in the

[27]State ground water classifications GA and GB.

pollution of waters within Nebraska, do not apply to drinking water treatment residuals unless such residuals are mixed with sewage sludge (Title 119-09). Nebraska's sewage sludge program is not authorized pursuant to 40 CFR Part 501.

4.7 New Mexico

4.7.1 Liquid Residuals

Direct Discharge to Surface Water

New Mexico is not currently authorized to implement the federal NPDES program. EPA Region 6 administers the NPDES program in New Mexico, developing and issuing all of the NPDES permits for direct dischargers within New Mexico (including the requisite technology-based and water quality-based effluent limits). When EPA develops the NPDES permit, New Mexico must certify that the permit will meet state water quality standards before the permit may be issued.

New Mexico has developed numeric arsenic water-quality standards applicable to surface waters.[28] These standards are presented in Table 4.10. These surface water quality standards vary based on the designated use of each water body within New Mexico (e.g., domestic water supply, irrigation, livestock watering).[29] Each surface water that is assigned each of the designated uses described in Table 4-10 should meet the corresponding arsenic limit specified. To ensure this occurs, each NPDES permit issued for a direct discharge to surface waters within New Mexico must ensure that the effluent discharged by that facility does not cause a violation of the corresponding arsenic standard at the point of discharge or in a mixing zone in reasonable proximity to the discharge. Typically, facilities employ effluent treatment to achieve compliance with NPDES permit limits.

In addition to these numeric surface water quality standards, New Mexico also imposes a narrative water quality standard applicable to waters used as a domestic water source. Under this standard:

- Waters designated for use as domestic water supplies shall not contain substances in concentrations that create a lifetime cancer risk of more than one cancer per 100,000 exposed persons (20 NMAC 6.1.3101).

Any discharge of an arsenic residual that is deemed to violate this narrative standard would be prohibited or limited through NPDES permit conditions.

New Mexico also establishes water quality standards for ground water with 10,000 mg/L or less TDS. These are discussed under management of Solid/Sludge Residuals, Lagoons.

Indirect Discharge to a Sanitary Sewer

New Mexico does not establish state limits for indirect discharges to surface waters (i.e., discharges to public sewer systems and treatment works). Local limits may be established by local sewer authorities or POTWs that administer pretreatment programs. For example, the following approved local limits for arsenic are imposed by various POTWs within New Mexico:

- Albuquerque - 0.051 mg/L
- Farmington - 1.07 mg/L (and proposed limit of 6.60 mg/L)
- Las Cruces - 0.66 mg/L (and proposed limit of 0.06 mg/L)
- Santa Fe - 2.74 mg/L

In addition, indirect discharges remain subject to the national general pretreatment standards (e.g., restrictions designed to prevent the introduction into POTWs of pollutants which will interfere with or pass through the treatment works).

New Mexico does have a regulatory program that addresses the land application of sewage sludge (see discussion under Solid/Sludge Residuals, Reuse). Therefore, if the indirect discharge of a liquid arsenic treatment residual causes the sewage sludge generated by the receiving POTW to exceed the applicable sewage sludge standard for arsenic, the POTW is likely to impose restrictions on the indirect discharge of arsenic.

Underground Injection

New Mexico administers the UIC program within the state, except for on Indian lands (see 40 CFR § 147 Subpart GG). New Mexico provides that an effluent disposal well may only be used pursuant to an approved discharge plan (20 NMAC 6.2.5101). In addition, under New Mexico rules, no effluent disposal well, which allows for movement of fluids into ground water having 10,000 mg/L or less TDS, may be approved, except where the aquifer has been "designated" (i.e., approved) under NMAC 6.2.5103 for the injection of contaminants into the ground water. New Mexico authorizes any person to petition the state to consider such injection. Where New Mexico approves such injection, it also imposes a water quality standard applicable to ground water that limits arsenic levels in ground water having 10,000 mg/L or less TDS to 0.1 mg/L.

