

**State of New Mexico**

**Arsenic Compliance Strategy**

**August 2004**

**Drinking Water Bureau**  
**New Mexico Environment Department**

# State of New Mexico Arsenic Compliance Strategy August 2004

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## **New Mexico Environment Department Drinking Water Bureau**

# **State of New Mexico Arsenic Strategy<sup>1</sup>**

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### **Section 1. Background**

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In 1942, the U.S. Public Health Service established an arsenic drinking water standard for interstate water carriers of 0.05 mg/L (50 µg/L). On December 24, 1975, under the authority of the Safe Drinking Water Act (SDWA) of 1974, EPA issued a National Interim Primary Drinking Water Regulation (NIPDWR) for arsenic of 50 parts per billion (ppb), or (50 µg/L). While scientific studies linked arsenic in drinking water to skin cancer in humans as early as 1898, the first studies reporting dose-dependent effects came from studies published in 1968 and 1977. EPA's arsenic work reflected scientific uncertainties about health effects of low concentrations of carcinogens and animal studies suggesting that arsenic may be an essential nutrient.

The 1986 SDWA Amendments converted the 1975 NIPDWR to a National Primary Drinking Water Regulation (NPDWR), directed EPA to revise NPDWRs by 1989, and specified that maximum contaminant levels goals (MCLGs) be promulgated simultaneously with MCLs. As a result of a citizen suit brought after EPA missed the 1989 deadline, the Agency entered into a consent decree providing deadlines for issuing a new arsenic regulation. The 1996 Amendments to the SDWA included new statutory deadlines for the arsenic regulation, requiring EPA to propose a revised Arsenic Rule by January 1, 2000, and issue a Final Rule by January 1, 2001.

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### **Section 2. Arsenic Rule Summary**

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On January 23, 2001, the Environmental Protection Agency (EPA) reduced the drinking water maximum contaminant level (MCL) for arsenic from 50 ppb to 10 ppb. The new Arsenic Rule applies to all community water systems (CWSs) and non-transient non-community water systems (NTNCWSs) (40 CFR 141.62(b)). The compliance date for the revised arsenic MCL is January 23, 2006 (40 CFR 141.6(j)). To satisfy the arsenic monitoring requirements, all surface water systems must complete monitoring for the revised arsenic MCL by December 31, 2006, and all ground water systems must complete monitoring for the revised arsenic MCL by December 31, 2007 (40 CFR 141.23(c)(1)).

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<sup>1</sup> New Mexico's arsenic strategy is adapted from EPA's "Implementation Guidance for the Arsenic Rule", document # EPA-816-K-02-018

### **Section 3. Critical Issues for New Mexico**

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The Arsenic Rule will have a significant impact on the water systems and population of New Mexico. As a state that has a high percentage of igneous geology, the naturally occurring levels of arsenic will result in a large number of water systems that will have source water in exceedance of the new arsenic MCL. Based upon an evaluation of our sampling data, there are 95 water systems in New Mexico, representing a population of approximately 756,000, or 41% of the State's population, that will be affected by the new arsenic MCL.

The majority of these systems are very small, serving a population of less than 500, but larger systems are affected as well, including the City of Albuquerque, the City of Rio Rancho, and the City of Santa Fe. Although there are several options that affected water systems may choose from in order to comply with the new arsenic standard, many of these options have inherent difficulties that can make them impractical for the smaller water systems.

Specifically, small systems are typically hindered by a lack of a large funding base, lack of a sophisticated operations staff, and limited water resources. However, even for the larger, more advanced water systems, the short timeframe for implementation of this Rule relative to their ability to implement large capital improvements may prove to be just as potent a roadblock for achieving compliance with the new arsenic rule.

### **Section 4. System Compliance Strategies**

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There are two types of options from which affected water systems may choose in order to comply with the new arsenic standard, non-treatment and treatment options. The "non-treatment" options consist of either blending treated water (See Appendix D), modifying water sources (e.g. changing the well's screen interval), consolidating water sources, or replacing water sources with new sources or consolidating with another water system. The "treatment" options consist of new and existing technologies that can be implemented at a source, point of entry (EPTDS), or even Point of Use (POU) to reduce existing arsenic levels. Treatment options include reverse osmosis (RO), activated alumina (AA), ion exchange (IE) and lime softening (LS), among others. EPA also classifies some of these treatment technologies as Best Available Technologies (BAT), see Appendix C, which may impact the ability of the water system to qualify for an exemption or a variance, as discussed later. There are significant issues with each of these options, briefly outlined below.

#### *4.1 Arsenic Species, As(III) and As(V)*

One of the complicating criteria for the treatment options is the presence of arsenic at two separate valence levels, As(III), or arsenite, and As(V), or arsenate. As(III) exists in most natural water as As(OH)<sub>3</sub> and is more mobile than As(V), H(As)O<sub>4</sub>, because it is less strongly absorbed on most mineral surfaces than the negatively charged As(V), thus it is commonly more prevalent in water. Unfortunately, studies have shown that most treatment technologies are more effective

in removing As(V) as opposed to As(III), and in particular, ion exchange technologies have been shown to be very ineffective in removing As(III).

Based on this research, the majority of the treatment options, including those listed by EPA as BATs, require the arsenic to be oxidized to As(V). This may require each treatment process to include a pretreatment process to convert As(III) to As(V).

#### 4.2 *Obtaining a New Water Source*

- Capital Costs – This option is funding intensive and will most likely require a significant amount of external funding, such as loans or grants.
- Water Rights – This option may require additional water rights. Depending on the location of the new source relative to the OSE Declared Basin and relative to other sources, water rights may or may not be available. The purchase of water rights may also be capital intensive.
- Common Presence of Arsenic – Using this option, there is no guarantee that the new water source will not also be impacted by the presence of arsenic due to the ubiquitous nature of arsenic in New Mexico. A new source that meets the arsenic MCL and all other MCLs may not be available.

#### 4.3 *Blending Water Sources*

- Available Low Arsenic Sources – This option will be dependent on the water system having other low arsenic water sources available. This is further hindered by the significant percentage (38%) of the affected systems having only a single water source at this time.
- System Configuration – This option will be dependent on the water system having a transmission and distribution system capable of providing reliable blending prior to delivering water to the consumers.
- Monitoring Infrastructure – This option will be dependent on the water system having the monitoring equipment and infrastructure necessary to track the required elements of operation and quantity to allow the accurate determination of the blended arsenic levels.

#### 4.4 *Modifying Water Sources*

- Capital Costs – This option is funding intensive and will most likely require a significant amount of external funding, such as loans or grants.
- Common Presence of Arsenic - Using this option, there is no guarantee that the modified water source will not also be impacted by the presence of arsenic due to the ubiquitous nature of arsenic in New Mexico. A new source that meets the arsenic MCL and all other MCLs may not be available.

#### 4.5 *Consolidation With Another System*

- Availability of a Suitable System – Due to the extreme nature of the geography in New Mexico and the lack of a dense population base in most areas of the state, there are many water systems for which the nearest neighboring system is either in a geographically unfavorable position or not in close enough proximity to make connection economically feasible.
- Suitability of Existing System – This option is dependent on the ability of any available water system to provide water that meets the quality standards of the SDWA and to provide sufficient water for the combined consumer base. Many water systems are also hindered by aging substandard infrastructures.
- Political or Social Factors - Due to the small population based served by most small systems, the impact of political or cultural issues or disagreements within the communities can greatly impact the ability of adjacent water systems to effectively accomplish consolidation.

#### 4.6 *Installing Treatment*

- Capital Costs – This option is funding intensive and will most likely require a significant amount of external funding, such as loans or grants.
- Operations – This option may require a higher level of certified operator than under previous existing conditions. For these systems, they will also need to obtain an operator certified to the required level or risk non-compliance
- Water Usage – Many of the treatment technologies effective for the removal of arsenic generate a waste stream that may become significant relative to the total quantity of water treated. Given the limited water resources available to most water systems, the reduction in the quantity of water provided may impact the ability of the water system to provide sufficient treated water to meet the current daily needs of consumers. Note: *The reduction in quantity may be offset by implementing significant water conservation measures.*
- Water Chemistry – Due to the nature of the hydrogeology in New Mexico, the majority of the groundwater resources are very high in dissolved ion content. Many of the treatment options are not ion specific and therefore may be less effective. Additionally, full treatment of the water source may also reduce the dissolved ion content to the extent where the water becomes aggressive, which may negatively impact the water quality within the distribution system.
- Waste Handling – Under this option, several of the treatment technologies will generate a waste product that may contain a concentrated level of arsenic along with other potentially hazardous materials, such as acid or other contaminants. Use of these technologies may require a water system to investigate an acceptable waste disposal strategy. For additional details on waste disposal issues, see Appendix H.

## Section 5. State Arsenic Compliance Priorities

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Due to the large number of water systems that will be affected by the Arsenic Rule and the limited timeframe until implementation, the State of New Mexico is prioritizing compliance strategies to maximize use of limited personnel resources.

In general, the State is placing the “Burden of Proof” on the water systems. For example, regarding any submittals or determinations, it will be the responsibility of the PWS to submit the required information to allow the State to make an accurate assessment and decision regarding any compliance strategies, including exemption or variance submittals.

