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**Applicable Rules and Regulations
for Concentrate Management
Task B.5.**

**for the
Investigation of Demineralization
Concentrate Management**

**Technical Memorandum B.5
Applicable Rules and Regulations for Concentrate Management**

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Investigation of Demineralization Concentrate Management

by

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INTRODUCTION

PROJECT OVERVIEW

The St. Johns River Water Management District's (SJRWMD) water supply plan, titled District Water Supply Plan, outlines water supply options to meet projected water needs through the year 2020. Currently, the Floridan aquifer provides most of the region's existing water needs for public supply. The high quality, economical and reliable characteristics of this groundwater source have made it the water supply of choice. However, the Floridan aquifer cannot provide all future water supply needs in the region without damaging water resources and related natural systems. Therefore, SJRWMD investigated the feasibility of alternative water supply strategies and identified brackish groundwater, brackish surface water, and seawater as potential sources of supply to meet future demands. These alternative water sources will require treatment using demineralization technologies. These technologies are primarily pressure driven membrane processes that include reverse osmosis or nanofiltration. During this process, minerals in the source water, including salt, are removed, producing potable water as well as a byproduct known as demineralization concentrate.

Developing acceptable management strategies for demineralization concentrate is the goal of this project, Investigation of Demineralization Concentrate Management (the Project). A primary component of the Project will be the development of a Demineralization Concentrate Management Plan. The plan will outline environmentally acceptable options for concentrate management. Currently, some available concentrate management options include deep well injection, land spreading, discharge to surface waters, discharge to domestic wastewater treatment facilities, and various forms of reuse (including blending with reclaimed water). This project is part of SJRWMD's water supply plan implementation to meet future water supply needs. Prior to development of the plan or implementation of the concentrate management alternatives mentioned, it is important to have an understanding of applicable rules and regulations governing concentrate management.

PURPOSE AND SCOPE

The purpose of this technical memorandum is to identify and summarize relevant demineralization concentrate management rules and regulations. The contents of this technical memorandum will be used to support the Project and the development of the Demineralization Concentrate

Management Plan. Addressing this topic is very important since demineralization concentrate management and the associated regulations are primary considerations associated with the development of demineralization facilities within SJRWMD.

Applicable rules and regulations have been collected, reviewed and summarized as they relate to demineralization concentrate management. In addition, recommendations have been provided regarding potential actions to support an environmentally sound, logical, and clear regulatory process.

The information presented herein does not represent a legal or binding interpretation of Florida laws and statutes. Legal counsel is the responsibility of the user.

METHODOLOGY

This technical memorandum was prepared by identifying agencies that have a direct or indirect impact on permitting of demineralization concentrate management, followed by the collecting and summarizing of specific rules and regulations. Information was obtained through a literature search and by contacting regulatory agency officials, other experts in the field, and utilities currently using demineralization processes.

REGULATORY AGENCIES

Demineralization concentrate management projects require permits, approvals, or authorizations from a number of governmental agencies. The need for interaction with these agencies may not be self evident when considering a demineralization project and associated concentrate management strategy. In considering the issues related to demineralization concentrate management, there are a number of agencies that would be considered “secondary,” as their review is related to ancillary facilities for concentrate disposal, such as pipelines and outfall structures. **Clearly, the Florida Department of Environmental Regulation is the primary agency responsible for the review and issuance of permits for demineralization concentrate management.**

This section identifies agencies that may have review and approval requirements for any portion of a demineralization concentrate management project. Agencies responsible for approval of components of a demineralization facility other than concentrate are also referenced if the agency’s authority or the language of its governing regulations is broad enough to allow expansion of the review process into the area of demineralization concentrate management.

Agencies are summarized in Table 1 below, followed by brief descriptions of each organization and its potential role in approval of a demineralization concentrate management project. The order in which these agencies are listed does not represent their relative level of importance, nor does it represent functional hierarchy related to a demineralization concentrate management project.

Table 1. Summary of agencies potentially requiring permits, approvals, or authorization for demineralization concentrate management projects

Responsible Agency
Federal
U.S. Environmental Protection Agency, Region IV
U.S. Army Corps of Engineers
Occupational Safety and Health Administration
U.S. Geological Survey
U.S. Fish and Wildlife Service
National Marine Fisheries Service
State
Florida Department of Environmental Protection (Primary Agency)
Florida Department of Transportation
Florida Fish and Wildlife Conservation Commission
Regional
Water management districts
Local
Health department
Local pollution control
Environmental resource management department or Natural resource management department
City/county building and/or zoning departments
CSX Railroad Corporation

U.S. ENVIRONMENTAL PROTECTION AGENCY

The U.S. Environmental Protection Agency (EPA) mission is to protect human health and to safeguard the natural environment (air, water, and land) upon which life depends. EPA is structured into 10 regions with Region 4 responsible for Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, and Tennessee.

EPA Region 4 office information is as follows:

Atlanta Federal Center

61 Forsyth Street, SW

Atlanta, GA 30303-3104

Telephone: (404) 562-9900 or (800) 241-1754

www.epa.gov

EPA has given full delegation to the Florida Department of Environmental Protection (FDEP) for the regulation of underground injection and surface water discharge permitting of demineralization concentrate and the associated management issues. However, EPA does participate in the review of demineralization concentrate management permits and related topics concerning demineralization concentrate subject matter in cooperation with FDEP. An EPA member sits on the Technical Advisory Committees for proposed underground injection control projects. Although the EPA's permitting authority is delegated to FDEP, their oversight and technical input are important factors in FDEP consideration of permitting for demineralization concentrate disposal.

U.S. ARMY CORPS OF ENGINEERS

The U.S. Army Corps of Engineers (USACE) is made up of civilian and military men and women, which include a diverse workforce of biologists, engineers, geologists, hydrologists, natural resource managers, and other professionals. The USACE mission is to provide quality, responsive engineering services to the nation, including planning, designing, building, and operating water resources and other civil works projects (navigation, flood control, environmental protection, disaster response, etc.); designing and managing the construction of military facilities for the Army and Air Force (military construction); and providing design and construction management support for other defense and federal agencies (interagency and international services).

USACE involvement in a desalination project and concentrate disposal would revolve around construction in navigable waterways of the United

States, for example, construction of ocean outfall; intracoastal waterway pipe crossing that requires dredge and fill permitting procedures; wetland modifications; construction, operation, or abandonment of facilities on land under federal jurisdiction; or actions requiring major federal action.

USACE district office information is as follows:
400 W. Bay Street or P.O. Box 4970
Jacksonville, FL 32202
Telephone: (904) 232-2568 or (800) 291-9405
www.usace.army.mil

OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION

The Occupational Safety and Health Administration (OSHA) was created under the Occupational Health and Safety Act to monitor health and safety in the work environment and to prevent work-related injuries, illnesses, and death. This agency may play a role in any construction aspects related to a demineralization project, especially concerning any trenching and confined-spaces issues encountered during the construction phase.

OSHA Region 4 office information is as follows:
St 61 Forsyth Street, SW
Atlanta, GA 30303
Telephone: (404) 562-2300
www.osha.gov

U.S. GEOLOGICAL SURVEY

The U.S. Geological Survey (USGS) serves the nation by providing reliable scientific information to describe and understand the Earth; minimize loss of life and property from natural disasters; manage water, biological, energy, and mineral resources; and enhance and protect our quality of life. USGS would play a role in concentrate discharge related to a demineralization project when the discharge concerns underground injection. USGS is part of a Technical Advisory Committee that is established by FDEP to evaluate the permitting of underground injection control projects.

USGS Florida office information is as follows:
227 N. Bronough St., Suite 3015
Tallahassee, FL 32301
Telephone: (850) 942-9500
www.usgs.gov

U.S. FISH AND WILDLIFE SERVICE

The U.S. Fish and Wildlife Service (FWS) serves the nation by working, with others, to conserve, protect, and enhance fish and wildlife and their habitats for the continuing benefit of the American people. Major responsibilities of FWS involve managing migratory birds, endangered species, certain marine mammals, and freshwater and anadromous fish; conserving wetlands; and restoring nationally significant fisheries. In addition, FWS enforces federal wildlife protection laws, such as the Endangered Species Act (ESA).