[28]Standards are developed by the Water and Waste Management Division within the New Mexico Department of Environment.

[29]Designated uses of New Mexico waterbodies are listed in 20 NMAC 6.1.2100-3099.

Table 4-10. New Mexico's Designated Use Numeric Arsenic Surface Water Quality Standards

Domestic Water Supply	Irrigation	Livestock Watering
0.05 mg/L (dissolved)	0.10 mg/L (dissolved)	0.2 mg/L (dissolved)

The New Mexico UIC program imposes technical criteria and performance standards that address the following areas: the area of review (i.e., potentially impacted), corrective action, mechanical integrity, construction requirements, operating requirements, monitoring requirements, reporting requirements, plugging and abandonment of wells, providing information, and notification regarding specified actions (20 NMAC 6.2.5200).

Land Disposal

New Mexico prohibits the disposal of bulk or noncontainerized liquid waste[30] at any landfill except when the liquid waste is household waste other than septic waste; or, the container holding the liquid waste is a small container similar in size to that normally found in household waste and the container is designed to hold liquids for use other than storage, and the waste is household waste. New Mexico requires that some wastes, such as municipal wastewater sludge, contain no free liquids.

New Mexico also has established requirements that address on-site residential and domestic liquid waste disposal through the use of seepage pits, drainfields, evapotranspiration systems, sand mounds, sand filters, and approved surface applications. These requirements only apply to liquid waste systems that receive two thousand (2,000) gallons or less of liquid waste per day, and that do not generate discharges that require a UIC Discharge Plan or a NPDES Permit. Moreover, they do not apply to commercial process wastewaters and, therefore, do not impact drinking water residual management (20 NMAC 7.3.102-301).

4.7.2 Solid/Sludge Residuals

Solid Waste Landfill

New Mexico defines DWTP residuals as a solid waste (but not a sludge) and imposes permit requirements for facilities that land dispose municipal, special, and construction and demolition wastes. All landfills (except those that qualify for a small landfill exemption) must conduct ground water monitoring, which consists of detection monitoring, assessment monitoring, and corrective action, as necessary. Landfills must conduct detection monitoring, including monitoring for arsenic. If detection monitoring indicates ground water arsenic levels have reached 50 percent of the applicable ground water standard for arsenic (i.e., 0.025 mg/L)[31] at the waste unit boundary, assessment monitoring must be initiated. If monitoring indicates that the arsenic level exceeds the corrective action level, which is 75 percent of the New Mexico landfill ground water standard for arsenic (i.e., 0.0375 mg/L) then corrective action must be undertaken.

New Mexico also imposes restrictions on the landfill disposal of special waste, which is defined as solid wastes that have unique handling, transportation, or disposal requirements, to assure protection of the environment and the public health, welfare and safety. Such wastes explicitly include treated formerly characteristic hazardous wastes (TFCH); packinghouse and killing plant offal; asbestos waste; ash; infectious waste; sludge (except compost which meets the provisions of 40 CFR Part 503); industrial solid waste; spill of a chemical substance or commercial product; dry chemicals, which, when wetted, become characteristically hazardous; and petroleum contaminated soils.

New Mexico imposes minimum test parameters for landfill disposal of municipal wastewater sludge (which does not include DWTP residuals) (20 NMAC 9.1.1109). These provisions require that municipal wastewater sludge be tested for the following parameters:

- No free liquids as determined by Paint Filter Liquids Test (EPA Test Method 9095)
- Percent solids
- pH: 2.0 to 12.5 (acceptable range)
- PCBs: No detectable concentration
- TCLP (EPA Test Method 1311) - the maximum allowable concentration of arsenic is 5.0 mg/L

Note that these requirements only impact arsenic residual management if such residuals are mixed with wastewater sludge. Under New Mexico rules, owners and operators of landfills dedicated solely for the disposal of sludge derived from the treatment of domestic sewage must comply with the requirements of 40 CFR Part 503.

