INTERIM METHODS FOR EVALUATING USE SUPPORT FOR GREAT SALT LAKE, UTAH POLLUTION DISCHARGE ELIMINATION SYSTEM (UPDES) PERMITS

Utah Division of Water Quality

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TABLE OF CONTENTS

INTRODUCTION **3**

SCOPE 3

METHODS **4**

Use Support Evaluations 4

Derivation of Screening Values 5

Mixing Zones 11

Mixing Analyses 12

REFERENCES **1**

Figures

Figure 1 Process for conducting use support evaluations for Great Salt Lake UPDES Permits 8

FORWARD

This document outlines guidance to be used by Division of Water Quality staff and permittees for permitted discharges to Great Salt Lake issued in accordance with the Utah Pollution Discharge Elimination System (UPDES). The process is intended to document that the uses (designated and existing) are protected. It is intended to assist permit writers and permittees in developing logical and consistent permits and to serve as an administrative guide towards reasonable and appropriate enforcement. This document is intended solely as guidance and, as such, cannot be relied upon to create any rights, substantive or procedural, enforceable by any party in litigation with the State. The specific procedures for whole effluent toxicity (WET) testing previously included are now in the 2016 statewide WET guidance.

INTRODUCTION

In 2012, the Utah Division of Water Quality (DWQ) published the draft Great Salt Lake Water Quality Strategy (Strategy) (DWQ, 2012). The draft was revised in response to public comments and the Strategy was published in 2014 (DWQ, 2014). Core Component 1: Developing Aquatic Life Criteria for Priority Pollutants outlines the steps DWQ will take to derive numeric criteria for Great Salt Lake. Currently, only one numeric criterion is available for selenium in Gilbert Bay (Class 5A). As discussed in Component 1 of the Strategy, derivations of numeric criteria for priority pollutants are anticipated to take years under even optimistic projections of resource availability.

As discussed in the Strategy, numeric criteria are used to evaluate if existing[1] and designated uses are protected. To accomplish this evaluation, a waste load allocation[2] is performed and based on the outcome of this analysis, the DWQ permit writer determines if any of the pollutants in the effluent are present at concentrations that have “reasonable potential” to cause or contribute to an exceedance of the numeric criteria in the receiving water (EPA, 2010).

Until numeric criteria are developed, DWQ will implement an interim approach for demonstrating that the aquatic life uses of Great Salt Lake are protected for Utah Pollution Discharge Elimination System (UPDES) permits requirements.

SCOPE

The methods outlined in this guidance document are intended to be applied only to direct UPDES discharges to Great Salt Lake and upstream discharges that are not required to meet numeric criteria for the protection of aquatic life prior to discharging to Great Salt Lake. The methods apply to pollutants that do not have applicable numeric criteria. If numeric criteria become available, the methods contained herein do not necessarily apply and these pollutants will be addressed as specified in R317-8-4.2(4). Specifically, the interim methods in this guidance apply to discharges to Class 5 Great Salt Lake (Classes 5A, 5B, 5C, 5D, and 5E) (UAC R317-2-6). These methods also apply to discharges to Class 3E when the Class 3E water discharges to Class 5. In addition to complying with the Narrative Standards (R317-2-7.2), discharges to Class 3E waters must be protective of downstream uses and therefore, these discharges must be protective of Great Salt Lake’s uses. While protection of the uses and compliance with the Narrative Standards are regulatory requirements, the specific methods described herein are guidelines and are not requirements. Alternative methods or

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[1] See UAC R317-1-1, Definitions Existing Uses means those uses actually attained in a water body on or after November 28, 1975, whether or not they are included in the water quality standards (UAC R317-1-1)

[2] http://www.waterquality.utah.gov/WQM/WQlimits.htm

interpretations are acceptable provided that a demonstration can be made that the aquatic life uses are protected. Nutrients are beyond the scope of this guidance.