### 5.1 Compliance Before/After January 23, 2006

One of the key elements among the various compliance strategies is the timeframe for compliance. The State will prioritize resources to assist water systems that are:

1. Trying to achieve compliance with the Arsenic Rule by the mandated deadline; and,
2. Have a reasonable expectation of being able to come into compliance by the mandated deadline.

Water systems planning on achieving compliance after the mandated deadline will be considered a lower priority, understanding that the SDWA mandates a State response within 90 days of any exemption or variance request (40 CFR 142.21).

### 5.2 Compliance Strategy Priorities

With regards to the individual compliance strategies, each strategy will be classified into one of four tiers. The four tiers follow a progressive approach based upon compliance within the mandated timeframe and the characteristics of each strategy. Tiers One and Two are based on achieving compliance by January 23, 2006 and Tiers Three and Four are based on achieving compliance after January 23, 2006. It is important for systems to incorporate this priority structure as part of their final compliance strategy. The tiers of compliance strategies are listed below.

**These tiers will be evaluated by the State on a sequential basis. A system must address the items in each Tier before moving on to the next one, as part of their compliance strategy. For example, a system requesting a third tier option will have to show that the options available under the first and second tiers are not viable before the State will proceed with an evaluation of their compliance strategy.**

- Tier One: Low Cost or Low Complexity Options – These are compliance strategies that a water system can implement that generally have a low capital cost and/or a low level of complexity associated with them. Specific examples include: management changes or restructuring, blending of water sources, consolidation (physical or contractual) with another system.



- Tier Two: High Cost or High Complexity Options - These are compliance strategies that a water system can implement that generally have a high capital cost and/or a high level of complexity associated with them. Specific examples include: Development of a new source, installation of new treatment technologies
- Tier Three: Exemptions – Since exemptions involve a request to achieve compliance after the mandated deadline, they are considered a lower priority option, except that they must be processed by January 23, 2006 to prevent any non-compliance on the part of water system.
- Tier Four: Variances – Variances involve achieving compliance with an alternate MCL standard for arsenic. Due to the seriousness of this type of request, the documentation required to be submitted by the water system is very extensive and complex. Based on this, the State does not recommend that a PWS pursue this option, although it is available if all other avenues have been exhausted.

## **Section 6. State Compliance Strategy Implementation**

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The following is a step-by-step process, which will be followed by the State outlining the implementation procedures for the State Arsenic Compliance Strategy.

1. Identify Affected Systems – Using existing electronic and hardcopy records where necessary, the State will compile a list of PWS's that will potentially be out of compliance with the new arsenic standard.
2. Obtain Stakeholder Input Into Arsenic Implementation Strategy – Coordinate with interested stakeholders using the Drinking Water Advisory Group to review strategy documentation and obtain comment. Review of the strategy is being proposed through this avenue to maximize the contact and minimize review time due to short timeframe for implementation.
3. Draft and Send Letter to All Affected Systems – A form letter will be drafted and sent out to all affected PWS's. The letter will contain basic information regarding compliance with the new arsenic standard, the date of required compliance, and information regarding what the PWS will need to do to request an exemption or variance.
4. Schedule Meetings with all local representatives of Funding Agencies Active in New Mexico – As part of a coordination strategy, representative of the State will meet with funding agencies in New Mexico to identify upcoming funding timeframes and begin identifying a process for prioritization of funding for affected PWS's.
5. Schedule Meetings with representatives of major Technical Assistance Providers and other significant groups in New Mexico – Also part of a coordination strategy, representative of the State will meet with the technical assistance providers and other drinking water-based groups, such as the New Mexico Municipal League. The goal will be to ensure that assistance or information provided by these groups is as accurate as possible with regards to the State Arsenic Implementation Strategy.

6. Schedule Statewide Public Meetings – Public meetings will be scheduled around the state to inform the public and any other interested parties on the State Arsenic Implementation Strategy. Particular attention will be paid to the state discretionary areas, such as determination of reasonable risk to human health, etc.
7. Begin Processing Reviews of Compliance Strategies – Begin the review of submitted compliance strategies. System oversight staff will review the compliance strategies and determine compliance. The District Engineers will work with oversight staff on an as-needed basis.
8. Begin Processing Review of Exemption/Variance Requests – Begin the review of submitted exemptions and variances. Exemption and variance requests will be reviewed and approved by the District Engineers. The SWDA mandates a State response within 90 days of submittal (40 CFR 142.21).

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## **Section 7. State Exemption and Variance Processing**

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In order to request an exemption or a variance, the PWS must submit the request to the State **in writing**. For specific details of what must be included in the submittal, see Section 8 below.

### *7.1 Submittal Deadlines*

In order to develop the administrative and technical procedures necessary to evaluate the compliance strategies and requests for exemptions or variances, the State will not begin accepting formal requests for review of the aforementioned documents until September 1, 2004.

To ensure sufficient time to process a request for an exemption or variance, including the timeframe for a public hearing, exemption or variance requests must be submitted by July 1, 2005 to guarantee complete processing and determination of validity by the mandated deadline, January 23, 2006.

Exemption or variance requests submitted after the July 1, 2005 deadline may result in a PWS being cited for non-compliance if the request cannot be processed by the mandated deadline. For eligibility requirements for an exemption or variance, see Appendix B.

Upon receipt of a request from a water system for an exemption or a variance, the written request and any documentation will be routed to the appropriate District Engineer. For direct contact, please use the following information:

Drinking Water Bureau  
Attn: Exemption/Variance Review  
4131 Montgomery Blvd, NE, Suite #4125  
Albuquerque, NM 87109

## 7.2 *Timeframe for an Exemption or Variance Decision*

A State must decide whether to grant an exemption or variance within 90 days of receiving the request (40 CFR 142.21). The State will use the information it has about the system, as well as supplementary information provided by the system, to determine whether the system is eligible.

Based upon the intensive data requirements necessary for the State to make an accurate and fair determination on the exemption or variance request, the 90 day response timeframe will not begin until the PWS has made a “good faith” effort to provide all the documentation needed for the exemption or variance request.

The State will use a checklist that will be made available to requesting systems which outlines all required components of a complete exemption or variance submittal. However, evaluation of the submitted materials will still be necessary to determine if sufficient information is provide to effectively evaluate the request. Incomplete applications will not be evaluated until all required items have been provided. See Appendix I for the checklist and other applicable forms.

## 7.3 *Exemption or Variance Processing*

Upon receipt of an exemption or variance request and application, the following steps outline the procedure the State will use to process the request:

1. Identify if all necessary data and forms have been submitted.
2. Request additional data, if needed, from PWS.
3. Certify that exemption or variance application is complete and eligible for review.
4. Begin 90-day timeframe for review.
5. Evaluate the materials provided.
6. Schedule meeting(s) with System personnel to clarify submittal, as needed.
7. Obtain any needed additional information from System.
8. Determine if an exemption or variance can be granted.
9. Develop the exemption or variance package, including schedule and conditions, if any.
10. Obtain Department Secretary Approval.
11. Schedule and carry out the public hearing.
12. Address any comments or issues arising from public hearing.
13. Issue the variance or exemption.

## 7.4 *Developing an Exemption or Variance Package*

1. When a State grants an exemption to a PWS, it “must document all findings required under SDWA section 1416”, including:
  - a. Management and restructuring changes (40 CFR 142.20(b)(1)).

- b. Financial assistance needs when granting an extension (40 CFR 142.20(b)(2)).
  - c. The reasons for granting each exemption, including documenting the need for the exemption.
  - d. The reason that the exemption will not result in unreasonable risk to health (40 CFR 142.15(a)(3)).
  - e. The PWS has met all eligibility requirements (see Appendix B).
2. Compliance Schedule - When a State grants an exemption, it must at the same time set a compliance schedule for the system, including increments of progress, or milestones (40 CFR 142.20(b), 40 CFR 142.53, and SDWA §1416(b)(1)). The schedule should require compliance as “expeditiously as practicable” (SDWA §1416(b)(2)(A)). In addition, the State will prescribe a schedule for the system to implement control measures for arsenic during the period of the exemption (40 CFR 142.20(b), 40 CFR 142.53(c) and SDWA §1416(b)(1)).
  3. Additional Conditions - In addition to the compliance schedule, States may add conditions to the exemption to further reduce the health risk. For example, States may require systems to use bottled water, point-of-use devices, or point-of-entry devices as a condition of granting an exemption (40 CFR 142.57(a)). Under this condition, bottled water must meet the requirements in 40 CFR 142.62(g) and point-of-use or point-of-entry devices must meet the requirements in 40 CFR 142.62(h).

### 7.5 *Public Hearing*

Before the schedules for compliance and control measures of the exemption or variance take effect, the State must notify and give the public an opportunity to comment on the schedules (40 CFR 142.20(b), 40 CFR 142.54, and SDWA §1416(b)(1)). Public participation is a key component of the new flexibilities (i.e., exemptions) to SDWA, allowing impacted consumers to participate in making key decisions.

It is important to note that the public cannot comment on whether or not an exemption or variance should be granted. The public may only comment on the implementation schedule and any conditions that have been put in place as part of the approval.

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## **Section 8. Exemption and Variance Submittal Requirements**

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This section outlines the specific information that a PWS should submit along with their request for an exemption or variance. Please note that a large portion of the data requirements will require a significant amount of time for a PWS to obtain. Based upon this, the 90-day timeframe for action required from the State by the SDWA for exemptions and variances will not begin until the PWS has submitted sufficient documentation for a complete assessment of the exemption or variance.