The ESA allows the listing of species as either “endangered” or “threatened.” A species classified as endangered means it is in danger of extinction throughout all or a significant portion of its range. A threatened classification means a species is likely to become endangered within the foreseeable future. All species of plants and animals (i.e., plants, mammals, birds, fish, reptiles, and clams/mussels), except pest insects, are eligible for listing as endangered or threatened. Therefore, the purpose of the ESA is to conserve “the ecosystem upon which endangered and threatened species depend” and to conserve and recover these listed species.

FWS and the National Marine Fisheries Service share the responsibility for administration of the ESA. The primary responsibility of FWS is for terrestrial and freshwater species, while NMFS responsibilities are mainly for marine species such as salmon and whales. Therefore, FWS could become involved if the proposed demineralization project could potentially impact listed species such as marine mammals (e.g., manatees) or other fish and/or wildlife habitats.

FWS Southeast Regional Office information is as follows:
1875 Century Blvd., Suite 400
Atlanta, GA 30345
Telephone: (404) 679-4000
www.fws.gov

NATIONAL MARINE FISHERIES SERVICE

The mission of the National Marine Fisheries Service (NMFS) is stewardship of the nation's living marine resources. Through conservation and wise use, these resources and their habitat are managed by NMFS to benefit the nation without jeopardizing options for the future. In addition, NMFS shares the responsibility with USFWS for administration of the Endangered Species Act. The agency could become involved in a similar role as USFWS if the proposed demineralization project could potentially impact marine resources such as fish and/or marine habitats.

NMFS Southeast Regional Office information is as follows:
9721 Executive Center Drive North
St. Petersburg, FL 33702
Telephone: (727) 570-5301
www.nmfs.noaa.gov

FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION

The Florida Department of Environmental Protection (FDEP) is the state agency whose mission is to "protect, conserve, and manage Florida's environment and natural resources." The FDEP accomplishes this mission through an established regulatory program of permitting, compliance, and enforcement actions for activities that could have a negative impact on public health and the natural environment. FDEP is also responsible for purchase and conservation of environmentally significant lands, management of the state park system, and outreach and environmental education. FDEP also provides water quality data on many surface waters throughout the state and coordinates the monitoring activities associated with ambient sampling with other agencies. FDEP has received federal delegation of the underground injection control (UIC) and surface water discharge (NPDES) permitting programs.

The state of Florida is divided into six regulatory districts: Northwest District, Northeast District, Southwest District, Central District, South District, and Southeast District. Headquarters of the FDEP are located in Tallahassee. The Central District and Northeast District cover the area that is within SJRWMD. FDEP office information for these two districts is as follows:

Northeast District
7825 Baymeadows Way, Suite 200B
Jacksonville, FL 32256-7590
(904) 448-4300 / sc 880-4300 x201
Fax (904) 448-4366 /
scfax 880-4366
www.dep.state.fl.us

Central District
3319 Maguire Boulevard, Suite 232
Orlando, FL 32803-3767
(407) 894-7555 / sc 325-2290
Fax (407) 897-2966 /
scfax 342-2966

ST. JOHNS RIVER WATER MANAGEMENT DISTRICT

SJRWMD is one of five water management districts in the state of Florida dedicated to the preservation and management of Florida's precious water resources. Duties of SJRWMD include:

- Issuing permits for various water use activities and/or activities that have the potential to adversely impact ground or surface water resources and adjacent lands
- Buying land to preserve or restore vital wetlands and water resources
- Conducting research about the quality and quantity of ground and surface water resources
- Mapping ground and surface water resources
- Conducting outreach and public education programs

SJRWMD is responsible for issuing many types of permits; however, some of the most common are the consumptive use permit (CUP) and the environmental resource permit (ERP). These source water permits include evaluation of environmental impacts and public water supply, which could include evaluation of impacts from the concentrate management component of a demineralization project. In addition, artificial recharge permitting could become an issue relating to injection wells associated with demineralization projects if the water is not being beneficially used or if the injection could adversely affect existing beneficial uses of water. Artificial recharge is addressed under the District's 40C-5 permitting program.

SJRWMD headquarters office information is as follows:
P.O. Box 1429
Palatka, FL 32178-1429
Telephone: (386) 329-4500
www.sjrwmd.com or sjr.state.fl.us

FLORIDA DEPARTMENT OF TRANSPORTATION

The Florida Department of Transportation's (FDOT) responsibilities impact nearly every facet of transportation – from highways to railways and airports to seaports. FDOT's mission is to provide a safe transportation system that ensures the mobility of people and goods, enhances economic prosperity, and preserves the quality of our environment and communities. Therefore, FDOT involvement with a demineralization project would be associated with transportation of any oversized structures or pipes on state or federal roadways during the construction phase, and/or any construction that takes place in state or federal road right-of-way would require utilization permits. Multiple permits could be required for various activities proposed in FDOT right-of-way.

FDOT office information is as follows:

605 Suwannee Street
Tallahassee, FL 32399-0450
Telephone: (850) 414-4100
www.dot.state.fl.us

FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION

The Florida Fish and Wildlife Conservation Commission's (FWC) responsibility is to manage fish and wildlife resources for their long-term well being and the benefit of people. The agency could become involved if the proposed demineralization project could potentially impact listed species such as manatees or other fish and/or wildlife habitats. In addition, this agency is provided the opportunity to comment on proposed FDEP NPDES permits.

FWC Northeast Region Office information is as follows:

1239 S.W. 10th Street
Ocala, FL 34474-2797
Telephone: (352) 732-1225
www.floridaconservation.org

OTHERS

The remaining agencies that could be involved in concentrate discharge from a demineralization project include local city and county government agencies. Depending on the location and extent of the project, many different departments from the local county and/or city could be

involved. Some of these departments include building and zoning, health, local drainage, and environmental resources management or natural resource management. These departments' involvement is associated with permits for construction, changes in zoning, public health and welfare, easement acquisitions, issues concerning rights-of-way as well as to restore, enhance, conserve and manage the air, water, and land resources in the local area. In addition, CSX Railroad Corporation, which is responsible for operating the rail network in the eastern United States, could require permits for any pipelines associated with a demineralization project when these pipelines cross over/under properties and/or tracks related to the rail network.

The degree of involvement and the compliance requirements from the agencies will differ depending on the city and/or county; however, their involvement has to be addressed because depending on the situations or different circumstances such as location, source regime, discharge regime, capacity, etc., could lead to methods requiring additional time, effort, policy decisions, and/or compliance requirements affecting the demineralization project. No contact information is provided since it will be based on location.

SUMMARY

As defined above, a large number of agencies could directly or indirectly affect permitting of demineralization concentrate management. However, the requirements of the EPA and the FDEP are the most pertinent to demineralization concentrate management and represent the critical test of the viability of any demineralization concentrate management project. Given that FDEP has primacy, the role of EPA is secondary and consists of review and comment on FDEP draft NPDES permits and associated information about the project. However, EPA can object to an FDEP-issued permit, which emphasizes the importance of both agencies in demineralization projects. Given that the focus of this technical memorandum is demineralization concentrate regulations, the following rules and regulations section specifically delineates the FDEP regulations that affect demineralization concentrate management.

APPLICABLE RULES AND REGULATIONS

FDEP regulates demineralization concentrate management based on the *Florida Statutes (FS)* and the associated *Florida Administrative Code (F.A.C.)*. In general, the *Florida Statutes* is an edited compilation of general laws of the state and the *Florida Administrative Code* is a compilation of the rules and regulations of state agencies that have been filed with the Department of State pursuant to the provisions of the *Florida Statutes*.

The federal acts that contributed to the development of these regulations were researched and are presented herein. In addition, the sections of the *Florida Administrative Code* that govern demineralization concentrate management have been identified and summarized.

REGULATORY DEVELOPMENT

The regulations that govern demineralization concentrate in the state of Florida have evolved with the increase in numbers of demineralization plants within the state, the availability of more detailed information on concentrate characteristics, and the promulgation of new federal regulations. Florida regulations have incorporated the federal requirements and, in some cases, have developed more stringent requirements consistent with the unique characteristics of Florida's natural environment.