Finally, New Mexico allows landfills to utilize alternative liner materials provided such materials are equivalent to the synthetic or natural materials specified in the state's regulations. As part of a liner equivalency demonstration, New Mexico has specified that the maximum allowable concentration of arsenic at the point of compliance is 0.05 mg/L (20 NMAC 9.1.1110).

[30]The term "liquid waste" is defined as any waste material that is determined to contain free liquids, defined by the Paint Filter Test, described in "Test Methods for Evaluating Solid Waste" contained in Section 1101.

[31]New Mexico identifies 0.05 mg/L as the landfill ground water standard for arsenic.

Hazardous Waste Landfill

New Mexico largely adopts the federal hazardous waste regulations by reference. New Mexico adopts the federal toxicity characteristic (5.0 mg/L), the federal quantity restrictions, and the federal standards for TSDFs, including the federal requirements for hazardous waste landfills.[32]

Lagoons

New Mexico imposes water quality standards applicable to ground water, which could be impacted by management of arsenic treatment residuals in lagoons. Under New Mexico State regulations, ground water with 10,000 mg/L TDS or less may not exceed 0.1 mg/L arsenic. With limited exception, no person may cause or allow effluent or leachate to discharge so that it may move directly or indirectly into ground water unless he or she is discharging pursuant to a discharge plan approved by the state. When a discharge plan has been approved, discharges must be consistent with the terms and conditions of the plan (20 NMAC 6.2.3104). New Mexico also requires monitoring of ground water around disposal sites that could potentially threaten this resource (20 NMAC 6.2.3107).

Reuse (Land Application)

Under New Mexico regulations, the land application of sludge derived from the treatment of domestic sewage[33] must comply with the federal regulations under 40 CFR, Part 503;[34] and any additional requirements imposed by the state, such as, but not limited to, analytical testing frequencies and parameters, siting criteria, and loading rates. These restrictions only apply to arsenic drinking water treatment residuals if those residuals were mixed with sewage sludge and then land applied.

New Mexico's sewage sludge program is not currently authorized by EPA pursuant to 40 CFR Part 501. However, New Mexico's rules incorporate by reference the federal sludge land application standards (i.e., 40 CFR Part 503).

4.8 Nevada

Nevada imposes some specific regulations that address waste management for drinking water treatment facilities. Under these regulations:

- A supplier of water must provide for the proper disposal of waste from a treatment facility, including sanitary waste, sludge, waste from any laboratory, waste from drainage within the facility and waste resulting from backwashing.
- The discharge of any waste from a treatment facility must comply with any requirements imposed by the Division of Environmental Protection.
- A supplier of water must locate facilities for the disposal of waste from a treatment facility in such a manner as to avoid any potential contamination of the environment, including any supply of water.

These requirements apply in addition to, and in conjunction with, the specific regulatory provisions discussed below.

4.8.1 Liquid Residuals

Direct Discharges to Surface Waters

Nevada is authorized to administer the NPDES program except for the pretreatment and sludge components of the program. Nevada develops all NPDES permits for direct discharges to surface waters within the state (including the requisite technology-based and water quality-based effluent limits). Nevada has developed numeric surface water quality standards for arsenic.[35] These standards are presented in Table 4-11. Each surface water in Nevada that is designated for each of the specific uses described in Table 4-11 should meet the corresponding arsenic limit specified. Thus, each NPDES permit issued for a direct discharge to surface waters in Nevada must ensure that the effluent discharged by that facility does not cause a violation of the corresponding arsenic standard.

In addition to these numeric surface water quality standards, Nevada also imposes narrative water quality standards that provide:

- [Surface] waters must be free from substances attributable to domestic or industrial waste or other controllable sources that will settle to form sludge or bottom deposits in amounts sufficient to be unsightly, putrescent or odorous or in amounts sufficient to interfere with any beneficial use of the water.
- [Surface] waters must be free from high temperature, biocides, organisms pathogenic to human beings, toxic, corrosive or other deleterious substances attrib-

[32]New Mexico does not adopt §264.301(1)[sic]. Section 264.301 addresses the design and operating requirements for hazardous waste landfills. Section 264.301(a)(1) requires that landfills (except existing portions, new landfills, and lateral expansions) must have a liner that prevents migration during the active life of the unit. New landfills and lateral expansions must have double liners.