The recommended approach is based on UAC R317-8-4.2(4)(a)6.a. and b. that specifically addresses UPDES permitting when numeric criteria are unavailable:

> *6. Where the State has not established a water quality criterion for a specific chemical pollutant that is present in an effluent at a concentration that causes, has the reasonable potential to cause, or contributes to an excursion above a narrative criterion within an applicable State water quality standard the Director will establish effluent limits using one or more of the following options:*
>
> > *a. Establish effluent limits using a calculated numeric water quality criterion for the pollutant which the Director determines will attain and maintain applicable narrative water quality criteria and will fully protect the designated use. Such a criterion may be derived using a proposed State criterion, or an explicit State policy or rule interpreting its narrative water quality criteria supplemented with other relevant information which may include: EPA's Water Quality Standards Handbook, October 1983, risk assessment data, exposure data, information about the pollutant from the Food and Drug Administration, and current EPA criteria documents:*
> >
> > *b. Establish effluent limits on a case-by-case basis, using EPA's water quality criteria, published under section 307(a) of the CWA, supplemented where necessary by other relevant information[3];*

METHODS

This document focuses on specific modifications to DWQ's UPDES permitting process for Great Salt Lake when numeric criteria are not available and is not intended to be a comprehensive guide to permitting. The following sections describe the interim procedures for use support evaluations, implementation of whole effluent toxicity (WET) testing, and mixing zones for Great Salt Lake.

Use Support Evaluations

The following presents an interim screening approach for ensuring that the Great Salt Lake's water quality supports the aquatic life uses of birds and their necessary food chain (R317-2-6). Variations to the approach described herein, or alternative approaches, may be acceptable provided they are scientifically and legally supportable. Consistent with the intent of all screening methods, conservatism

[3] The rule also includes "Establish effluent limitations on an indicator parameter for the pollutant of concern…" but no guidance is currently available for this option.

should be applied as necessary to minimize the likelihood that a pollutant is improperly screened out from further consideration. Nutrients are beyond the scope of this approach.

If the data required to conduct the following evaluations are unavailable for renewing permits without changes to effluent quality or quantity[4], the permittee should identify the data gaps and formulate a plan for collecting these data. While the permittee should make every effort to complete the analyses prior to the expiration of the existing permit, permits may include requirements for future data submittals, when appropriate, to address data gaps during the upcoming permit cycle. However, the available data and analyses at permit renewal must be sufficient to support that the effluent will not harm the uses of the receiving water.

Derivation of Screening Values

Screening values are generic pollutant concentrations that are intended to define the threshold below which adverse effects are unlikely. When applied, comparisons to screening values are intended to rapidly and efficiently identify pollutants that don't require any further evaluations because the screening values are intended to be much more likely to overestimate the potential for adverse effects than to underestimate. The exceedance of a screening value is not a reliable indicator that adverse effects will occur. Rather, an exceedance indicates that additional investigations or more refined analyses are needed.

To select appropriate screening values, the organisms to be protected have to be identified. DWQ has begun compiling a species list of resident species for Great Salt Lake in support of the derivation of numeric criteria. These species are summarized from an aquatic life use workshop convened by DWQ in 2015. After the Great Salt Lake species list is completed, DWQ anticipates using the EPA (2013) deletion process as part of the recalculation procedure for deriving site-specific aquatic life numeric criteria for the less saline locations of the Lake where salinities range from fresh to approximately ocean waters (*i.e.*, portions of Farmington and Bear River Bays). The species that have been identified (e.g., three species of daphnia , dragonfly larvae, amphipods and snails) as being residents of the less saline portions of Great Salt Lake support that the recalculation procedures applied to existing freshwater numeric criteria, supplemented with any available more recent toxicity data, is a viable methodology for deriving numeric criteria for the Lake.

DWQ expects that the less saline waters of Great Salt Lake will have fewer taxonomic families represented than were used to derive the national freshwater chronic criteria for protection of aquatic

[4] These renewing permits are not required to conduct a Level II antidegradation review in accordance with R317-2-3.5.b.1.(b).

life. If sensitive species included in the derivation of the national freshwater criteria are not likely to be present in these waters, application of EPA's deletion procedure is expected to result in criteria that are less stringent than the freshwater criteria. An exception would be if avian species are more sensitive to a pollutant than the aquatic biota such as was the case with selenium and likely will be the case for pollutants that biomagnify, such as methylmercury. The presence of freshwater organisms supports the use of freshwater criteria as screening values and the use of freshwater species for WET testing.

For Great Salt Lake waters with salinity greater than ocean water, the criteria are anticipated to be based on Great Salt Lake-specific species toxicity testing (*e.g.*, brine shrimp and brine flies). Great Salt Lake species would have to be more sensitive for the criteria to be more stringent than the freshwater criteria. The available toxicity data for brine shrimp and limited data for brine flies suggest that these species are relatively tolerant of metals and organic pollutants (Persoone and Wells, 1987; Gajbhiye. and Hirota. 1990; DWQ, 2013). Therefore, freshwater criteria are concluded to be appropriate as screening values for discharges to Great Salt Lake.