Federal acts that impact demineralization concentrate management include the Clean Water Act (CWA), the Safe Drinking Water Act (SDWA), and the Resource Conservation and Recovery Act (RCRA). The role of each federal act is described below.

The Federal Water Pollution Control Act, enacted in 1972, was amended in 1977 with the Clean Water Act (CWA). This act addresses the discharge of pollutants to surface water of the United States. The CWA established a National Pollutant Discharge Elimination System (NPDES) under which the administrator of EPA may issue permits for discharge of pollutants from a point source into waters of the United States that meet applicable CWA requirements. These requirements include effluent limitations, waste load allocations, monitoring and entry provisions, toxic and pretreatment effluent standards, and guidelines for ocean discharge criteria, among others. The CWA directly affects discharge of demineralization concentrate to surface waters and municipal wastewater treatment plants that subsequently discharge to surface waters, via the

NPDES permitting process. However, there is no known, specific reference to demineralization concentrate in the CWA.

The Safe Drinking Water Act (SDWA), enacted initially in 1974, contains provisions for the protection of groundwater. Subtitle C is designed to prevent endangerment of underground drinking water sources. It contains the Underground Injection Control (UIC) program provisions and the sole source aquifer provision, which are the only provisions of the SDWA specifically addressing groundwater protection. The UIC program directs EPA to establish minimum requirements for state regulation of injection of liquids into wells. This program directly affects deep well injection of concentrate, via the UIC permitting process.

The Resource Conservation and Recovery Act (RCRA), enacted in 1970, provided legislation for solid waste management that includes guidelines and standards for solid waste storage, treatment, and disposal of hazardous and non-hazardous wastes. RCRA requirements would apply to the disposal of solid or crystallized concentrate in landfills. There is no known specific reference to demineralization concentrate in the RCRA.

In summary, the CWA and the SDWA provide the primary basis for federal criteria that apply to the most common demineralization concentrate management methods (underground injection control alternatives and the various surface water discharge options). The RCRA provides criteria related to disposal of materials to landfills and would encompass solidified demineralization concentrate.

Under federal regulations, demineralization concentrate is a category of industrial wastewater. The state of Florida has enacted legislation and is developing regulations specific to demineralization concentrate. State law classifies concentrate as a drinking water treatment byproduct, which is permitted as an industrial wastewater through the Industrial Wastewater Permitting Section of FDEP.

CURRENT REGULATIONS

Current FDEP regulations that affect demineralization concentrate permitting are listed in Table 2 and summarized below. The table includes regulations that directly affect the disposal of concentrate, such as the State Water Quality Criteria in 62-302, as well as regulations that may have secondary or indirect effects on a concentrate disposal option such as ERP review in section 62-330. These sections from Chapter 62, *F.A.C.*, include all known references to demineralization concentrate as well as

the sections generally used by FDEP as part of concentrate permitting efforts.

The purpose of this information is to provide a reference point for rapid identification of pertinent sections of the *Florida Administrative Code*. However, permitting of concentrate management alternatives is site-specific and complex. As with most regulations, a step-wise checklist of permit feasibility cannot be gleaned from the regulations due to the numerous factors that are considered in permitting of discharges to the environment. Therefore, more detailed comparison of regulations with project-specific factors is necessary on a case-by-case basis to more accurately determine viable options for concentrate management.

Table 2. State regulations from the *Florida Administrative Code*

Reference	Description	Keyword
62-4	Permits	Surface water discharge, ocean outfall, underground injection control, non-surface water discharge, mixing zones
62-160	Quality Assurance	Sampling, analyses, laboratories, surface water, ground water, wastewater
62-301	Surface Waters of the State	Surface water, ocean outfall
62-302	Surface Water Quality Standards	Toxicity, Outstanding Florida Waters
62-330	Environmental Resource Permitting	Dredge and fill, pipelines
62-343	Environmental Resource Permit Procedures	Dredge and fill, pipelines
62-520	Ground Water Classes, Standards, and Exemptions	Ground water disposal
62-522	Ground Water Permitting and Monitoring Requirements	Ground water disposal
62-528	Underground Injection Control	Underground injection control wells
62-550	Drinking Water Standards, Monitoring, and Reporting	Land application
62-610	Reuse of Reclaimed Water and Land Application	Reuse, land application
62-620	Wastewater Facility and Activities Permitting	Industrial wastewater, permit applications
62-650	Water Quality Based Effluent Limitations	Surface water discharge
62-660	Industrial Wastewater Facilities	Industrial wastewater, effluent limitations

62-4: Permits

Chapter 62-4, *F.A.C.*, outlines procedures for obtaining permits of all types from FDEP. This regulation contains Part 1 – General, Part 2 – Specific Permits; Requirements, and Part 3 – Procedures for General Permits.

Part 1 – Generally identifies procedures and fees associated with permits and includes 62-4.001 through 62-4.160. The majority of this information consists of administrative procedures and fees related to permit issuance, renewal, transfer, and revocation.

Part 2 – Specific Permits; Requirements includes Rule 62-4.200 through Rule 62-4.250 and specifies criteria that are important for determining the viability of a concentrate management project that involves a discharge to surface waters. Sections of particular interest are described below.

Rule 62-4.242, *F.A.C.* – Antidegradation Permitting Requirements; Outstanding Florida Waters; Outstanding National Resource Waters; Equitable Abatement. This regulation includes criteria to balance the value of a project with the associated impacts to surface waters to determine if issuance of the permit is clearly in the public interest. In addition, the regulation requires confirmation that no other viable alternative exists in lieu of the proposed surface water discharge. Specific water quality criteria are not presented but are contained in other, referenced regulations. This regulation is a critical test of the viability of a surface water discharge option for concentrate disposal and can be a primary permitting focus point. Anti-degradation requirements are applicable to new and/or expanding surface discharge projects.

Rule 62-4.244, *F.A.C.* – Mixing Zones: Surface Waters. Requirements for mixing zones, including dilution ratios, water quality requirements, and toxicity requirements are identified. This section is critical to many demineralization concentrate management projects discharging to surface waters, including open ocean waters, in those situations where the demineralization concentrate does not meet water quality criteria established for the classification of the water body.

Rule 62-4.246, *F.A.C.* – Sampling, Testing Methods, and Method Detection Limits for Water Pollution Sources. A portion of this section addresses method detection limits (MDLs) and practical quantification limits (PQLs). It is possible that FDEP would deem the PQL of a parameter(s) to be the necessary and acceptable effluent limit for issuance of a permit. It is important to ensure that laboratories conducting analyses

for a permit, in addition to being certified, are able to meet the MDLs and PQLs established through this regulation.

62-160: Quality Assurance

Chapter 62-160, *F.A.C.*, applies to all programs, projects, studies or other activities that involve the measurement, use or submission of environmental data or reports to FDEP. The section address quality assurance plans, laboratory and field procedures, record keeping requirements, sampling and analytical requirements for FDEP programs, which would govern monitoring procedures for demineralization concentrate projects.

62-301: Surface Waters of the State

This chapter defines the landward demarcation of surface waters of the state. This connection point to Surface Waters of the State is where the state's jurisdiction – and thus application of rules and water quality standards – begins. This demarcation is also used for permitting of pipelines and other physical improvements that may be associated with construction of a demineralization concentrate outfall.

62-302: Surface Water Quality Standards

Chapter 62-302, *F.A.C.*, defines many water quality-related factors and requirements important to demineralization concentrate permitting efforts. This information is material to most permitting efforts and includes such data as the state water quality standards for each classification of surface water, thermal surface water criteria, and special protection requirements for Outstanding Florida Waters and Outstanding National Resource Waters.

62-302.400: Classification of Surface Waters, Usage, Reclassification, Classified Waters

This subsection classifies waters of the state according to their designated use or uses, as follows:

Class I	Potable water supplies
Class II	Shellfish propagation or harvesting
Class III	Recreation, propagation and maintenance of a healthy, well-balanced population of fish and wildlife
Class IV	Agricultural water supplies
Class V	Navigation, utility and industrial use

Water quality classifications are ordered in the degree of protection required, with Class I generally having the most stringent water quality criteria and Class V the least stringent. The classification of any water considered for concentrate disposal is critical in determining the viability of the project. Most surface waters in the state are Class I, II, or III waters. Class IV waters are described in 62-302.400(12) as wholly artificial canals or ditches contained on agricultural lands behind a control structure which is part of a water control system that is connected to the works of a water management district and which is permitted by such water management district. There are currently no Class V waters remaining in the state of Florida.