[33]Facilities also must meet the definition of a solid waste facility. Such facilities include public or private facilities used for processing, transformation, recycling or disposal of solid waste, including landfill disposal facilities, transfer stations, resource recovery facilities, incinerators and other similar facilities not specified. Solid waste facility does not include facilities that handle less than 25 tons per day dry weight.

[34]Under Part 503, no land application of sewage sludge may cause the arsenic level to exceed 75 mg/kg. In addition, where sewage sludge is applied in bulk, cumulative arsenic loading may not exceed 41 kg/hectare or 41 mg/kg monthly average. (40 CFR § 503.13.)

[35]Standards are developed by the Nevada Department of Conservation and Natural Resources, Environmental Protection Division, Water Pollution Section.

Table 4-11. Nevada's Designated Use Numeric Arsenic Surface Water Quality Standards

Municipal or Aquatic Life Domestic Water Supply	Irrigation	Livestock Watering
0.05 mg/L (dissolved)	0.10 mg/L (dissolved)	0.2 mg/L (dissolved)

utable to domestic or industrial waste or other controllable sources at levels or combinations sufficient to be toxic to human, animal, plant or aquatic life or in amounts sufficient to interfere with any beneficial use of the water.

- Waste from municipal, industrial or other controllable sources containing arsenic, barium, boron, cadmium, chromium, cyanide, fluoride, lead, selenium, silver, copper, and zinc that are reasonably amenable to treatment or control must not be discharged untreated or uncontrolled into the waters of Nevada [the state also prohibits uncontrolled discharge into the Colorado River System]. In addition, the limits for concentrations of the chemical constituents must provide water quality consistent with the mandatory requirements of the 1962 Public Health Service Drinking Water Standards.

Nevada also has narrative standards applicable to beneficial uses. For example, one such standard provides that with regard to aquatic life:

- Surface water must be suitable as a habitat for fish and other aquatic life existing in a body of water.

Any discharge of an arsenic residual that is deemed to violate any of these narrative standards would be prohibited or limited through NPDES permit conditions.

Indirect Discharge to a Sanitary Sewer System

Although Nevada is not authorized to implement the pretreatment program, the state shares responsibility for the management of this program with EPA Region 9. Local limits may be established by local sewer authorities or POTWs that administer pretreatment programs. In addition, indirect discharges remain subject to the national general pretreatment standards (e.g., restrictions designed to prevent the introduction into POTWs of pollutants which will interfere with or pass through the treatment works).

Underground Injection

Nevada administers the UIC program within the state, except for on Indian lands. EPA Region 9 administers the program on Indian lands (see 40 CFR § 147 Subpart DD). Consistent with the federal UIC requirements, Nevada prohibits underground injection that is not conducted pursuant to a permit, and provides that applicants for a permit to inject fluids must satisfy the State Director that the underground injection will not endanger any source of drinking water. In addition, Nevada regulations provide that no person may inject a fluid which degrades the physical, chemical, or biological quality of the aquifer into which the fluid is injected (unless the State Director exempts the aquifer from this requirement, and EPA Administrator does not disapprove the exemption). Nevada UIC provisions include construction, operating, monitoring, and abandonment requirements, as well as permitting procedures.[36]

Land Disposal

An owner or operator of a Class I (municipal solid waste) landfill site must restrict the types and amounts of liquids disposed of at that facility except as permitted by the solid waste management authority. Bulk or noncontainerized liquids may not be placed in a municipal solid waste landfill unit unless the waste is household waste other than septic waste; or the waste is leachate or gas condensate from the municipal solid waste landfill unit and the new or existing unit or lateral expansion is designed with a composite liner and system for the collection of leachate as described in NAC 444.681. Containers holding liquid waste may not be placed in a municipal solid waste landfill unit unless the container is a small container similar in size to a container which would normally be found in household waste; the container is designed to hold liquids for use other than storage; and the liquid waste is household waste. For purposes of these requirements, the term "liquid waste" means any waste material which is determined to contain free liquids as a result of a paint filter liquids test, Method 9095, described in "Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods," EPA Publication No. SW-846.