The items below outline the general information to be submitted as part of an exemption or variance request. For complete details and explanations of these items, please refer to Appendix B.

### *8.1 General Exemption and Variance Submittal Requirements*

The following items are required for both exemption and variance requests.

1. Request for an Exemption or Variance – The PWS must submit a request, in writing, for an exemption or variance.
2. Documentation of Inability to Comply by Mandated Implementation Date – The PWS must outline their inability to comply with the new arsenic MCL by the implementation date (January 23, 2006). The PWS must **document** the “compelling factors” that are preventing it from achieving compliance within the mandated timeframe. Each factor should include an indication of why it is a compelling factor and how it is preventing compliance within the mandated timeframe. Some of the categories of factors are:
  - a. Financial Hardship
  - b. Existing or Proposed Project Timeframes (Funding, Design, & Construction)
  - c. Other (Water Rights Acquisition)
3. Proposed Strategy for Compliance – The PWS must provide a proposed strategy for compliance with the new arsenic MCL.
4. Proposed Timeframe for Compliance – The PWS must include, as part of its strategy, a timeframe for compliance. The timeframe should be within the limitations imposed by the various options of exemptions of variances.
5. Current Financial & Management Structure – The PWS must provide information regarding their current financial and management structure, including a summary of the operating fund base for the community and its mandated uses. The PWS must also provide information regarding:
  - a. Current Water Rates
  - b. Current Median Household Income
  - c. Certified Operator Documentation
6. Funding Considerations – The PWS must document all funding considerations, both from existing internal sources and future acquisition of funds, including their impact on the community. This should include an evaluation of the current water rate structure and the feasibility of rate increases to address the proposed solution.

7. Document Availability of Alternative Source of Water – The PWS must document that no alternate supply of water is available and document the reason(s) why for each of the following categories. For further details see Appendix E:
  - a. New Water Sources.
  - b. Modified or Re-structured Water Source.
  - c. Consolidation with Another System.
8. Documentation of Risk to Human Health – The PWS must document that the proposed exemption or variance and associated timeframe for compliance does not cause an “unreasonable risk to human health”. The timeframe for this documentation must include the entire timeframe until compliance with 10 ppb MCL is achieved. For further details, see Appendix E.

### 8.2 *Additional Exemption Submittal Requirements*

These additional requirements are only required for systems requesting an exemption.

1. Operating Status – The PWS must document that it was in operation prior to the effective date of the Arsenic Rule, January 23, 2006.
2. Feasibility of Internal Restructuring – The PWS must evaluate the feasibility of internal restructuring as a means to either achieve compliance with the new arsenic MCL by the mandated timeframe or as an aid to compliance through the exemption request. The restructuring can be in either the managerial, financial, or operational area, as appropriate, and could include accounting changes, ownership changes, etc.
3. Feasibility of External Restructuring – The PWS must evaluate the feasibility of external restructuring as a means to either achieve compliance with the new arsenic MCL by the mandated timeframe or as an aid to compliance through the exemption request. The primary focus of external restructuring would be to take advantage of the “shared resources” concept with other nearby water systems, i.e., contractual agreements for joint operation with one or more systems, etc.). This is additional information to supplement Item 7. of the General Application listed above.

### 8.3 *Additional Variance Submittal Requirements*

These additional requirements are only required for systems requesting a variance.

1. Documentation of Installation of Best Available Technology (BAT) – The PWS must document the existence or provide clear evidence regarding the installation of a BAT within the near future. The BAT must be installed prior to the compliance deadline for the new Arsenic Rule to avoid being out of compliance with the new standard.

2. Document Limitations or Restrictions for use of BAT – The PWS must document the limitations of the existing or proposed BAT, and:
  - a. For an existing BAT, provide justification why modifications to the treatment train cannot be made to achieve compliance;
  - b. For a proposed BAT, provide documentation that the proposed BAT is the most viable and feasible solution for the PWS, which includes comparison to the other BAT options available for arsenic. The documentation can include supporting information from any applicable area (technical, economical, and managerial).
3. Documentation of Effectiveness of BAT – The PWS must provide supporting documentation as to the limitations of the selected BAT in treating the source water available to the PWS. The documentation provided must include significant details, such as operational studies with supporting data, which clearly identify the limitations of the selected BAT.
4. Identify Best MCL Standard Achievable – The PWS must provide supporting documentation to show how the alternate MCL was determined and show that this level of treatment can be reliably and consistently maintained. The documentation provided should include supporting engineering assessments or pilot studies, and must clearly identify the lowest arsenic level that can be reliably achieved and maintained.
5. Documentation of Compliance Schedule – The PWS must identify a schedule for compliance as part of the variance. Due to additional State restrictions on variances, the schedule must include:
  - a. A schedule to comply with the PWS's proposed Alternate MCL.
  - b. An additional schedule to comply with 10 ppb MCL.

## Appendix A - Arsenic Background and Health Effects

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Arsenic is found in the environment in rocks, soil, water, air, and in biota. Natural concentrations of arsenic in soil typically range from 0.1 to 40 mg/kg. Higher concentrations are found in some igneous and sedimentary rocks, particularly in iron and manganese ores. Other natural sources of arsenic include volcanism and forest fires. Through erosion, dissolution, and weathering, arsenic can be released to ground water or surface water.

Arsenic is also released from a variety of human activities. Almost 8 million pounds of arsenic and arsenic containing compounds were released into the environment in 1997. Arsenic is found in the preservative chromated copper arsenate (CCA) used to preserve wood. 90% of all arsenic consumed in the U.S. is used in the production of CCA. Arsenic can be a by-product of mining and smelting, and is of particular concern in old waste disposal sites (e.g., mine tailings). In agriculture, organic arsenic is a constituent of organic herbicides and is a constituent of feed additives for poultry and swine. Other industries and processes which use or release arsenic:

- Manufacturing of metals and alloys;
- Petroleum refining;
- Pharmaceutical, glass, and cement manufacturing;
- Production of lead-acid batteries;
- Production of a particular semiconductor used in computers and other electronic applications;
- Burning of fuels and wastes; and,
- Pulp and paper production.

Arsenic can combine with other elements to form inorganic and organic arsenicals. In general, inorganic derivatives are regarded as more toxic than the organic forms. While food contains both inorganic and organic arsenicals, primarily inorganic forms are present in water. Inorganic arsenic, considered to be the more toxic form, is found in ground water, surface water, and many foods. Chronic exposure to high levels of inorganic arsenic in drinking water has been found to result in a variety of adverse health effects, including skin and internal cancers and cardiovascular and neurological effects. Exposures to organic forms of arsenic also occur through ingestion of food and metabolism of ingested inorganic arsenic. Experimental data on the effects of organic forms of arsenic are not as well characterized as those for inorganic arsenic, and thus are the subject for future research. Although people may be exposed to arsenic from industrial sources, as noted above, consumption of food and water is the major source of arsenic exposure for the majority of U.S. citizens.

Arsenic's carcinogenic role was noted over 100 years ago (NCI, 1999) and has been studied ever since. The Agency has classified arsenic as a Class A human carcinogen, "based on sufficient evidence from human data. An increased lung cancer mortality was observed in multiple human populations exposed primarily through inhalation. Also, increased mortality from multiple internal organ cancers (liver, kidney, lung, and bladder) and an increased incidence of skin cancer were observed in populations consuming drinking water high in inorganic arsenic." A 1999 NRC report on arsenic states that "epidemiological studies ... clearly show associations of arsenic with several internal cancers at exposure concentrations of several hundred



micrograms per liter of drinking water.” Ten epidemiological studies covering eight organ systems have quantitative data for risk assessment (NRC, 1999, Table 4-1). The organ systems where cancers in humans have been identified include skin, bladder, lung, kidney, nasal cavity, liver, and prostate. Table 10-6 of the same NRC report provides risk parameters for three cancers: bladder, lung, and liver cancer. Considering all cancers in aggregate, the NRC states that “considering the data on bladder and lung cancer in both sexes noted in the studies ... a similar approach for all cancers could easily result in a combined cancer risk on the order of 1 in 100” (at the current MCL of 50 µg/L).

In addition to cancer, NRC (1999) reported that arsenic exposures have been linked to other adverse health effects. These include thickening of the skin, effects on the nervous system such as tingling and loss of feeling in limbs, hearing impairment, effects on the heart and circulatory system, diabetes, developmental effects, and effects on the gastrointestinal system and liver. Many of these effects are observed at concentrations where cancer effects were observed in the epidemiology studies.

EPA estimated in the Economic Analysis (EPA 815-R-00-026) that reducing arsenic from 50 ppb (0.050 mg/L) to 10 ppb (0.010 mg/L) would prevent:

- More than 19-31 cases of, and 5-8 deaths from, bladder cancer each year;
- More than 19-25 cases of, and 16-22 deaths from, lung cancer each year; and,
- A number of cases of cancerous and noncancerous diseases, such as skin cancer and heart disease.