62-302.530: Table: Surface Water Quality Criteria

This section includes water quality criteria for different classes of water, including a differentiation between fresh and marine waters. For tidally influenced waters, requirements may include dual limits to encompass both fresh and marine conditions. Over 70 water quality parameters are listed and represent a significant body of data required for approval of any surface water discharge of demineralization concentrate. Surface water discharges must meet all of the water quality criteria established for the classification of waters or be granted a mixing zone or other administrative relief by FDEP. Revisions to the water quality criteria are considered by FDEP every three years (triennial review). FDEP is currently working on revision to the water quality criteria, including revisions to the antidegradation permitting requirements and risk-based assessment of numeric criteria that were established based on human health.

62-302.700: Special Protection, Outstanding Florida Waters, Outstanding National Resource Waters

This section lists water bodies designated by the Environmental Regulation Commission (the Commission) as Outstanding Florida Waters (OFWs) or Outstanding National Resource Waters (ONRWs). These waters are designated as worthy of special protection because of their natural attributes. In addition, the ONRWs are designated as such exceptional recreational and ecological significance that water quality should be maintained and protected under all circumstances. Discharge of demineralization concentrate to OFWs and ONRWs is extremely limited in scope and will not be acceptable in most instances. Discharges to OFWs may not degrade the natural background water quality established at the time that they were classified as an OFW.

62-330: Environmental Resource Permitting

This chapter authorizes FDEP to adopt by reference certain environmental resource permit rules of the water management districts to be used in conjunction with certain regulations, thus giving FDEP independent authority to regulate surface water management systems including activities in, on, or over wetlands or other surface waters. The environmental resource permitting process applies to concentrate discharge permitting in relation to construction of pipelines and outfalls within waters of the state.

62-340: Delineation of the Landward Extent of Wetlands and Surface Waters

This chapter defines the landward demarcation of wetlands and surface waters of the state. This connection point to Surface Waters of the State is where the state's jurisdiction – and thus application of rules and water quality standard – begins. In addition, this information is used for permitting of pipelines and other physical improvements that may be associated with construction of a demineralization concentrate outfall.

62-341: Noticed General Environmental Resource Permits

General environmental resource permits are defined in this chapter for a broad range of activities, primarily related to construction, installation, or maintenance of various types of infrastructure. While over 25 permits are included in this chapter, examples that may be pertinent to concentrate management projects include construction or installation of riprap, fences, pipelines, and subaqueous utility crossings.

62-343: Environmental Resource Permit Procedures

This chapter provides the procedural requirements for processing environmental resource permits and for obtaining formal determinations of the landward extent of wetlands and surface waters. This connection point to Surface Waters of the State is where the state's jurisdiction – and thus application of rules and water quality standards – begins. In addition, this information is used for permitting of pipelines and other physical improvements that may be associated with construction of a demineralization concentrate outfall.

62-520: Groundwater Classes, Standards, and Exemptions

Groundwater classes are defined in this chapter as shown in Table 3 below. Groundwater classifications are ordered in the degree of protection required, with Class G-I generally having the most stringent water quality

criteria and Class G-IV the least stringent. Among other requirements, discharges into Class G-I and G-II groundwaters must meet the primary and secondary drinking water standards for public water systems. This standard is difficult to meet for virtually any concentrate stream. Typically, underground injection of demineralization concentrate occurs in Class G-IV groundwater aquifers.

Finally, Chapter 62-520, *F.A.C.*, defines exemptions for installations discharging into groundwater and exemptions from secondary drinking water standards in Class G-II groundwater.

The standards and requirements in this section relate to percolation ponds, deep well injection, land spraying, reuse, and any other concentrate management alternative that could result in migration of concentrate into underground sources of drinking water (USDWs).

Table 3. Definition of groundwater classes

Class F-I	Potable water use, groundwater in a single source aquifer described in Rule 62-520.460, <i>F.A.C.</i> , which has a total dissolved solids content of less than 3,000 mg/L and was specifically reclassified as Class F-I by the Commission
Class G-I	Potable water use, groundwater in single source aquifers which has a total dissolved solids content of less than 3,000 mg/L
Class G-II	Potable water use, groundwater in aquifers which has a total dissolved solids content of less than 10,000 mg/L, unless otherwise classified by the Commission
Class G-III	Non-potable water use, groundwater in unconfined aquifers which has a total dissolved solids content of 10,000 mg/L or greater; or which has total dissolved solids of 3,000–10,000 mg/L and either has been reclassified by the Commission as having no reasonable potential as a future source of drinking water or has been designated by the Department as an exempted aquifer pursuant to Rule 62-28.130(3), <i>F.A.C.</i>
Class G-IV	Non-potable water use, groundwater in confined aquifers which has a total dissolved solids content of 10,000 mg/L or greater

62-522: Groundwater Permitting and Monitoring Requirements

Permitting and monitoring requirements for discharge to groundwater are defined, including general provisions, dimensions of zones of discharge, permit renewal and modification procedures, exemptions, and monitoring requirements. These criteria are applicable to percolation ponds, deep well injection, land spraying, reuse, and any other concentrate management alternative that could result in migration of demineralization concentrate into groundwater.

Per 62-522.300.5, *F.A.C.*, concentrate from potable water demineralization plants is exempt from obtaining a zone of discharge in order to discharge to groundwater, provided the applicant demonstrates that the receiving unconfined aquifer exhibits a natural background total dissolved solids concentration exceeding 1,500 mg/L. Such installations cannot cause violation of primary or secondary drinking water standards at any private or public water supply well outside of the installation's property boundary.

62-528: Underground Injection Control

Chapter 62-528, *F.A.C.*, is the primary regulation governing underground injection of demineralization concentrate. The UIC regulations protect the groundwater sources of drinking water within the state and prevent the degradation of aquifer water quality adjacent to the injection zone that could potentially be used for other purposes. This chapter governs the construction and operation of injection wells in such a manner that the injection fluid remains in the determined injection zone and is not allowed to interchange between aquifers.

The chapter includes eight sections, defined as follows:

- Part I (general information)
- Part II – Criteria and Standards for Class I and Class III Wells
- Part III – Class I Well and Class III Well Permitting
- Part IV – Criteria and Standards for Class IV Wells
- Part V – Criteria and Standards for Class V Wells
- Part VI – Class V Well Permitting
- Part VII – Specific Permits; Requirements
- Part VIII – General Permits

General descriptions of each class of well are as follows:

Class I wells are technologically sophisticated wells that inject large volumes of hazardous and non-hazardous wastes, including municipal wastewater, into deep, isolated rock formations that are below the lowermost underground source of drinking water.

Class II wells inject fluids associated with oil and natural gas production. Most of the injected fluid is brine that is produced when oil and gas are extracted from the earth.

Class III wells inject super-hot steam, water, or other fluids into mineral formations, which is then pumped to the surface and extracted.

Class IV wells inject hazardous or radioactive wastes into or above underground sources of drinking water. These wells are banned under the UIC program because they directly threaten the quality of underground sources of drinking water.

Class V wells use injection practices that are not included in the other classes. Some Class V wells are technologically advanced wastewater disposal systems used by the desalination industry for disposal of concentrate.

Under current regulations, concentrate from desalination plants may only be injected via a Class I or Class V well. Underground injection regulations are organized almost entirely in this single chapter (62-528, *F.A.C.*) and facilitate a clear understanding of the potential acceptability of subsurface injection of concentrate. Sections of Chapter 62-528 that are pertinent to Class I and Class V wells are described below.

Part I (Sections 62-528.100–360) provides general provisions, permit processing information, public notification requirements, and other general information necessary for all classes of wells.