If pollutant concentrations are less than or equal to the screening values, adverse effects to Great Salt Lake biota are unlikely and the uses are likely supported. If the screening values are exceeded, additional data are required to evaluate the potential for adverse effects and the support status is uncertain.

The process by which UPDES permitted discharges will be evaluated in the interim is outlined as a series of steps in Figure 1. The steps are arranged in order of increasing effort and complexity. The steps do not have to be followed sequentially and the permittee may elect to proceed directly to the more complex steps without completing the initial steps. The final outcome must be that the discharge will not impair the designated and existing uses or lead to a violation of R317-2-7 (Water Quality Standards). Adequate documentation of the process and outcome is essential and will become part of the administrative record.

Step 1. Quantify Pollutant Concentrations. The pollutant concentrations are the maximum estimated concentration for the effluent or desired as a permit limit by the permittee (EPA, 1991). If the pollutant concentrations are based on actual discharge data, the maximums should be estimated taking into account operational variability and dissolved fraction (EPA, 1991) using the methods described in Utah's Reasonable Potential Guidance (2016). All priority pollutants should be considered. Consistent with the existing UPDES permitting process[5], pollutants can be excluded based on knowledge of the nature of the discharge and/or treatment process or analytical data (assuming analytical detection limits are adequate).

Step 2. The maximum expected effluent pollutant concentrations from Step 1 are compared to the chronic criteria for Class 3 waters found in R317-2-14. Unless data are available to the contrary, concentrations that are less than the Class 3 criteria can be concluded to be protective of Great Salt Lake's aquatic life uses. Concentrations greater than the Class 3 criteria are carried forward to Step 3. Note that the numeric criteria for Classes 3A through 3D are the same for toxics. For discharges to Great Salt Lake, the numeric criteria for Class 3D (protected for waterfowl, shore birds and other water-oriented wildlife including the necessary aquatic organisms in their food chain) can be applied as screening values based on the rationale provided earlier in this section.

The chronic criteria should be adjusted for hardness as shown in R317-2-14 based on the hardness of the effluent and receiving water. Currently, adjustments for hardness up to 400 mg/l $CaCO_3$ are supported. Adjustments for higher hardness will be considered with adequate scientific justification.

If analytical data alone are used to exclude pollutants from further consideration, the detection limit should be less than the comparison criteria. If the detection limits are higher than the criteria, refined analytical techniques should be attempted to accurately estimate pollutant concentrations. This situation is anticipated for mercury but may also apply to other pollutants. Depending on site-specific circumstances, the additional characterization efforts may be temporary. If lower detection limits are impracticable, DWQ should be consulted for guidance.

Step 3. This screening in this step is invalid for pollutants that have been concluded to be impairing the beneficial uses. For pollutants that have not been concluded to be impairing the beneficial uses, the effluent concentrations are compared to the receiving water concentrations before mixing. By definition, pollutant concentrations less than ambient do not degrade water quality. The receiving water concentrations must be adequately characterized to support these comparisons and collection of additional site-specific data may be necessary. The permittee should prepare a Sampling Plan for DWQ review and only collect data after receiving approval from DWQ. Comparisons should be consistent with the methods outlined in DWQ's (2012a) Waste Load Allocation procedures.

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[5] See EPA Permit Application NPDES Forms 2A, 2C, or 2D, as appropriate, http://www.waterquality.utah.gov/UPDES/updes_f.htm