For further information on arsenic and the Arsenic Rule, see the EPA website:  
<http://www.epa.gov/safewater/arsenic.html>

## Appendix B - Exemptions and Variances

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### *Exemptions*

Exemptions are administrative tools that allow water systems additional time to acquire financial assistance and develop mechanisms necessary to ensure compliance with a drinking water standard. PWSs are required to meet the revised arsenic MCL of 10 ppb by January 23, 2006 (40 CFR 141.6(j)). To avoid noncompliance, exemptions must be issued prior to this date. If granted an exemption, a PWS would have up to 3 additional years to comply (January 23, 2009). Eligible systems serving fewer than 3,300 persons may be granted up to 3 exemption extensions of 2 years each (SDWA §1416(b)(2) and 40 CFR 142.20(b)(2)), allowing up to 9 total years (14 years since the rule was published) to obtain financial assistance and implement a compliance strategy (January 23, 2015). A system is eligible for an exemption from the arsenic MCL if, at a minimum, it meets all four of the following criteria (40 CFR 142.20(b) and SDWA §1416(a)):

1. “Due to **compelling factors**,” (40 CFR 142.50) the PWS is unable to achieve compliance by January 23, 2006 through any means, including treatment or developing an alternative source of water supply;
2. The PWS “**was in operation**” by **January 23, 2006** or, if not in operation by January 23, 2006, the system has “no reasonable alternative source of drinking water” available to it;
3. The exemption “**will not result in an unreasonable risk to health**.”; and
4. The system **cannot reasonably make management and/or restructuring changes** that would result in compliance or improve the quality of the drinking water if compliance cannot be achieved.

#### *Example:*

System X collected samples in April 2002. The results at the three sampling points were:

Sampling point 1: 0.006 mg/L (6 µg/L)  
Sampling point 2: 0.027 mg/L (27 µg/L)  
Sampling point 3: 0.015 mg/L (15 µg/L)

The system has not had to treat for arsenic under the 50 µg/L MCL. However, with two sampling points above the revised MCL of 10 ppb (0.010 mg/L), System X plans to install treatment in order to comply with the Rule. The system has started researching various technologies and plans to pilot test three different technologies. Due to a relatively small customer base, System X will need time to obtain financing, pilot test, and install new treatment. The system applies to the State for an exemption. The State decides that System X will not be able to implement the most appropriate technology without additional time. In addition, the financial burden of all of the activities associated with choosing and installing treatment would be better allocated over a longer period of time. The State grants System X an exemption and works with the system to develop a compliance schedule to obtain financing and install treatment.

To receive an exemption from the State, an eligible PWS must, at a minimum, be “taking all practicable steps to meet” the MCL (40 CFR 142.20(b), 40 CFR 142.50(b), and SDWA §1416(b)(2)(B)). In addition, no exemption shall be granted by a State unless the PWS establishes that:

1. In order to meet the MCL, the system needs capital improvements that cannot be completed prior to January 23, 2006;
2. In the case of a system that needs financial assistance for the necessary improvements, the system has entered into an agreement to receive the necessary financial assistance or has demonstrated that such financial assistance, either from a federal or State program, is “reasonably likely to be available within the period of the exemption”; or,
3. The system has entered into an enforceable agreement to become part of a regional water system (SDWA §1416(b)(2)(B)).

For example, a PWS that needs capital improvements and requires financial assistance could provide written documentation showing its position on the Drinking Water State Revolving Fund (DWSRF) priority list. Alternatively, the PWS could document its loan agreement with another lender, or provide a written and enforceable agreement to become a part of a regional PWS.

When reviewing a system’s need for capital improvements that cannot be completed prior to January 23, 2006, the State will determine whether it is feasible for the system to design an appropriate treatment train, obtain sufficient funding, and install the treatment technology by January 23, 2006. In addition, the State will consider whether the DWSRF or other forms of federal or State assistance are “reasonably likely to be available within the period of the exemption” to implement the appropriate measures (40 CFR 142.20(b)(1)(i)).

Systems should consider installing a Best Available Technology (BAT), and small systems should consider installing a small system compliance technology (SSCT) listed in the Final Arsenic Rule (40 CFR 141.62(c) & (d)). Systems should consider the possibility of upgrading the system’s existing treatment capabilities and the installation of additional treatment technology.

In addition, the State will consider whether the system can develop a new source or gain access to an alternative water source by January 23, 2006 (40 CFR 142.20(b) and 40 CFR 142.50(a)). The feasibility of establishing a partnership to use a neighboring system’s source must be considered along with the development of a new source (40 CFR 142.20(b)(1)(ii)). The State will evaluate any consolidation option in accordance with the guidelines provided in Appendix F.

#### *Determining Reasonable Risk to Human Health*

See Appendix E for information on determining the reasonable risk to human health.

### *Compelling Factors*

As a minimum condition for receiving an exemption, a system must be unable to achieve compliance by January 23, 2006 due to compelling factors (40 CFR 142.20(b), 40 CFR 142.50(a)(1), and SDWA section 1416(a)(1)).

According to the SDWA, compelling factors may include economic factors, including qualification of the PWS as a system serving a disadvantaged community pursuant to SDWA section 1452(d). SDWA section 1452(d) defines a disadvantaged community as “the service area of a PWS that meets affordability criteria established after public review and comment by the State in which the public water system is located.”

Per the State of New Mexico Capacity Development Program, the State has provided a definition of a “disadvantaged community”, which is based upon the community’s median household income and affordability ratio. See Appendix F for further details.

Other factors the State will consider in determining whether a system needs additional time to achieve compliance are the following:

1. The number and types of activities that should reasonably be undertaken, consistent with the size of the system and the financial consequences to its ratepayers, in order to choose and implement an appropriate technology. These activities may include pilot-testing or field-testing arsenic-removal technologies, selecting an engineering consultant, coordinating with State and local agencies, preparing plans and specifications, obtaining financing, obtaining bids for construction, obtaining permits, constructing the facilities, and testing the completed facilities.
2. The time appropriately allocated for each of the activities identified in (1), and the total time allocated for all activities.
3. The cost of performing the activities identified in (1), and any savings that might be obtained from additional time.
4. The benefits that may be obtained from additional time, including any improvements in cost-effectiveness that may be obtained from non-BAT technologies or from ascertaining which technology may be most appropriate for the raw water supplies available to the system.

Other compelling factors affecting a system’s ability to comply may be identified by the State on a case-by-case basis.

### *Management Or Restructuring Changes*

The regulation (40 CFR 142.20(b)(1)) defines the measures a State must consider before determining that management or restructuring changes cannot reasonably be made by a system to achieve compliance or, if compliance cannot be achieved, improve the quality of its drinking water. The State will use information from existing files, site visits, and telephone conversations with system managers to make these determinations. In making the determination, the State will

consider what a system could reasonably accomplish through all of the following (40 CFR 142.20(b)(1)(i)):

1. Rate increases;
2. Accounting changes;
3. Appointment of a State-certified operator (under the State's Operator Certification program);
4. Joint operation with one or more PWSs (through a contractual agreement);
5. Activities consistent with the State's Capacity Development Strategy (to help the PWS acquire and maintain technical, financial, and managerial capacity);
6. Ownership changes; or
7. Consolidation (physical or otherwise) with another PWS.

### *Compliance Schedule*

When a State grants an exemption, it must at the same time set a compliance schedule for the system, including increments of progress, or milestones (40 CFR 142.20(b), 40 CFR 142.53, and SDWA §1416(b)(1)). The schedule should require compliance as "expeditiously as practicable" (SDWA §1416(b)(2)(A)). In addition, the State will prescribe a schedule for the system to implement control measures for arsenic during the period of the exemption (40 CFR 142.20(b), 40 CFR 142.53(c) and SDWA §1416(b)(1)).

### *Additional Conditions*

In addition to the compliance schedule, States may add conditions to the exemption to further reduce the health risk. For example, States may require systems to use bottled water, point-of-use devices, or point-of-entry devices as a condition of granting an exemption (40 CFR 142.57(a)). Under this condition, bottled water must meet the requirements in 40 CFR 142.62(g) and point-of-use or point-of-entry devices must meet the requirements in 40 CFR 142.62(h).

### *Exemption Extensions*

PWSs that receive exemptions and serve no more than 3,300 persons may be able to extend their exemptions by up to 6 years. These extensions can be considered and granted when the State grants the original 3-year exemption. These extensions provide States the flexibility to develop compliance schedules longer than 3 years. A system is eligible to extend its exemption only if, at a minimum, it:

1. Proves that it is taking all practicable steps to meet the established schedule to achieve full compliance with the arsenic MCL.
2. Needs financial assistance for the necessary improvements and has entered into an agreement for, or is reasonably likely to obtain (from a federal or State program), financial assistance to make necessary capital improvements, or has entered into an enforceable agreement to become a part of a regional public water system (40 CFR 142.20(b) and SDWA §1416(b)(2)(C)).

States may grant up to three additional 2-year extensions during which systems are exempt from the MCL. The extensions should be based on how much time the system reasonably needs to come into compliance. A primacy State must document its findings when extending an exemption (40 CFR 142.20(b)(2)).