4.8.2 Solid/Sludge Residuals

Solid Waste Landfills

Nevada, which regulates solid waste management under state plans and local controls, authorizes three classes of landfills. Generally, Class I landfills include municipal solid waste landfills, Class II landfills include small municipal solid waste landfills with no ground water contamination and located in areas of low precipitation, and Class III landfills include industrial waste landfills. Solid waste landfills must hold a permit and must conduct ground water monitoring program capable of identifying contamination, including monitoring for arsenic. Nevada's monitoring program parallels that imposed under 40 CFR Part 258 (a phased program that includes detection monitoring, assessment monitoring, and corrective measures as needed). Nevada offers flexibility for a landfill to establish alternative monitoring parameters for inorganic materials, including arsenic. And certain monitoring parameters may be eliminated if it is shown that the detected constituents are not reasonably expected to be contained in or derived from the waste contained in the unit (NAC 444.7487).

[36]Nevada defines UIC well consistent with federal regulations, and defines "fluid" as any material or substance which flows or moves whether in a semisolid, liquid, sludge, gaseous, or other form or state.

Generally, owners or operators of a Class I landfill may not cause a discharge of pollutants or contaminants from a municipal solid waste landfill unit into the waters of the state, including wetlands, which violates any requirements of the federal CWA, or comparable state law, or cause the discharge of a nonpoint source of pollution into the waters of the state which violates any water quality management that has been approved pursuant to sections 208 or 319 of the CWA or NRS 445A.300 to 445A.730.

Hazardous Waste Landfill

Nevada adopts by reference the federal toxicity characteristic for arsenic (i.e., 5.0 mg/L). Nevada requires any person who generates, transports, treats, stores, disposes or otherwise manages hazardous waste to comply with federal regulations under 40 CFR Part 2, Subpart A, Part 124, Subpart A and B, Parts 260 to 270, and Parts 273 and 279 as adopted by reference, except as modified by NAC 444.86325, 444.8633 and 444.8634. Nevada regulations provide that any out-of-state waste deemed hazardous in the state of origin is a hazardous waste within Nevada, regardless of whether it is a hazardous waste under RCRA.

Lagoons

Nevada does not impose specific regulations that address lagoons or surface impoundments. Rather, under its solid waste disposal regulations, Nevada defines the term "surface impoundment"[37] and imposes general standards that apply to such waste management units. These standards provide that solid waste systems (including impoundments) may not be placed in operation unless approved by the solid waste management authority, and must be operated in a manner that will not cause or contribute to pollution of the atmosphere, or surface or ground waters of Nevada. Nevada does not establish specific ground water quality standards, but does protect ground water resources through its mining reclamation and ground water protection programs (e.g., mining facilities may not degrade ground water beyond federal or state drinking water standards).

Reuse (Land Application)

Nevada regulations provide that special wastes, including sewage sludges, septic tank pumpings and medical wastes, may be deposited at a disposal site only if provisions for such disposal are included in the operational plan and approved by the solid waste management authority. Nevada is not authorized to implement the federal sewage sludge program.

[37]A facility or part of a facility which is a natural topographic depression, man-made excavation or diked area formed primarily of earthen material or lined with man-made material, which is designed to hold an accumulation of liquid wastes or wastes containing free liquids. The term includes holding storage, settling and aeration pits, ponds and lagoons. The term does not include injection wells (NAC 444.6265).