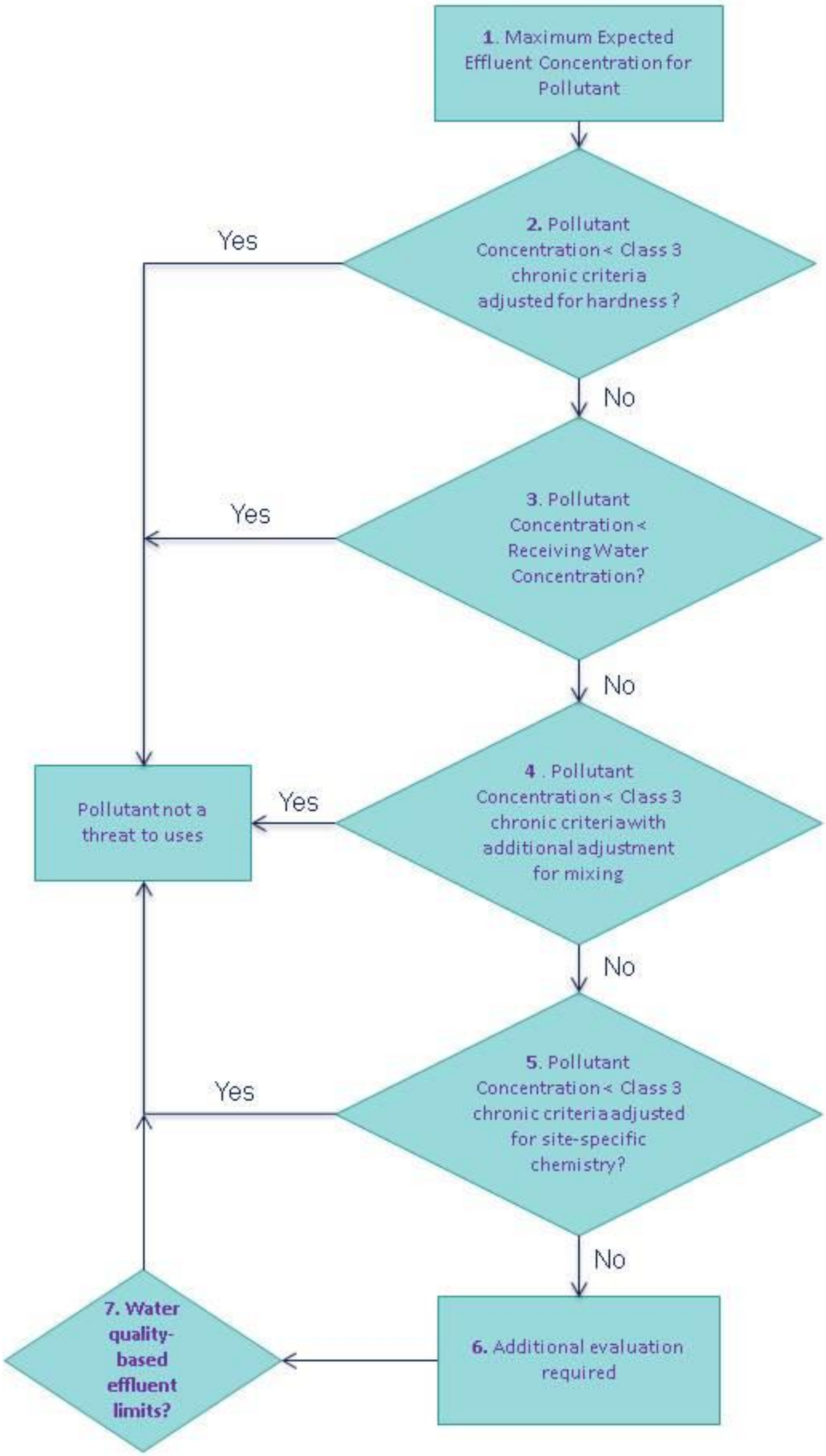

FIGURE 1 PROCESS FOR CONDUCTING USE SUPPORT EVALUATIONS FOR GREAT SALT LAKE UPDES PERMITS

Step 4. Mixing can be considered, when consistent with the requirements of R317-2-5, for the remaining pollutants. The concentrations adjusted for mixing are compared to the chronic criteria adjusted for hardness. For POTW's with a pretreatment program, these concentrations are typically used in the derivation of local limits. Depending on the mixing assumed, comparisons may also have to be conducted for acute criteria. When a pollutant concentration after mixing is less than the criterion, these concentrations can be concluded to be protective of the use. See the Mixing Zone section later in this document for more information on the application of mixing zones. Pollutants with concentrations greater than the criteria are carried forward to Step 5 for additional evaluation.

Step 5. In this step, the freshwater criteria may be further adjusted with site-specific water chemistry data. The EPA approved biotic ligand model (BLM), such as is available for copper and zinc, can be applied to be fresh waters. These models require the collection of additional site-specific data to support the modeling. These investigations can be used to support development of site-specific criteria or effluent limits. For Great Salt Lake specifically, these investigations can only be used to support the development of effluent limits because of the lack of numeric criteria. When a pollutant concentration is less than the criteria, the concentrations can be concluded to be protective of the use. Metals with conversion factors (see Table 2.14.3 in R317-2-14) can be adjusted by measuring the amount of dissolved pollutant and total pollutant to obtain a site-specific conversion factor. Details can be found in EPA's (1996) Metals Translator Guidance. Pollutants with concentrations greater than the criteria are carried forward for additional evaluation.