### *Variances*

General variances are administrative tools that allow systems to provide drinking water that exceeds the MCL, on the condition that the quality of the drinking water is still protective of public health. PWSs are required to meet the revised arsenic MCL of 10 ppb by January 23, 2006 (40 CFR 141.6(j)). To avoid noncompliance, variances must be issued prior to this date. If granted a variance, a PWS would have additional time to comply with an alternate MCL, and then an additional secondary timeframe to come into compliance with the revised arsenic MCL of 10 ppb.<sup>2</sup> If a system cannot meet the arsenic MCL because of the characteristics of its raw water sources, it may be eligible for a variance under SDWA §1415(a) and 40 CFR 142.20(a), provided that:

1. The system install a BAT (SDWA §1415(a)(1)(A) and 40 CFR 142.62(c));
2. A State evaluation indicates that alternative sources of water are not reasonably available (SDWA §1415(a)(1)(A)); and,
3. The quality of the water delivered under the variance will not result in an unreasonable risk to health (SDWA §1415(a)(1)(A)).

#### *Example:*

System A collected samples in April 2002. The results at the three sampling points were:

Sampling point 1: 0.035 mg/L (35 µg/L)

Sampling point 2: 0.027 mg/L (27 µg/L)

Sampling point 3: 0.015 mg/L (15 µg/L)

The system has not had to treat for arsenic under the 50 µg/L MCL. However, with sampling points above the revised MCL of 10 ppb (0.010 mg/L), System A plans to install treatment in order to comply with the Rule. The system installs an ion exchange plant, an EPA approved BAT, to treat the arsenic. However, results show that under normal operating conditions, the treatment plant can only provide water at an arsenic level of 19 ppb. The system then researches various technology modifications and pilot tests different combinations of treatment operations. The system then develops documentation showing that the best treatment option will provide water at a level of 13 ppb. The system then develops a strategy to ensure that there is no “unreasonable risk to health”, which may include epidemiological studies, alternate water supplies, and other documentation. The State approves the combined strategy and grants System A a variance and works with the system to develop a compliance schedule to obtain financing and install other treatment to eventually comply with the 10 ppb standard.

<sup>2</sup> The State has chosen to implement additional restrictions on any variance request. In addition to a requirement for the system to develop a compliance schedule with the State (SDWA §1415(a)(1)(A) and 40 CFR 142.62(b)&(c)) for the alternate proposed MCL, the State is also requiring an additional schedule outlining the timeframe for compliance with the new arsenic standard.

To receive a variance from the State, an eligible PWS must, at a minimum, be “taking all practicable steps to meet” the MCL (40 CFR 142.20(b), 40 CFR 142.50(b), and SDWA §1415(a)(1)). In addition, no variance shall be granted by a State unless the PWS establishes that:

1. The public is given an opportunity for a public hearing on the new schedule to comply with the revised MCL (SDWA §1415(a)(1)(C));
2. The system installs, operates, and maintains a BAT specified in the Final Arsenic Rule; and
3. The system enters into a compliance schedule with the State (SDWA §1415(a)(1)(A) and 40 CFR 142.62(b)&(c)) for compliance with the alternate proposed MCL.
4. The system enters into a compliance schedule with the State for compliance with the revised arsenic MCL of 10 ppb.

Additionally, the State has the option of requiring additional control measures (SDWA §1415(a)(1)(A)(ii)), during the period ending on the date compliance with the alternate proposed MCL or the revised arsenic MCL of 10 ppb.

#### *Determining the Alternate MCL*

The basis of a variance request is that even after installing a BAT, a PWS is still unable to meet the MCL due to characteristics of its raw water sources that prevent any installed treatment options from fully treating the raw water to the primary standard. Given the wide variety of treatment options, this should be a relatively rare occurrence. When determining applicability for a variance, several criteria are used in determining what the alternate MCL will be:

1. Water quality characteristics of the raw water.
2. Economic factors as they apply to the installation of the optimal treatment train.
3. Documentation of the effectiveness of the existing or chosen BAT.
4. Documentation of the effectiveness of other viable BATs.
5. Water quantity evaluations if the treatment technology will generate a waste stream flow that is significant compared to the influent “untreated” flow.

The alternate MCL proposed must represent the optimal treatment that can be achieved by the PWS on a reliable and consistent basis and must be supported by sufficient documentation (SDWA §1415(a)(1)(A) and 40 CFR 142.20(a)). The PWS must:

1. Employ a certified operator of sufficient level as required by the State of New Mexico Operator Certification Program (20.7.4 NMAC).
2. Document that the operator has or will receive training in the operation of the chosen BAT.
3. Document the treatment levels achieved during operation of the BAT sufficient to determine that:
  - a. The BAT can provide treatment to the proposed alternate MCL during normal operating conditions.



- b. The BAT can provide treatment to the proposed alternate MCL during peak operating conditions
4. Document that the PWS has the ability to maintain the BAT in operating condition, as required by the manufacturer.

### *Compliance Schedule*

When a State grants an variance, it must at the same time set a compliance schedule for the system, including increments of progress, or milestones (40 CFR 142.20(b), 40 CFR 142.53, and SDWA §1415(a)(1)(A)(ii)). The schedule should require compliance as “expeditiously as practicable” (SDWA §1415(a)(1)(D)). In addition, the State will prescribe a schedule for the system to implement control measures for arsenic during the period of the variance (40 CFR 142.20(b), 40 CFR 142.53(c) and SDWA §1415(a)(1)).

Additionally, although the timeframe for compliance with the alternate proposed MCL is variable, per 40 CFR 141.20(a), additional justification is required if the proposed compliance schedule exceeds five years.

### *Additional Conditions*

In addition to the compliance schedule, States may add conditions to the variance to further reduce the health risk. For example, States may require systems to use bottled water, point-of-use devices, or point-of-entry devices as a condition of granting an exemption (40 CFR 142.57(a)). Under this condition, bottled water must meet the requirements in 40 CFR 142.62(g) and point-of-use or point-of-entry devices must meet the requirements in 40 CFR 142.62(h).

## Appendix C - EPA Best Available Technology

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As part of the new Arsenic Rule, EPA listed seven best available technologies (BATs) in the Final Arsenic Rule (66 FR 6976). EPA determined these technologies to be the BATs for the removal of arsenic in drinking water based on a demonstration of efficacy under field conditions, taking cost into consideration (40 CFR 141.62(c) and SDWA §1412(b)(4)(D)). EPA reviewed several technologies to determine the BATs for the removal of arsenic. EPA has identified seven BATs, including:

1. Activated Alumina;
2. Coagulation/Filtration (not a BAT for systems with fewer than 500 service connections);
3. Ion Exchange;
4. Lime Softening (not a BAT for systems with fewer than 500 service connections);
5. Reverse Osmosis;
6. Electrodialysis; and,
7. Oxidation/Filtration.

The BATs' removal efficiencies and a brief discussion of the major issues surrounding the usage of each technology can be found in the preamble to the Final Arsenic Rule (66 FR 6976 at 6981). Additional details can be found in the EPA's Technologies and Costs for the Removal of Arsenic From Drinking Water, December 2000.

Systems are not required to use BATs to achieve compliance with the MCL. Any technology that is accepted by the State primacy agency and achieves compliance with the MCL is allowed. However, if a system is unable to meet the MCL with its chosen technology, the system is not eligible for an exemption or variance unless it agrees to install a BAT. For more information on variances and exemptions see Appendix B.

The technologies examined for BAT determinations were also evaluated as small system compliance technologies (SSCTs). EPA must list SSCTs for three sizes of small systems: systems serving between 25 and 500 people, systems serving between 501 and 3,300 people, and systems serving between 3,301 and 10,000 people (SDWA §1412(b)(4)(E)(ii)). Because EPA has listed SSCTs, small systems:

1. Have the latitude to choose the type of treatment technology that is most cost effective and appropriate (from an operation and maintenance standpoint).
2. Are not eligible for a small system variance since EPA has determined that SSCTs exist for all three size categories.
3. May be eligible for a general variance under SDWA §1415(a) after they have installed or agreed to install the BAT but, due to source water quality, will not be in compliance with the MCL.

Small System Compliance Technologies and their associated size categories:

1. Activated Alumina (centralized)	All size categories
2. Activated Alumina (point-of-use)	All size categories
3. Coagulation/Filtration	501-3,300; 3,301-10,000
4. Coagulation-assisted Microfiltration	501-3,300; 3,301-10,000
5. Electrodialysis Reversal	501-3,300; 3,301-10,000
6. Enhanced Coagulation/Filtration	All size categories
7. Enhanced Lime Softening (pH>10.5)	All size categories
8. Ion Exchange	All size categories
9. Lime Softening	501-3,300; 3,301-10,000
10. Oxidation/Filtration	All size categories
11. Reverse Osmosis (centralized)	501-3,300; 3,301-10,000
12. Reverse Osmosis (point-of-use)	All size categories

### *Point of Entry (POE) and Point of Use (POU) Devices*

POU and POE treatment devices rely on many of the same treatment technologies that have been used in central treatment plants. However, while central treatment plants treat all water distributed to consumers, POU devices treat water at a single tap typically intended for direct consumption, and POE treatment devices treat all water used within a single home.

To ensure that POU and POE devices are as protective of public health as central treatment, the SDWA requires that (SDWA §1412(b)(4)(E)(ii)):

1. POU and POE units be owned, controlled, and maintained by the PWS or by a contractor hired by the PWS to ensure proper operation and maintenance of the devices and compliance with the MCL. Therefore, the burden to ensure compliance remains with the system and is not transferred to the customer.
2. POU and POE units have mechanical warnings to automatically notify customers of operational problems.