Parts II and III provide information on Class I and Class III wells. Class I wells require injection into an aquifer with a total dissolved solids (TDS) concentration of greater than 10,000 mg/L, acceptable transmissivity, and a secure confining unit. Concentrate injection wells are most commonly Class I. Tubing and packer are required. In addition, an emergency disposal option is required for up to three days of flow. Specific requirements are contained in Sections 62-528.400–460.

Part V – Criteria and Standards for Class V Wells (Sections 62-528.600–625) and Part VI – Class V Well Permitting (Sections 62-528.630–645)

address Class V wells specifically and include general criteria, exploratory well and testing permitting information, well construction standards, operating and monitoring requirements, and other relevant information. Class V wells apply to aquifers with a TDS of less than 10,000 mg/L and therefore may not be applicable for direct concentrate discharge.

Section 62-528.600 defines groups of Class V wells based on usage, to facilitate the determination of permitting, operating, or monitoring requirements for these wells. A total of eight groups are defined in Section 62-528.300(1)(e). Demineralization concentrate falls under Group 4, Type d:

Non-hazardous industrial and commercial disposal wells, which include laundry waste wells, dry wells, injection wells associated with aquifer remediation projects, desalination process concentrate wells, and nuclear disposal wells used to inject radioactive wastes, provided the concentrations of the waste do not exceed drinking water standards contained in Chapter 62-550, F.A.C.

To obtain a permit for a Class V demineralization concentrate well, an exploratory well is required to determine the feasibility of the underground injection at the proposed site. Section 62-528.603 defines exploratory well construction and testing requirements.

Section 62-528.605 defines construction standards for Class V wells. Both exploratory and operational Class V concentrate wells are required to have tubing and packer, among other requirements.

Section 62-528.610 characterizes operational requirements for Class V wells, including the need for pretreatment of fluids as necessary for the fluid to comply with applicable water quality standards. Typical pretreatment of concentrate includes dilution with freshwater and/or mixing with treated reclaimed water.

Sections 62-528.615–625 provide Class V requirements for monitoring, reporting, and plugging and abandonment.

In Part VI, 62-528.630–645, specific permitting requirements are defined. A Class V concentrate well involves a multi-phased approval process. A permit application must be submitted for construction of an exploratory well. Following collection and submission of data from the exploratory well, approval must be granted for construction of the full-scale well. Following collection and submission of data from the full-scale well,

approval must be granted for operation of the well. A necessary and critical measure of the viability of a Class V well is the adequacy and preservation of the integrity of the confining beds between aquifers. These criteria are outlined in Part VI.

62-550: Drinking Water Standards, Monitoring, and Reporting

The drinking water standards and associated requirements are defined in this chapter. This information is relevant to concentrate management for those alternatives that require compliance with drinking water standards. Chloride can be one of the most critical parameters, and it is a violation of Secondary Standards when it increases above a maximum contaminant level of 250 mg/L. The regulations in this chapter include restrictions on discharge or migration of concentrate to certain classes of groundwater, such as Classes G-I and G-II. These concerns would apply to land spraying, percolation ponds and potentially other alternatives. Demineralization concentrate generally will not comply with drinking water standards. Therefore, options that require compliance with drinking water standards are not typically viable. However, exceptions for up to three parameters may be granted under the UIC rules. This opens up the opportunity for dilution and mixing of demineralization concentrate with treated domestic effluent and for combined disposal.

62-600: Domestic Wastewater Facilities

The requirements for domestic wastewater facilities are defined in this chapter, including the characteristics of the influent water necessary to meet the domestic wastewater classification (62-600.200(25), *F.A.C.*). The maximum amount of demineralization concentrate that can be discharged to a domestic wastewater facility is dependent upon the resulting changes to influent quality and the ability to meet the classification requirements. In addition, each FDEP office, depending on the type of industrial waste, may require pretreatment of the waste consistent with Chapter 62-625 prior to mixing. Therefore, at this time the demineralization concentrate must be mixed with the raw wastewater and receive complete treatment with the domestic wastewater.

62-610: Reuse of Reclaimed Water and Land Application

This chapter addresses all forms of domestic wastewater reuse, reclaimed water, and land application. It only applies to demineralization concentrate when it is blended with domestic reclaimed water. Sections include the following:

Part I – General

Part II – Slow-Rate Land Application Systems; Restricted Public Access

Part III – Slow-rate Land Application Systems; Public Access Areas, Residential Irrigation, and Edible Crops

Part IV – Rapid-Rate Land Application Systems (Rapid Infiltration Basins and Absorption Fields)

Part V – Ground Water Recharge and Indirect Potable Reuse

Part VI – Overland Flow Systems

Part VII – Industrial Uses of Reclaimed Water

Part VIII – Permitting

Part IX – Forms and Instructions

Parts II and III address slow-rate land application systems such as spray irrigation. Part IV identifies rules and regulations associated with rapid-rate land application systems such as rapid infiltration basins and percolation ponds. These sections provide pertinent information regarding the requirements for such disposal methods. While the FDEP office governing the SJRWMD service area has granted permits for concentrate mixing with reclaimed domestic wastewater and disposal via rapid infiltration basins and percolation ponds, this practice is limited.

Parts V, VI, and VII are generally not applicable to demineralization concentrate management.

Part VIII – Permitting provides detailed information related to issuance of domestic wastewater reuse permits. Of most importance is subsection 62-610.865 – Blending of Demineralization Concentrate with Reclaimed Water. Per this regulation, all land application and reuse projects must be designed to meet the groundwater standards at the edge of a zone of discharge. These standards, for the most part, are the primary and secondary drinking water standards. Given the high concentration of inorganic constituents in concentrate and the relatively limited opportunity for dilution, the reclaimed water blend normally must come close to meeting the groundwater standard as it is applied to the land. This puts practical limits on using large quantities of demineralization concentrate in a blending operation with reclaimed water.

62-620: Wastewater Facility and Activities Permitting

This chapter addresses permitting requirements for any wastewater facility or activity that will reasonably be expected to be a source of pollution. This includes domestic and industrial facilities and is the key chapter associated with demineralization concentrate permitting. Permit applications necessary for a demineralization concentrate project are

identified in 62-620.910. This chapter will likely undergo amendment in pending rule-making efforts, described in the Proposed and Pending Regulations section of this document.

62-650: Water Quality Based Effluent Limitations

This chapter contains the procedures for establishing water quality based effluent limitations (WQBELs) and applies to all surface water discharges. The intent of the regulation is to ensure that no wastes are discharged to any waters of the state without first being given the level of treatment necessary to protect the designated uses of the water. Criteria are provided to establish discharge water quality requirements based on one of the following:

- Technology based effluent limit
- Level 1 WQBEL
- Level 2 WQBEL

Criteria for each method of establishing an effluent limit are provided. Technology based effluent limits do not preclude compliance with surface water quality criteria. Level 1 WQBELs are based on the availability of sufficient data to determine that the current quality of the receiving water body meets standards and will continue to do so with the introduction of the concentrate. Level 2 WQBELs involve an assessment of the assimilative capacity of a water body and setting WQBELs by simulating and predicting water quality impacts.

62-660: Industrial Wastewater Facilities

This chapter contains the procedures for permitting an industrial wastewater facility. This includes definitions for industrial wastewater and effluent limitations, both applicable to demineralization concentrate. In addition, there are specific definitions for exemptions that may apply to certain demineralization concentrate projects or situations.

Proposed and Pending Regulations

Pursuant to Senate Bill 536, signed in June 2001, Section 403.0882, *FS*, was amended. The amended statute states that the Legislature finds and declares that it is in the public interest to conserve and protect water resources, provide adequate water supplies and provide for natural systems, and promote brackish water demineralization as an alternative to withdrawals of freshwater, groundwater, and surface water. This is to be accomplished by removing institutional barriers to demineralization and

through research to advance water and wastewater byproduct treatment technology, sound waste byproduct disposal methods, and regional solutions to water resource issues.