Step 6. The methods for evaluating the pollutants remaining after the previous screening steps are dependent on the specific pollutant and other site-specific conditions which precludes providing detailed methodologies. The default conversion factors are published in Utah's Water Quality Standards. Another option is use of a water effects ratio (using receiving water for dilution in chronic testing versus laboratory water). Water effects ratios are site-specific and determined by conducting a whole effluent toxicity (WET) test using laboratory (i.e., clean) water for dilution and comparing the toxicity to a WET test conducted using receiving water for dilution. For most discharges to Great Salt Lake, measuring water effect ratios may be impractical because of the lack of dilution water (effluent dependent) or salinity of the receiving water. Using saline receiving water for dilution in the WET test could result in an increase in observed effects that are due to salinity. However, ocean WET test organisms may be a viable alternative for situations when the dilution water is appropriate for ocean test organisms.

Any remaining pollutants that do not meet the screening benchmarks should be evaluated using methods that demonstrate that the uses will not be impaired by the pollutant. No specific guidance is available for how to conduct these evaluations but portions of EPA's *Guidance for Ecological Risk Assessment* (1996) and *Interim Process for Designing and Conducting Ecological Risk Assessments at Superfund Sites* (1997) can be adapted. These evaluations are anticipated to require specialized expertise in toxicology and risk assessment. Close coordination with DWQ is essential because of the lack of specific guidance and complexity of Great Salt Lake.

A use attainability analysis (UAA) can be conducted where the best attainable use is determined which may support that less stringent, site-specific effluent limitations are appropriate. A UAA may also be an effective way to evaluate effluent-dependent receiving waters. Because of their complexity, UAAs may require significant resources and any changes to the uses must be adopted by rulemaking. UAAs are beyond the scope of this document. More information on UAAs can be found at http://water.epa.gov/scitech/swguidance/standards/uses/uaa/index.cfm.

Step 7. If the outcome of Step 6 is that the effluent pollutant concentrations cannot be concluded to be protective of the aquatic life uses, then the effluent pollutant concentrations must be reduced. If the outcome of Step 6 is that the effluent pollutant concentrations are protective of the uses, no further evaluation is required. Pollutants that have "reasonable potential" to cause or contribute to the exceedance of a water quality standard must have water quality-based effluent limits.

Mixing Zones

According to EPA's *Technical Support Document for Water Quality-based Toxics Control* (TSD) (EPA, 1991) and Utah's Mixing Zone Policy in UAC R317-3-5,, "a mixing zone is an area where an effluent discharge undergoes initial dilution and is extended to cover the secondary mixing in the ambient waterbody. A mixing zone is an allocated impact zone where water quality criteria can be exceeded as long as acutely toxic conditions are prevented." Water quality criteria may be exceeded within the mixing zone but the criteria must be met at the boundary. Given the unique environment of Great Salt Lake, with its shallow water depth and high salinity levels, special considerations are required for determining the allowable mixing zone and the dilution of discharges at the mixing zone boundary.

The elevation of the open waters of the Great Salt Lake varies with the climatic cycle and seasonally. The area between approximately 4,208 feet and the Great Salt Lake open waters are considered Great Salt Lake transitional waters, which contain brackish fringe wetlands. Freshwater standards apply above approximately 4,208 feet, which by UAC is considered outside the Great Salt Lake.

The mixing zone rule in Utah Administrative Code (UAC R317-2-5) specifies the maximum dimensions of the mixing zone, including discharges to lakes and reservoirs. The rule does not specify the allowable mixing zone for discharges to wetlands although EPA Region 8 (1995) policy is no mixing zones for wetlands. For discharges to fringe wetlands within the Class 5E Transitional Waters of Great Salt Lake, based on the assumption that the wetland will not have standing water during critical dry periods, no mixing zones are allowed[6]. In the case where Transitional Waters have standing water even during critical dry periods, the maximum allowable mixing zone for discharges to lakes and reservoirs will apply.