The primary advantage of using a POU or POE treatment strategy is that implementation may be less expensive than constructing, upgrading, or expanding a central treatment plant. The cost savings achieved through POU or POE treatment may enable some systems to provide more protection to their consumers than they might otherwise be able to afford.

The implementation of a POU or POE treatment strategy will require a system to address several issues:

1. As with any treatment technology, not all treatment devices are compatible with all sources of water. Pilot testing on the local source water is necessary prior to the implementation of a POU or POE strategy.
2. Public education is crucial to the success of a POU or POE strategy. The system must be able to obtain regular access to POU or POE units to perform necessary maintenance and

monitoring. Some systems have successfully passed local ordinances requiring access to be granted as a condition of water delivery.

3. Implementing a POU or POE treatment strategy will require a rigorous preventative maintenance program. Devices may also require frequent sampling. Systems should ensure, prior to implementation, that they have available staff to perform the necessary maintenance, monitoring, and record keeping, or they can make arrangements to contract out their maintenance and monitoring duties.

## Appendix D - Source Blending Requirements

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### *Blending Criteria*

Systems must sample at each entry point to the distribution system (EPTDS). Systems that use more than one source that are combined before distribution (e.g., an intermittent source of supply or a supply affected by seasonal demand) must sample at each EPTDS during periods of normal operating conditions (i.e., when the water is representative of the water that usually enters the system) (40 CFR 141.23(a)(3)). However, systems may sample at a more representative sampling point to satisfy the monitoring requirements if the State has determined that conditions make another sampling point more representative of each source (40 CFR 142.11(a)(1) and 141.23(a)(1)).

In order for a public water system to qualify for a blending plan, the system will have to provide a significant amount of documentation both initially and as part of a regular monitoring program to show that it can reliably achieve blending. As a general matter, a water system may exceed 10 ppb at one or more sampling points and still be in compliance with the revised arsenic MCL, as long as:

1. The State has approved a monitoring program that is more is more representative of the true arsenic concentration to which individuals are being exposed over the year, compared with the standard monitoring requirements, and
2. the monitoring program shows that the running annual average of water served to every consumer is less than the MCL, and
3. the system can satisfactorily document to the State how its alternative monitoring approach keeps annual arsenic exposure below the MCL.

### *Configuration of the Distribution System and Sources.*

The PWS will need to identify the specific distribution zones within the distribution system and which sources or EPTDSs will feed each zone. This will include documentation on how all users will receive blending water, including identifying if any users are being served prior to the blending points and are receiving “unblended” water.

Additionally, if a PWS is dividing the distribution system into separate zones, the PWS will need to provide documentation on how each zone is defined and separated to control the level of arsenic within each zone. At a minimum, the PWS should provide:

1. A schematic map of the entire distribution system.
2. The location of all sources and EPTDSs, including associated tanks or other appurtenances.
3. The proposed blending zone(s) and associated sources.
4. Identification of any areas outside of blending plan.
5. Specific information about each source, including current arsenic levels, maximum pump rates, and ability to meet demand of each zone with the associated sources.

6. Line configurations, valving, pressure characteristics, and other information needed to identify how each zone within the distribution system will be maintained as a separate entity.

### *Sampling Plan*

Monitoring frequency to determine compliance is set by the State. Systems may not monitor more frequently than specified by the State for compliance determinations. However, systems may apply to the State to conduct more frequent monitoring under Alternative Monitoring Programs (40 CFR 141.23(h)).

The PWS will need to propose a sampling plan to accurately identify the arsenic levels within the system and within each zone of blending. The State will require quarterly sampling at a minimum for any PWS proposing to blend. The PWS may wish to increase the sampling frequency beyond quarterly, however, the State will only pay for sampling frequencies up to quarterly sampling through the Water Conservation Fee.

### *Monitoring Plan*

The PWS will need to provide a plan that includes monitoring each source or EPTDS on a continuous basis for:

1. The quantity of water produced.
2. The timeframe for production.

This information will be combined the arsenic levels to determine compliance with the new arsenic standard.

### *Other Distribution System Sampling*

The State will not allow distribution system sampling to be used for compliance sampling as part of a blending plan due to the high variability in flow characteristics within a distribution system.

### *Determining Compliance*

The State will use a running annual average based on quarterly or more frequent sampling for each blending zone within the distribution zone. Failure of the PWS to maintain the average arsenic level below the 10 ppb MCL will result in a violation (40 CFR 141.23(i)).

### *Sample Results Calculation*

In order to clearly demonstrate that EPA intended 10 ppb (0.010 mg/L) as the arsenic MCL, EPA included a special rule requirement in the Final Rule, "Arsenic sampling results will be reported to the nearest 0.001 mg/L" (40 CFR 141.23(i)(4)). For the purposes of compliance determinations, analytical results for arsenic will be reported to the nearest 0.001 mg/L (40 CFR 141.23(i)(4)). For purposes of rounding, the last digit should be increased by one unit if the digit

dropped is 5 or greater. If the digit dropped is 4 or less, do not alter the preceding number. For example, analytical results for arsenic of 0.0105 mg/L would round off to 0.011 mg/L, while a result of 0.0104 mg/L would round off to 0.010 mg/L.

## Appendix E - Determination of Equivalent Risk to Human Health

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An exemption or variance from the revised arsenic MCL requires, among other things, that the exemption or variance will not result in an unreasonable risk to health. An exemption to an MCL allows a PWS to continue to provide water at some level above the MCL for a specified period of time, after which the system must come into compliance. A variance from an MCL allows a PWS comply with an alternate MCL for a variable period of time, after which the system must come into compliance.

In this guidance, the State of New Mexico is following the approach identified by EPA in the Implementation Guidance for the Arsenic Rule to determine what does **not** constitute an unreasonable risk to health with respect to arsenic. This approach bases the length of an exemption on the level of arsenic in the water. The State of New Mexico is modifying this approach based upon the availability of three years of verifiable compliance data for the 2001-2003 timeframe.

The previous arsenic MCL was 50 ppb. Systems must begin complying with the revised MCL of 10 ppb by January 23, 2006, five years from the date the Arsenic Rule was published (January 22, 2001). Through the time frame allowed in SDWA, Congress made the tacit determination that these exposures will pose an acceptable, and therefore not “unreasonable” risk of adverse health effects to the affected population. Thus, in principle, a system could be providing water with an arsenic level of 50 ppb until January 23, 2006 and be in full compliance with the SDWA and EPA regulations. The system would remain in compliance if it reduced its arsenic level to 10 ppb or less by January 23, 2006.

Exemptions could extend the compliance date by up to 3 years or up to 9 years, depending on system size and number of extensions granted. The longest period a system could have to achieve compliance would be 14 years (the 5-year base of January 22, 2001-January 23, 2006, plus a 3-year exemption and three 2-year extensions).

As a matter of policy, exposure at 50 ppb for the 5 years from January 22, 2001 to January 23, 2006 should **not** pose an unreasonable risk to health. This represents 40 ppb above the revised MCL of 10 ppb ( $50 \text{ ppb} - 10 \text{ ppb} = 40 \text{ ppb}$ ). The total exposure above the revised MCL for those 5 years is  $40 \text{ ppb} \times 5 \text{ years} = 200 \text{ ppb} \times \text{years}$ . This  $200 \text{ ppb} \times \text{years}$  may be thought of as the “excess compliance-period exposure.” That is, it represents the exposure above what would have occurred if water systems had instantaneously complied with the revised MCL on January 22, 2001. It represents “excess exposure” that, as a matter of law and policy, should not pose an unreasonable risk to health.

EPA’s policy is to assume a linear relationship between adverse health effects of a chemical and exposure unless there are sufficient data to decide otherwise. In its review of the Arsenic Rule extending into fall 2001, the scientific community again endorsed EPA’s decision to use a linear approach for estimating arsenic risks. Exemptions and any subsequent extensions cannot be granted for more than 9 years and for concentrations higher than 50 ppb. Thus, for an exemption, the determination of what concentration level and duration does not pose an unreasonable risk to health can be conservatively determined by limiting “excess compliance-period exposure” to



#200ppb×years for the total compliance period including the full duration of an exemption. The following calculations clarify the application of this concept:

$$(5 \text{ years}) \times (40 \text{ ppb}) = 200 \text{ ppb} \times \text{years}.$$

$$(8 \text{ years}) \times (C8) = 200 \text{ ppb} \times \text{years}; (C8) = (200 \text{ ppb} \times \text{years}) / (8 \text{ years}) = 25 \text{ ppb}$$

Thus, for an initial 3-year exemption (which provides a total compliance period of 8 years), a concentration of 25 ppb above the MCL of 10 ppb (a total concentration of 35 ppb) would not generally pose an unreasonable risk to health.

$$(10 \text{ years}) \times (C10) = 200 \text{ ppb} \times \text{years}; (C10) = (200 \text{ ppb} \times \text{years}) / (10 \text{ years}) = 20 \text{ ppb}$$

Thus, for a 2-year extension to the initial 3-year exemption (which provides a total compliance period of 10 years), a concentration of 20 ppb above the MCL of 10 ppb (a total concentration of 30 ppb) would not generally pose an unreasonable risk to health.

$$(12 \text{ years}) \times (C12) = 200 \text{ ppb} \times \text{years}; (C12) = (200 \text{ ppb} \times \text{years}) / (12 \text{ years}) = 17 \text{ ppb}$$

Thus, for two 2-year extensions to the initial 3-year exemption (which provides a total compliance period of 12 years), a concentration of 17 ppb above the MCL of 10 ppb (or a total concentration of 27 ppb) would not generally pose an unreasonable risk to health.

$$(14 \text{ years}) \times (C14) = 200 \text{ ppb} \times \text{years}; (C14) = (200 \text{ ppb} \times \text{years}) / (14 \text{ years}) = 14 \text{ ppb}$$

Thus, for three 2-year extensions to the initial 3-year exemption (which provides a total compliance period of 14 years), a concentration of 14 ppb above the MCL of 10 ppb (or a total concentration of 24 ppb) would not generally pose an unreasonable risk to health.