Key changes to Section 403.0882, *FS*, include:

1. FDEP is to develop rules that will address demineralization concentrate regulatory issues, including:
 - a. Permit application forms for demineralization concentrate disposal
 - b. Specific options and requirements for demineralization concentrate disposal
 - c. Specific requirements and accepted methods for evaluating mixing of effluent in receiving waters
 - d. Specific toxicity provisions
2. For surface water discharges, failure of whole effluent toxicity tests predominately due to the presence of constituents to be specifically identified in the regulations as naturally occurring in the source water may not be the basis for denial of a permit, provided that the volume of water necessary to achieve water quality standards is available within a distance less than or equal to two times the natural water depth at the point of discharge under all flow conditions
3. Specific permitting requirements for small water utility businesses (i.e., those discharging <50,000 gallons per day)
4. Specific permitting requirements for discharge of demineralization concentrate to Outstanding Florida Waters

Senate Bill 536 will result in revised regulations that should provide a clearer permitting process for demineralization concentrate management and discharge. Therefore, the information presented herein regarding the permitting process will require revision following development of the new rules.

In addition, and not directly associated with legislation or rulemaking for demineralization concentrate discharge, FDEP is considering changes to the surface water quality standards, antidegradation permitting requirements, identification of impaired waters, and potential reclassification of certain waters. These changes could ultimately impact discharges of all types, including demineralization concentrate.

OVERVIEW OF PERMITTING PROCESS

Developing a viable demineralization water treatment plant in Florida is contingent upon obtaining necessary permits for the demineralization concentrate management component of the project. As described previously, FDEP represents the primary and most important agency associated with concentrate management. Demineralization concentrate is regulated by FDEP through issuance of the appropriate permit for any of the management alternatives proposed. Various components of the *Florida Administrative Code* are integrated into FDEP's evaluation of the permit application.

Given the varying requirements depending upon application, this section defines the primary steps associated with a demineralization concentrate management permitting effort, as determined by the management approach.

The following demineralization concentrate management options are addressed:

1. Underground injection
2. Surface water discharge
3. Ocean outfalls
4. Blending with wastewater effluent
5. Brackish wetlands discharge
6. Other methods

The information presented herein is representative of a typical application and provides an initial guide as to FDEP's permitting requirements and processes that should be expected. However, site-specific conditions render every concentrate permit effort unique. In addition, agencies other than FDEP may become the critical factor in determining the acceptability of a project, such as projects that would impact endangered or threatened species.

The regulations contained within the *Florida Administrative Code* are not specific to concentrate and in many cases require policy decisions on the part of FDEP for interpretation of a permit application and issuance of a permit. Therefore, it is critical to understand the challenges faced by FDEP industrial wastewater permitting personnel and the need to begin pre-application permitting efforts well in advance of any demineralization water treatment plant project.

In addition, the lack of a specific regulation for concentrate permitting creates an uncertain environment for the municipal water treatment community. The amendments to Section 403.0882, *FS*, pursuant to Senate Bill 536, will result in development of concentrate-specific regulations and is intended to provide a consistent approach for FDEP permitting personnel to follow. Therefore, future permitting efforts may differ from those presented below.

UNDERGROUND INJECTION

Obtaining an FDEP permit for underground injection of demineralization concentrate begins with the requirements of Chapter 62-528, *F.A.C.*, and identification of the type of well to be constructed. Class I and Class V wells are the two viable candidates for concentrate projects.

Primary aquifer considerations for a Class I well are:

- Suitable transmissivity
- Aquifer TDS greater than 10,000 mg/L
- Confining zone is present

If the fluid is non-hazardous, as is typical for demineralization concentrate streams, and suitable geology exists, then the demineralization concentrate will not need to meet other water quality standards and the project has reasonably high probability of being permitted. Class I wells are most common.

Aquifer considerations for a Class V well are as follows:

- Suitable transmissivity
- Confining zone is present

If the aquifer TDS is less than 10,000 mg/L or if the fluid can migrate to an underground source of drinking water (USDW), then fluid must meet drinking water standards. If the aquifer TDS is greater than 10,000 mg/L and confined from a USDW or absent of a USDW, then it will not need to meet other groundwater quality standards. Given the elevated levels of TDS and other constituents in many concentrate streams, drinking water standards typically cannot be met.

However, certain projects, such as softening applications or treatment of fresh or slightly brackish water, may be eligible for a Class V well permit. In addition, FDEP has the authority to issue an exemption for parameters that exceed drinking water standards. An exemption will only be granted if exceeding secondary standards and the state primary standard for

sodium. An exemption is renewable with the permit and requires a fee that is currently \$6,000 per parameter. At least one reverse osmosis WTP operates a Class V concentrate well, with a TDS less than 10,000 mg/L and exemptions for certain secondary standards.

Once the class of well has been selected, FDEP will review information provided by the applicant to determine the steps that will be required for issuance of a UIC permit. If insufficient information is available on the hydrogeologic environment, then FDEP may require an exploratory well, in which case a three-phased permit process would result:

1. Approval for construction of the exploratory well. This well will be used to obtain additional subsurface information and may eventually be used as a monitoring well.
2. Approval for construction of the full-scale well. If the information from the exploratory well is acceptable, the permit for construction of the full-scale well may be issued. Information gained following construction of the full-scale well must be submitted as part of an engineering report and will be used to evaluate issuance of an operating permit.
3. Approval of an operating permit. Only following receipt of acceptable information from both the exploratory well and the full-scale well will an operating permit be issued.

Of great importance is the potential for FDEP to deny further and subsequent approvals at any point in the process described above. A municipality may invest funds in an exploratory well and possibly a full-scale well only to find that FDEP will not issue the operating permit due to concerns over transmissivity, confining layers, or other issues. The large capital expenditure (typically over \$2M) and the uncertainty and financial risk associated with deep well injection are such that careful consideration should be given before a decision is made. Collection of detailed hydrogeologic information as well as preliminary meetings with FDEP is recommended.

One specific area of interest to FDEP is the solubility level of the various constituents concentrated by the desalination process. The main concern is with the potential for precipitation when some parameters at near supersaturated levels in the concentrate mix with the same parameters at nearly saturated levels in the native waters of the receiving formation. This potential for the creation of precipitates of various concentrated salts inside the well would endanger the permeability of the receiving aquifer. FDEP often requires bench studies of solubility and precipitate formation

in mixed media with similar hydrologic characteristics as the receiving aquifer.

Once an underground injection well has been approved, the mechanical integrity of the well must be demonstrated every five years. A minimum of two monitoring wells will need to be constructed to provide monthly monitoring of the injection well. In addition, an emergency disposal alternative is required and will need to accommodate at least three days of flow. In some cases, the redundancy requirements for the continued operation of potable water treatment facilities can lead to the requirement for two separate injection wells. Any additional permits associated with this alternative disposal method must also be procured. This duplicate permitting effort may also be a critical factor in determining viability of underground injection alternatives.

Finally, the construction of Class I or Class V wells must follow design standards outlined by FDEP, which include tubing and packer construction, testing during drilling and construction, and testing upon completion of well. Due to high construction costs, with drilling and construction costs on the order of \$2–5M per well, underground injection is most applicable for larger water treatment plants.

In summary, a feasibility study is recommended prior to pursuing underground injection. Also, FDEP is required under their primacy agreement with EPA to form a Technical Advisory Committee (TAC). This TAC brings into the permit process the opinions of diverse agencies including EPA, USGS, SJRWMD, the local county health department, and the local county environmental regulatory agency, in addition to the local office of FDEP and the FDEP UIC Tallahassee office.

SURFACE WATER DISCHARGE

Discharge of concentrate to a surface water requires an NPDES permit. The permitting process brings together numerous portions of the *Florida Administrative Code* and can be complex. Surface water discharges are more likely to result in the need for discretionary decisions by FDEP permitting staff when compared to other alternatives such as underground injection.

The first and foremost factor associated with a surface water discharge is the classification of the receiving water. The definition for each class is presented below.