R317-2-5. Mixing Zones is as follows:

A mixing zone is a limited portion of a body of water, contiguous to a discharge, where dilution is in progress but has not yet resulted in concentrations which will meet certain standards for all pollutants. At no time, however, shall concentrations within the mixing zone be allowed which are acutely lethal as determined by bioassay or other approved procedure. Mixing zones may be delineated for the purpose of guiding sample collection procedures and to determine permitted effluent limits. The size of the chronic mixing zone in rivers and streams shall not to exceed 2500 feet and the size of an acute mixing zone shall not exceed 50% of stream width nor have a residency time of greater than 15 minutes. Streams with a flow equal to or less than twice the flow of a point source discharge may be considered to be

[6] Also see EPA Region VIII Mixing Zones and Dilution Policy (1995)

totally mixed. The size of the chronic mixing zone in lakes and reservoirs shall not exceed 200 feet and the size of an acute mixing zone shall not exceed 35 feet. Domestic wastewater effluents discharged to mixing zones shall meet effluent requirements specified in R317-1-3.

5.1 Individual Mixing Zones. Individual mixing zones may be further limited or disallowed in consideration of the following factors in the area affected by the discharge:

a. Bioaccumulation in fish tissues or wildlife,

b. Biologically important areas such as fish spawning/nursery areas or segments with occurrences of federally listed threatened or endangered species,

c.Potential human exposure to pollutants resulting from drinking water or recreational activities,

d. Attraction of aquatic life to the effluent plume, where toxicity to the aquatic life is occurring,

e. Toxicity of the substance discharged,

f. Zone of passage for migrating fish or other species (including access to tributaries), or

g. Accumulative effects of multiple discharges and mixing zones.

The mixing zone rule applies to discharges to the open waters of the Great Salt Lake. Unless the rule is modified, the size of the chronic mixing zone to the open waters of the Great Salt Lake shall not exceed 200 feet and the size of an acute mixing zone shall not exceed 35 feet.

Mixing Analyses

This section summarizes the methods for conducting mixing analyses for discharges to Great Salt Lake.

For discharges to freshwater lakes and reservoirs, the lake level is assumed to be at the Ordinary High Water Mark (OHWM). Due to the long term fluctuation of the Great Salt Lake water surface elevation over multiple years, the OHWM may not occur during a given permit period. For the purposes of the mixing analysis, the average lake elevation over the previous five years will be assumed.

Fresher-water discharges to the Great Salt Lake are buoyant, dispersing in a thin layer over the denser, more saline lake water. In addition, due to the shallow lake depth, there can be boundary effects associated with the lake bottom and the shoreline. Also due to the shallow lake depth, the mixing can be highly dependent on wind shear and water current. Due to these considerations, only more sophisticated mixing zone models are appropriate to simulate the discharge plume. The following tools are acceptable for evaluating the mixing zone dilution.

CORMIX[7]: EPA supported model that simulates near field concentrations of water quality constituents (Jirka et al. 1996). CORMIX is applicable to more complex discharges, including multiple pipes and diffusers, boundary interactions, and buoyant plumes and is appropriate for discharges to Great Salt Lake. The CORMIX methodology contains systems to model single-port, multiport diffuser discharges and surface discharge sources. Effluents considered may be conservative, non-conservative, heated, brine discharges, or contain suspended sediments.

Visual Plumes (VP): EPA supported model that simulates single and merging submerged aquatic plumes in arbitrarily stratified ambient flow and buoyant surface discharges (Frick et al. 2003). VP includes four different methods for simulating near-field plume behavior that may be run consecutively and compared graphically to help verify their performance. The Brooks equations are retained to simulate far-field behavior. In addition, DOS PLUMES may be selected as one of the models, giving full access to its capabilities. Note that the distribution version of this model (Version 1.0) is not supported beyond Windows XP and Windows XP is no longer supported by Microsoft.

3-D Hydrodynamic Models: Though more resource intensive to build and calibrate than CORMIX, three-dimensional hydrodynamic models, such as CE-QUAL-ICM or EFDC, are appropriate for simulating the effluent plume.

Tracer Studies: An allowable alternative to utilizing modeling tools for the mixing analysis is to conduct a tracer study to evaluate the mixing zone and estimate dilution. Note the logistics of conducting the tracer study will be made more complicated due to the presence of a thin buoyant freshwater layer over the denser brine layer. The concentration of the tracer will need to be measured at sufficient depths to adequately characterize vertical mixing within the water column.

[7] See http://water.epa.gov/scitech/datait/models/ for more information

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