4.9 Pennsylvania

4.9.1 Liquid Residuals

Direct Discharges of Liquids to Surface Waters

Pennsylvania is authorized to implement the federal NPDES program except for the pretreatment and sludge components of the program. Pennsylvania has developed designated uses for surface waters within the state and has established water quality criteria designed to protect those uses.[38] These criteria, which are summarized in Table 4-12, vary based on the acute or chronic nature of the water quality impact. Each surface water within Pennsylvania should meet the corresponding arsenic limit specified. To ensure this occurs, each NPDES permit issued for a direct discharge to surface waters in Pennsylvania must ensure that the effluent discharged by that facility does not cause a violation of the corresponding arsenic standard at the point of discharge or in a mixing zone in reasonable proximity to the discharge. Typically, facilities employ effluent treatment to achieve compliance with NPDES permit limits. In addition to the numeric surface water quality standards, Pennsylvania also imposes a narrative surface water quality standard that provides that:

- [Surface] water may not contain substances attributable to point or nonpoint source waste discharges in concentration or amounts sufficient to be inimical or harmful to the water uses to be protected or to human, animal, plant, or aquatic life.

Any discharge of an arsenic residual that is deemed to violate this narrative standard would be prohibited or limited through NPDES permit conditions.

Indirect Discharges to a Sanitary Sewer System

Pennsylvania is not authorized to implement the federal pretreatment program. Rather, EPA Region 3 and Pennsylvania implement the program under a cooperative agreement. Nevertheless, Pennsylvania requirements are generally consistent with the federal standards, including the prohibition on the indirect discharge (i.e., discharge to POTWs) of pollutants that would interfere or pass-though a POTW. Pennsylvania provides that a POTW, in cases where pollutants indirectly discharged by industrial users result in interference or pass through and the violation is likely to recur, must develop and implement specific local limits. Such limits must ensure renewed or continued compliance with the POTW's NPDES permit or sludge use or disposal practices.

Underground Injection

Pennsylvania is not authorized to administer the federal UIC program. EPA Region 3 administers the program within Pennsylvania (see 40 CFR Subpart NN). The requirements

[38]Uses and standards are developed by the Department of Environmental Resources, Water Management Division.

Table 4-12. Pennsylvania's Arsenic Surface Water Quality Criteria[39]

Contaminant	Maximum Concentration -Acute	Continuous Concentration - Chronic	Health Criteria
Arsenic (III)	0.36 mg/L	0.19 mg/L	0.05 mg/L

imposed within Pennsylvania are consistent with those described in Section 3.

Land Disposal

Pennsylvania provides that bulk or noncontainerized liquid waste may not be disposed or processed at a municipal waste landfill. In addition, containers holding free liquids may not be accepted unless the container is less than 1 gallon in size, except as otherwise provided in the municipal solid waste permit.

4.9.2 Solid/Sludge Residuals

Solid Waste Landfill

Pennsylvania authorizes municipal, residual and construction and debris landfills (solid and sludge DWTP residuals are most likely managed as municipal wastes). A landfill permit application must contain a description of the chemical characteristics of ground water quality for each aquifer in the proposed permit area and adjacent area, based on at least 1 full year of monitoring data. For municipal landfills, this description must be based on quarterly sampling and analysis from each monitoring well for various parameters, including arsenic. For residual landfills, such characterization must be based on at least two quarters of sampling. In addition, a person or municipality operating a municipal waste landfill or residual waste landfill must conduct annual sampling and analysis from each monitoring well, again including analysis for arsenic.

Hazardous Waste Landfills

Pennsylvania is authorized to implement the federal RCRA program. Pennsylvania has promulgated requirements that are generally consistent with the federal hazardous wasteregulations. Thus, Pennsylvania imposes the same toxicity characteristic standard as imposed under federal regulations (i.e., 5.0 mg/L). Pennsylvania provides that before placing a hazardous waste in or on a land treatment facility, the owner or operator must determine the concentrations in the waste of any substances which exceed toxicity characteristic levels.