Class I	Potable water supplies
Class II	Shellfish propagation or harvesting
Class III	Recreation, propagation and maintenance of a healthy, well-balanced population of fish and wildlife
Class IV	Agricultural water supplies
Class V	Navigation, utility, and industrial use

While each situation is unique and the regulations are complex, every surface water permit application is reviewed for compliance in four main areas:

1. Antidegradation policy and WQBEL (antidegradation is only applicable to new or increased discharges)
2. Compliance with surface water criteria and mixing zone limitations
3. Impacts of tidal influence
4. Toxicity of demineralization concentrate
5. Whether the demineralization concentrate contributes to an existing impairment of the surface water/WQBEL

The antidegradation policy is defined in 62-302.300, *F.A.C.*, and requires abatement of water pollution and conservation and protection of Florida's natural resources and scenic beauty. The antidegradation policy was adopted by the Commission in 1989. In addition to requiring compliance with water quality standards that were originally developed and adopted in 1979, the policy requires that any degradation of existing background quality be found to be clearly in the public interest. Revisions to the water quality standards are considered every three years (triennial review) in accordance with the Clean Water Act. The water quality criteria are listed in 62-302.500-530, *F.A.C.*

FDEP's application of the antidegradation policy includes a variety of intentionally subjective criteria that are applied uniquely to each specific permit scenario. There is a "weighing" of various public interest criteria, including economic and social concerns, against the potential for degradation of the state's valuable water resources. An excerpt from 62-302.300, *F.A.C.*, best explains the purpose behind the flexibility:

62-302.300.10.b.1 – The Department's rules that were adopted on March 1, 1979, regarding water quality standards are based upon the best scientific knowledge related to the protection of the various designated uses of waters of the state.

62-302.300.10.b.2 – The mixing zone, zone of discharge, site-specific alternative criteria, exemption, and equitable allocation provisions are designed to provide an opportunity for the future consideration of factors relating to localized situations which could not adequately be addressed in this proceeding, including economic and social consequences, attainability, irretrievable conditions, natural background, and detectability.

62-302.300.10.d – Without the moderating provisions described in b.2 above, the Commission would not have adopted the revisions described in b.1 above nor determined that they are attainable as generally applicable water quality standards.

While some latitude may exist depending upon site-specific conditions, it is important to compare the expected concentrate quality with the water quality standards as soon as possible. Projects that meet all water quality criteria, although rare, greatly simplify the permitting process.

In addition, the anti-degradation policy requires that the Department consider and balance four factors, paraphrased below (see 62-4.242, F.A.C.):

1. Whether the proposed project is important to and is beneficial to the public health, safety, or welfare
2. Whether the proposed discharge will adversely affect conservation of fish and wildlife, including endangered or threatened species, or their habitats
3. Whether the proposed discharge will adversely affect the fishing or water-based recreational values or marine productivity in the vicinity of the proposed discharge
4. Whether the proposed discharge is consistent with any applicable Surface Water Improvement and Management Plan that has been adopted by a water management district and approved by the Department

Each permit application is evaluated on an individual basis to ensure that the Department has reasonable assurance that the proposed facility will meet applicable water quality standards. Staff members and the Department must make discretionary decisions, balancing these factors, with each surface water permit application. Since the majority of membrane concentrate discharges are related to public water supply facilities, they are considered to be beneficial to the public health, safety, and welfare in most, but not all, cases. However, the economic analysis

requirements may often point to other alternatives for disposal (e.g., underground injection control) that, although more costly, can be implemented and avoid any degradation of surface waters.

Mixing zones may be granted for dilution of concentrate, if no pre-dilution takes place at the treatment facility. The applicant must demonstrate a current and continuing need for the mixing zone. Mixing zones are commonly needed for concentrate projects due to exceedance of water quality criteria such as radionuclides and acute or chronic toxicity. Criteria for mixing zones are complex and are dependent upon the type of receiving water body. Three categories of water bodies are defined and addressed differently:

1. Canals, rivers, streams, and other similar water bodies
2. Lakes, estuaries, bays, lagoons, bayous, sounds, and coastal waters
3. Open ocean waters

Open ocean waters are defined as all surface waters extending seaward from the most seaward natural 90-foot (15-fathom) isobath.

For additional information on mixing zones, 62-4.244, *F.A.C.*, should be referenced. In addition, the passage in June 2001 of Senate Bill 536 allows for approval of mixing zones for toxicity due to ionic imbalance in Outstanding Florida Waters, if certain criteria are met. This expands the classes of surface waters eligible for consideration.

Tidal influences are addressed via identification of the chloride concentrations of the water body and flow patterns. Predominately freshwaters are defined as waters in which the chloride concentration at the surface is less than 1,500 mg/L. Marine waters are those with chloride concentrations greater than 1,500 mg/L. In tidally influenced water bodies, FDEP may require dual limits, addressing both fresh and marine waters. In addition, tidally influenced water bodies pose difficult flow modeling challenges since there is reduced flow during tide reversal and, at least for a short period of time, concentrate is accumulating at the discharge location. Identification of the range of chloride concentrations for the receiving water body should be conducted as soon as possible to determine if tidal influence will be an issue in the permitting process as well as whether the receiving waters will be considered predominantly marine.

Biotoxicity requirements are identified in 62-302, *F.A.C.* – Surface Water Quality Standards for acute and chronic toxicity. For discharge of

concentrate to marine waters, FDEP typically requires assessment of the mortality rates for the mysid shrimp and silverside minnow. Certified laboratories are available in Florida and are familiar with FDEP's testing procedure requirements.

In many cases, demineralization concentrate has been found to fail biotoxicity tests due to naturally occurring constituents such as calcium, potassium, and sodium. In many cases, the relative ratio of these constituents is different than that of the proposed receiving water body, even though the concentration of total dissolved solids may be equal. This difference in the ratio of constituents has been found to cause mortality in test organisms that can be corrected by adjustment of the ratio of these ions, such as naturally occurs in free flowing surface water bodies via dilution effects. Due to the source of and solution to this toxicity, Senate Bill 536 has dictated that failure of toxicity tests due to naturally occurring constituents cannot be the cause for rejection of a permit application. Therefore, demineralization concentrate streams that fail biotoxicity tests should be evaluated to determine if naturally occurring constituents are the cause. In 1995, FDEP published a methodology for testing membrane demineralization concentrate to determine whether and to what degree observed toxicity is the result of naturally occurring constituents.

In summary, permitting of concentrate discharge to surface waters involves balancing numerous factors and considerations. The viability of a permit application is highly dependant on site-specific conditions and interpretation of regulations.

OCEAN OUTFALLS

Discharge of demineralization concentrate to the open ocean falls under the NPDES permitting requirements presented herein for surface water discharge. This section should be referenced for basic requirements of ocean discharge. Note that 'open ocean waters' are defined as all surface waters extending seaward from the most seaward natural 90-foot (15-fathom) isobath. In many instances, ocean discharges may not meet this criteria and thus would fall under the criteria for coastal waters, also addressed in the surface water discharge section herein.

As defined in 62-4.244, *F.A.C.*, requirements for ocean discharges are less stringent than that for other surface water bodies. Specific differences are:

1. Compliance with the antidegradation policy is more likely
2. Dissolved oxygen requirements are less stringent

3. Biototoxicity requirements are less stringent: the discharge can be diluted one-third its normal concentration for toxicity testing
4. Water quality standards must be met at the point of 20:1 dilution, not at the point of discharge
5. If water quality standards are met at the point of 20:1 dilution, a mixing zone exemption is not required
6. A larger mixing zone is allowed (four times larger than other surface water discharges)

Regulations require the use of a diffuser system that results in at least a 20:1 dilution before the effluent reaches the surface. In addition, the relative density of demineralization concentrate should be considered (e.g., in ocean waters, brackish demineralization concentrate will be less dense and seawater demineralization concentrate would be more dense) and appropriate diffuser and outfall structures constructed.

While FDEP requirements may be less stringent, additional agencies may become involved in an ocean outfall project. These may include the Coast Guard (navigable waterways), USACE (navigable waterways), FWC (well-being of fish and wildlife resources), and local coastal and ocean protection agencies.

In summary, ocean outfalls are a subcategory of surface water discharge, with similar permitting requirements. However, the reduced water quality requirements and the ability to discharge large quantities of water treatment plant concentrate are such that ocean discharge may be a reasonable alternative for large municipal demineralization water treatment plant projects.

BRACKISH WETLANDS DISCHARGE

Discharge of demineralization concentrate to brackish wetlands is considered a surface water discharge and requires an NPDES permit. FDEP requirements are consistent with those presented for surface water discharges.