Based on these calculations, the values in Table 1 offer a conservative and appropriate framework for determining the duration of an exemption that should not generally pose an unreasonable risk to health for systems with various historical average arsenic concentrations. As a result, the State of New Mexico will consider exemptions for the indicated average arsenic concentrations over the indicated time periods. Under this approach, the total length of the exemption for which a system is eligible is determined by the historical arsenic concentrations in the system's source water at the time of application for an exemption. Note that these values must be the values used for compliance, unless otherwise approved by the State.

**Table 1.**

Systems Serving	Total Compliance Time	Exemption Periods Available	Exemption Eligibility for Average Arsenic Concentrations				
			> 35 ppb	31-35 ppb	26-30 ppb	21-25 ppb	<20 ppb
> 3,300	8 years	3 years	No	Yes	Yes	Yes	Yes
≤3,300	8 years	3 years	No	Yes	Yes	Yes	Yes
	10 years	5 years	No	No	Yes	Yes	Yes
	12 years	7 years	No	No	No	Yes	Yes
	14 years	9 years	No	No	No	No	Yes

## **Appendix F - Determination of Availability of Alternate Source Criteria**

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As mentioned above, in evaluating the request for an exemption or variance, the State must consider whether the system can develop a new source or gain access to an alternative water source by January 23, 2006 (40 CFR 142.20(b) and 40 CFR 142.50(a)). The feasibility of establishing a partnership to use a neighboring system's source must be considered along with the development of a new source (40 CFR 142.20(b)(1)(ii)).

With regards to the latter, the State is aligning the strategy on arsenic compliance with the goals and concepts of the EPA-approved Capacity Development Program, as required by 40 CFR 35.3515.b.(1).i and 40 CFR 35.3515.b.(1).ii. Based upon this, the State will not grant an exemption or variance if the following conditions can be met:

1. The system requesting the exemption or variance serves a population of less than 3300.
2. An alternate PWS or alternate public source of water is located within one mile.
3. The alternate source of water has sufficient capacity to serve both its existing consumers and the consumers of the requesting system.
4. The alternate source of water is of satisfactory quality and meets the new arsenic standard as well as all other MCLs.
5. An evaluation of the configuration and characteristics of the infrastructures of both the requesting system and the alternate source of water shows that integration is a feasible and viable option.
6. The project can be completed within the timeframe mandated for compliance with the new Arsenic Rule.

For more information on the State of New Mexico Capacity Development Program, please visit our website at: <http://www.nmenv.state.nm.us/dwb/dwbtop.html>, and review the materials found under the heading "Capacity Development"

## Appendix G - Determination of Financial Hardship and “Compelling Factors” Criteria

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### *Disadvantaged Status*

The State has chosen to use the existing definition of a “disadvantaged community” listed as part of the EPA-approved Capacity Development Program for determination of financial hardship for the new arsenic standard.

The NMED/New Mexico Finance Authority (NMFA) Capacity Development Strategy determines “disadvantaged community” status according to the community’s affordability ratio:

$$\text{Affordability Ratio} = \frac{\text{Average Annual Residential Cost of Water}}{\text{Median Household Income for Community}}$$

Communities whose median household income (MHI) is less than 90% of the State MHI and whose affordability ration is greater than 0.01 will be eligible to use financial hardship as a compelling factor for qualification for an exemption.

For more information on the State of New Mexico Capacity Development Program, please visit our website at: <http://www.nmenv.state.nm.us/dwb/dwbtop.html>, and review the materials found under the heading “Capacity Development”

### *Cut-off Date for Systems to be Eligible.*

Although the acquisition of funding can also be used as a “compelling factor” for systems attempting to comply with the new arsenic standard, the State must also acknowledge that a lack of planning or action on the part of a PWS does not necessarily constitute a “compelling factor”.

Therefore, it is the determination of the State that for systems wishing to use the timeframe for compliance as an underlying factor in their inability to achieve compliance, the system must document actions taken to identify and acquire the necessary funding prior to November of 2004.

**If the PWS fails to document any actions taken to obtain funding prior to November of 2004, the PWS will not be eligible for an exemption or variance under this category.**

## Appendix H - Waste Disposal<sup>3</sup>

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Waste disposal can be a critical element of any treatment plan developed and must be taken into consideration. All arsenic treatment technologies, other than zero-treatment options such as alternate source use and blending, create residuals with concentrated arsenic and other contaminants. Regardless of the raw water source and quality and the processes used, WTPs can produce four types of residuals:

1. Liquids, including brines, concentrates, backwash water, rinse water, and filter to waste water.
2. Solids, including spent media, spent membranes, and dewatered sludge.
3. Sludges, which are semi-solid and usually must be dewatered prior to disposal.
4. Gases.

While all treatment processes will produce one or more types of residuals, the amount of residuals produced is a function of raw water quality, facility design and operating flow, and treatment process employed. These types of arsenic mitigation processes produce the following residuals:

1. Chemical precipitation processes, such as enhanced lime softening - process water, filter backwash water, and sludge;
2. Sorption processes with disposable media, such as granular ferric hydroxide - backwash water, regeneration liquid, neutralization fluid, rinse water, sludge, and spent media;
3. Sorption processes with reusable media, such as ion exchange - backwash water, regeneration liquid, neutralization fluid, rinse water, sludge, and spent media;
4. Membrane processes, such as reverse osmosis - spent membranes, reject brines, and backwash water;
5. Iron/manganese removal and greensand filtration - filter backwash fluid, sludge, and spent media.

Because removal technologies frequently remove other contaminants in addition to arsenic, the residual may also have concentrated levels of co-occurring contaminants, such as lead, barium, or radionuclides. The removal of co-occurring contaminants may pose disposal problems even when the arsenic levels in process residuals are not high enough to lead to a hazardous waste classification or interfere with local limits set by publicly owned treatment works (POTWs). Water systems should thoroughly test their wastes prior to making disposal decisions.

### *Waste Residual Disposal Options*

Below is a brief list of options for disposal of either liquid or solid wastes. For the purposes of this section, sludge residuals are assumed to be processed into both a liquid and solids phase.

Liquid residual disposal options include:

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<sup>3</sup> Based on EPA training modules available at: <http://www.epa.gov/ogwdw/ars/implement.html>

1. Direct discharge to a receiving body.
2. Discharge to a POTW.
3. Underground injection.
4. Land application.
5. Recycle to facility headworks.

Solid residual disposal options include:

1. Non-hazardous waste landfill.
2. Hazardous waste landfill.
3. Land application.

Intermediate processing for wastes generated may include:

Flow equalization - Large spikes in flow quantity or contaminant concentration may interfere with POTW treatment. Therefore, detaining and mixing water system wastes may be necessary prior to release to a POTW.

Brine recycling - Water systems may be able to reuse brine rinse, reducing the total amount of brine that must be disposed. Systems should use caution, however, because the reused brine streams may contain higher levels of suspended solids and contaminants, which may limit disposal options.

pH neutralization - Waste streams with excessively high or low pH may need to adjust the pH before release to a POTW or to receiving bodies.

Settling or gravity thickening - Settling basins or mechanical presses may be used to remove suspended solids and contaminants from liquid waste streams, resulting in a sludge and a cleaner liquid waste.

Evaporation - In hot or dry climates, evaporation can enhance settling basins by removing water and leaving solids and contaminants.

Chemical precipitation - Coagulants can be added to remove contaminants from liquid waste streams and precipitate them as sludges.

### *Waste Management Strategy*

From a residuals management perspective, systems should attempt to manage their sources by changing the source or blending two or more sources together.

**If the system has no existing treatment, and using alternate sources and blending allows the system to avoid installing treatment, then the system will not generate any residuals.**

If the system treats its water, then using alternate sources and blending will reduce the level of arsenic in the system's residuals. Systems may combine alternate sources and blending with treatment if the system has treatment in place for other contaminants, or if the level of arsenic in the alternate or blended sources is still not reliably below the MCL without treatment.

When a water system is choosing an arsenic mitigation strategy, it should consider both arsenic removal efficiency and residuals disposal. The system should seek both to produce water with arsenic levels below the MCL and to minimize its waste streams, especially its production of hazardous waste. There are a number of options a system can consider:

Systems that choose to optimize an existing treatment process will already be familiar with the residuals they produce and have disposal options in place. However, modification of the treatment process to meet the revised arsenic MCL may result in changes to the residuals, which will require the system to change how the residuals are managed and disposed. Systems should analyze the residuals to determine whether they will now be classified as hazardous waste. Systems that install new treatment for arsenic will need to complete engineering feasibility studies. Pilot testing provides an excellent opportunity to test residuals and determine the optimum configurations and operating conditions for meeting drinking water standards while maintaining non-hazardous residuals management options.