Lagoons

Pennsylvania has developed requirements applicable to impoundments generally, as well as specific requirements applicable to the use of impoundments for the disposal of residual and hazardous waste based on discussions with state personnel; it does not appear that DWTP residuals meet the state definition of residual waste. As for general requirements applicable to impoundments, persons managing polluting substances in an impoundment must take necessary measures to prevent the substances from directly or indirectly reaching waters within Pennsylvania. Such persons may not operate, maintain or use an impoundment for the production, processing, storage, treatment or disposal of polluting substances unless the impoundment is structurally sound, impermeable, protected from unauthorized acts of third parties, and is maintained so that a freeboard of at least 2 feet remains at all times.

The person or municipality owning, operating or possessing an impoundment has the burden of satisfying state officials that the impoundment complies with these requirements. The requirements described above do not apply to residual waste[40] processing,[41] disposal, treatment,[42] collection, storage or transportation. Pennsylvania requires that residual waste disposal impoundments must have a permit, and that permit applications must include ground water quality data, including sampling for arsenic. In addition, no person may not dispose of residual waste at a residual waste disposal impoundment unless the free liquid fraction of the waste can be readily separated from the solid fraction and is collected and discharged in accordance with Pennsylvania law, and the waste will solidify by a chemical or physical process upon disposal or within the shortest period of time technologically practicable. With limited exception, such wastes must solidify prior to closure.

[39]Acute limits may not be exceeded for 1 hour in any 3-year period. Chronic limits may not be exceeded for any 96-hour (4-day) period in any 3-year period.

[40]Residual waste includes garbage, refuse, other discarded material or other waste, including solid, liquid, semisolid, or contained gaseous materials resulting from industrial, mining, and agricultural operations and sludge from an industrial, mining or agricultural water supply treatment facility, wastewater treatment facility, or air pollution control facility, if it is not hazardous. Based on discussions with Pennsylvania DEP personnel, DWTP residuals are regulated as municipal wastes and not residual wastes under state regulations.

[41]Volume reduction or conversion for off-site reuse.

[42]A method, technique or process, including neutralization, designed to change the physical, chemical, or biological character or composition of waste to neutralize the waste or to render the waste nonhazardous, safer for transport, suitable for recovery, suitable for storage or reduced in volume. The term includes an activity or process designed to change the physical form or chemical composition of waste to render it neutral or nonhazardous.

Finally, impoundments used to manage hazardous waste are subject to comprehensive regulations, including requirements addressing impoundment siting, design, liner specifications, leachate management, ground water monitoring, operation, closure, and financial responsibility.

Reuse (Land Application)

Pennsylvania has established regulations that address the land application of sewage sludge and the beneficial use of sewage sludge through land application, but not explicit requirements that apply to the land application of DWTP sludge. Pennsylvania is not authorized to implement the federal sewage sludge program requirements.

Under Pennsylvania's sewage sludge beneficial use requirements, sewage sludge may only be land-applied pursuant to a state permit and consistent with specified standards, which are consistent with 40 CFR Part 503 standards. No sewage sludge may be applied to the land if the concentration of arsenic exceeds 75 mg/kg. In addition, sewage sludge applied to agricultural land, forest, a public contact site or a reclamation site may not exceed a cumulative arsenic loading rate of 41 kg/hectare (36 pounds per acre). Finally, if sewage sludge is applied to a lawn or a home garden, or is sold, given away or otherwise distributed in a bag or other container for application to the land, the concentration of arsenic in the sewage sludge may not exceed a concentration of 41 mg/kg (monthly average).

Under Pennsylvania's general sewage sludge provisions, a permit is required but no numeric standards are imposed. Rather, Pennsylvania provides that the operator may not cause or allow a point or nonpoint source discharge of pollution from or on the facility to surface waters of the state. Land application facilities must be operated to prevent and control surface and ground water pollution. In addition, such facilities may not cause or allow a discharge of a contaminant into ground water except as authorized by a state permit.

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