BLENDING WITH WASTEWATER

The permitting process associated with blending of demineralization concentrate with wastewater is application-specific. Primary methods for combining demineralization concentrate and wastewater are listed below, followed by a description of the permitting approach.

1. Discharge to sewerage system or at the headworks of a wastewater treatment plant
2. Blending with wastewater effluent for
 - a. Discharge to a surface water
 - b. Subsurface injection
 - c. Reuse

Concentrate may be discharged into the sewerage system or conveyed to the headworks of a domestic wastewater treatment facility. This method is commonly used by small demineralization facilities due to the low capital costs involved. The maximum amount of industrial waste, including demineralization concentrate a domestic wastewater treatment plant may receive, is limited by the domestic wastewater facility capacity to accept the discharge as well as meet the appropriate effluent regulations. Depending on the type of industrial waste, pretreatment may be required prior to mixing. The utility selects the pretreatment in accordance with the approved pretreatment program for the utility.

Additional considerations include confirmation that the introduction of the concentrate will not affect the treatment process and that the wastewater effluent discharge permit requirements will not be impacted. If introduction of concentrate into the sewerage system does not increase the total influent flow of industrial waste above 10%, no separate permitting requirements are expected from FDEP.

Permitting requirements for blending of concentrate with treated wastewater effluent are dependant upon the fate of the combined stream. Typical management methods include surface water discharge, deep well injection, and reuse.

Discharge of blended water to a surface water must comply with NPDES permitting requirements, as described previously herein. In the event the concentrate is introduced to a wastewater effluent with an existing NPDES permit, a new or updated permit application will be required to confirm compliance with surface water discharge requirements.

Underground injection of blended water must comply with UIC permitting requirements. Given the differing requirements for concentrate and wastewater effluent, permit modification or construction of a different Class of well may be required. It is also possible that improvements will likely be required of an existing and permitted Class I well if it is to receive a blend of reclaimed water and desalination concentrate and the ratio of concentrate to reclaimed water exceeds 10%. The improvements

required will likely include a need for tubing and packer as well as fluid filled annulus and hydropneumatic fluid level control of the annular fluid.

Reuse of blended concentrate/wastewater effluent is approached cautiously by FDEP due to concerns over violation of water quality standards and impact to the environment. The applicant must submit an engineering report addressing an array of issues. Major points that should be addressed in the engineering report include:

1. Compliance with groundwater quality criteria at the edge of the zone of discharge. For the most part, water quality criteria are the primary and secondary drinking water standards. The high concentration of inorganic ions in demineralization concentrate limits the ability to meet such standards. In addition, rainfall exceeds evapotranspiration by less than 10 inches per year over much of Florida. Therefore, rainfall at the land application sites provides a limited dilution before the edge of the zone of discharge. Detailed water balances will be required in the report and possibly monitoring wells to confirm compliance.
2. Impact of sodium on percolation rates. The sodium adsorption ratio and other factors should be evaluated to determine if an adverse impact to percolation rate would occur. FDEP generally views a sodium adsorption ratio of less than 15 to be acceptable.
3. Vegetation concerns. Vegetative concerns may result from salinity, boron, selenium, beryllium, and other specific constituents. The report must provide reasonable assurances that the blend will not harm vegetation or crops grown on the land application site(s).
4. Operating protocol. Given the interruptible nature of a reuse supply, the report must include an operating protocol for the disinfection process (for the wastewater) and for the blending operation.
5. Monitoring requirements must be addressed and must include multiple locations (individual supplies, blend, and groundwater).

Concentrate/wastewater reuse projects will be required to have a minimum of three days of demineralization concentrate and reclaimed water storage. Storage for extended wet weather conditions must be evaluated as part of any project involving slow rate irrigation. Finally, an annual summary must be prepared and submitted to FDEP for review. Concentrate reuse has been addressed in detail via 62-610.865, *F.A.C.*, and Program Guidance Memo DOM-00-04 – Blending of Concentrate with Reclaimed Water.

OTHER METHODS

While a number of lesser-known demineralization concentrate management methods are available, most fall into one of the categories described previously. These lesser-known methods and the permitting approach are defined as follows:

1. Land Spraying and Percolation Ponds. Demineralization concentrate addressed via land spraying or percolation ponds must meet groundwater standards at edge of zone of discharge. Given the issues of percolation rates and land area required, these methods are typically not used for large-scale facilities.

Nevertheless, permits can be issued and have similar requirements as those described previously for reuse of blended concentrate and wastewater effluent. Primary concerns that must be addressed by the applicant include impact of sodium on percolation rates, protection of vegetation and crops, operational and monitoring procedures, concentrate storage, and the ability to meet drinking water standards at the edge of the zone of discharge. This latter requirement can be the most difficult to meet.

2. Evaporation Ponds. The use of evaporation ponds for management of concentrate is typically restricted to small-scale water systems in areas with a warm, dry climate, high evaporation rates, level terrain, and low land costs. As a result, most applications are in the western United States. However, a survey of Florida demineralization WTPs indicates at least one concentrate evaporation pond is operating in the state.

Permitting of an evaporation pond requires an impervious liner and development of monitoring wells. While evaporation ponds are typically designed to accommodate concentrate for the projected life of the demineralization facility, precipitation of salts is expected and must be incorporated into the depth requirements of the pond. These precipitated salts or the liquid brine may ultimately have concentrations of constituents at levels that result in a hazardous waste classification. Therefore, the ultimate fate of the concentrated salts and the future regulatory implications should be considered for any evaporation pond project.

3. Zero Discharge. Zero discharge systems have been designed for concentrate from industrial applications. The most cost-effective method involves increasing the TDS of the stream via use of a

concentrator evaporator, followed by solidification via a crystalizer. The resulting wet cake can readily be transported for disposal in a landfill. Both a concentrator evaporator and a crystalizer are thermal processes and require a source of steam or electrical power for heating. Amortized capital costs (excluding operation and maintenance costs) for a zero discharge system are typically over \$12 per 1,000 gallons of potable water produced (Mickley et al.). Therefore, zero discharge applications have been limited to select industrial applications.

Permitting of a zero discharge system would be limited to the RCRA requirements for landfill disposal. Considerations include the ability of the material to pass a toxicity characteristic leaching procedure test and confirmation that the cake does not contain levels of constituents that result in a hazardous waste classification.

4. Coastal Exfiltration Galleries – Surface water discharges include coastal exfiltration galleries, given their direct connection to coastal and ocean waters. Based on input from FDEP, standard NPDES permitting requirements would apply as described herein. However, it is also possible that the FDEP UIC group would become involved to confirm that the design and location of the galleries were such that they did not fall under UIC domain.
5. Bore Holes. A bore hole represents a Class V UIC system under the Safe Drinking Water Act. Requirements for Class V systems were defined in the Deep Well Injection section herein.

In summary, the alternative disposal methods described can all be permitted in Florida, pending compliance with specific criteria. Other factors such as costs may have more bearing on the use of these methods.

SUMMARY AND CONCLUSIONS

The rules and regulations governing the management of demineralization concentrate in Florida are primarily associated with FDEP, with additional requirements from a broad base of local, state, and federal agencies. While FDEP must grant approval for any and all concentrate projects, the involvement of other agencies may be dependant upon project-specific factors such as the selected concentrate management alternative or the location of the project.

The complexity of FDEP's regulations are such that the acceptability of a demineralization concentrate management alternative to FDEP is difficult to determine prior to detailed development of the permit application. In addition, the specifics of individual demineralization water treatment projects render each concentrate permitting effort unique.

The amendments to Section 403.0882, *FS*, pursuant to passage of Senate Bill 536, will result in rule making by FDEP that will, at a minimum, result in permit applications specific to demineralization concentrate and clarification of options and requirements for demineralization concentrate disposal. Therefore, the permitting approach defined in this document will change following this rule making. However, the federal industrial wastewater requirements that form the base of FDEP's regulations have not changed. Therefore, technical criteria may remain as stringent, but the level of effort to determine permit viability and the intentions of FDEP should be reduced. This summary of rules and regulations should be updated following completion of the rule making pursuant to Senate Bill 536.

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