#### *Waste Disposal – Other Regulatory Impacts*

If the water system chooses a treatment process which generates a waste stream, it is important for the system to evaluate the impact of other existing State and Federal regulations which may limit or complicate the disposal options available to the system. The regulations that may impact waste disposal are:

The Resource Conservation and Recovery Act (RCRA) - RCRA establishes a framework for national programs to achieve environmentally sound management of both hazardous and non-hazardous wastes. RCRA gives EPA the authority to control hazardous waste from the cradle to grave. This includes the generation, transportation, treatment, storage, and disposal of hazardous waste. For more information on the impact of RCRA in the State of New Mexico, please contact the Hazardous Waste Bureau (HWB) and/or the Solid Waste Bureau (SWB).

Hazardous Waste Bureau  
2905 Rodeo Park Drive East, Building 1  
Santa Fe, New Mexico 87505-6303  
Phone: (505) 428-2500  
Fax: (505) 428-2567  
<http://www.nmenv.state.nm.us/hwb/>

Solid Waste Bureau  
PO Box 26110 - 1190 St. Francis Drive  
Santa Fe, New Mexico 87502-0110  
Phone: (505) 827-2775  
[http://www.nmenv.state.nm.us/swb/swb  
main.htm](http://www.nmenv.state.nm.us/swb/swb_main.htm)

Clean Water Act (CWA) - The CWA regulates domestic sewage and discharges from point sources. Under 40 CFR 261.4(a), these types of wastes are specifically excluded from being solid waste and are therefore not regulated under RCRA. As authorized by the CWA, the NPDES permit program controls water pollution by regulating point sources that discharge pollutants into waters of the US (40 CFR Parts 122-133). Individual homes that are connected to a municipal system, use a septic system, or do not have a surface discharge do not need an NPDES permit; however, industrial, municipal, and other facilities must obtain permits if their discharges go directly to surface waters. For more information on the impact of the CWA and the NPDES permitting process in the State of New Mexico, please contact the Surface Water Quality Bureau (SWQB).

Surface Water Quality Bureau  
Harold Runnels Building Room N2107  
1190 St. Francis Drive - P.O. Box 26110  
Santa Fe, NM 87502  
Phone: (505) 827-0187  
FAX: (505) 827-2836  
<http://www.nmenv.state.nm.us/swqb/index.html>

Safe Drinking Water Act Underground Injection Control (SDWA UIC) – The SDWA established the UIC program to provide safeguards so that injection wells do not endanger current and future underground sources of drinking water. Underground injection means the subsurface emplacement of fluids through a well (40 CFR 144.3). A well is defined as:

1. a bored, drilled, or driven shaft whose depth is greater than the largest surface dimension;
2. a dug hole whose depth is greater than the largest surface dimension;
3. an improved sinkhole; or,
4. a subsurface fluid distribution system.

All injection wells require authorization under general rules or specific permits. The UIC program sets minimum requirements for injection wells, which affect siting, construction, operation, maintenance, monitoring, testing, and, finally, the closure of a well. All underground injections are illegal unless authorized by permit or rule, and no injection shall be authorized if it results in the movement of fluid containing any contaminant into underground sources of drinking water, if the presence of that contaminant may cause a violation of any primary drinking water regulation or adversely affect public health.

The goals of the EPA's UIC Program are to prevent contamination by keeping injected fluids within the well and the intended injection zone, or, in the case of injection of fluids directly or indirectly into an underground source of drinking water, to require that injected fluids not cause a public water system (PWS) to violate drinking water standards or otherwise adversely affect

public health. For more information on the impact of the UIC program in the State of New Mexico, please contact the Ground Water Quality Bureau (GWQB).

Groundwater Quality Bureau  
Harold Runnels Building Room N2250  
1190 St. Francis Drive - P.O. Box 26110  
Santa Fe, NM 87502  
Phone: (505) 827-2918  
FAX: (505) 827-2965  
<http://www.nmenv.state.nm.us/gwb/gwqbhome.html>

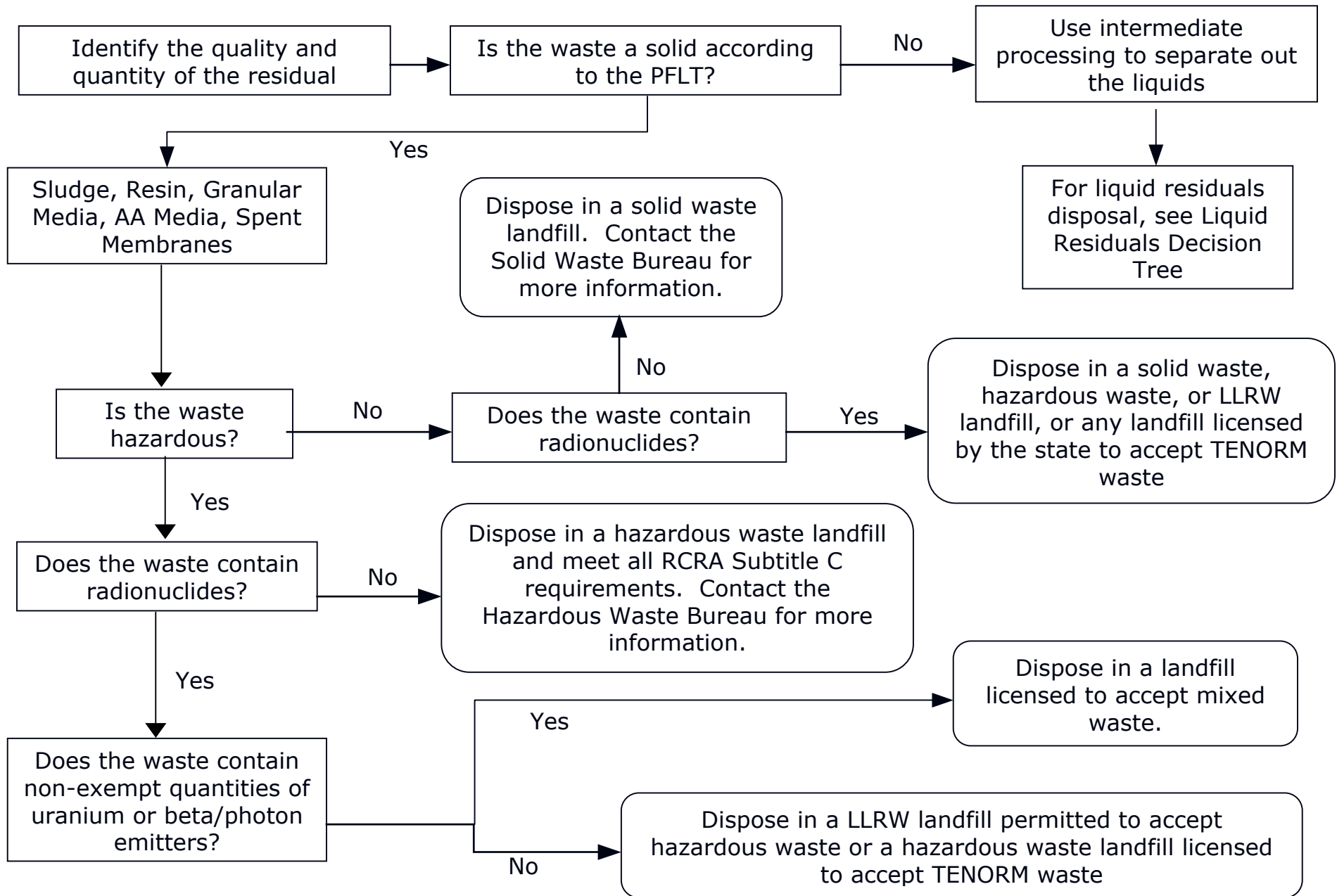
Land Application or non-NPDES Surface Discharge (WQCC) – The Ground Water Pollution Prevention Section (GWPPS) of the Groundwater Quality Bureau reviews and approves of ground water discharge plan applications and issues pollution prevention permits for discharges that have the potential to impact ground water quality pursuant to Subparts III and V of the Water Quality Control Commission (WQCC) regulations (20.6.2 NMAC). Ground water discharge permits address a wide variety of discharges including domestic wastewater treatment plants, commercial septic tank leachfields, power generating plants, commercial laundries not served by sanitary sewers, dairies, food processing plants, commercial landfarms for treatment of contaminated soil, industrial discharges, injection wells and ground water remediation systems. The program also addresses unauthorized discharges such as spills and abatement of ground water contamination related to permitted facilities. The discharge permitting process includes public notification, a public comment period and a public hearing in situations where there is substantial public interest. Permits are issued for 5-year terms and must be renewed to provide continuous coverage. For more information on the impact of the WQCC and the groundwater discharge permitting process in the State of New Mexico, please contact the Ground Water Quality Bureau (GWQB).

Groundwater Quality Bureau  
Harold Runnels Building Room N2250  
1190 St. Francis Drive - P.O. Box 26110  
Santa Fe, NM 87502  
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<http://www.nmenv.state.nm.us/gwb/gwqbhome.html>

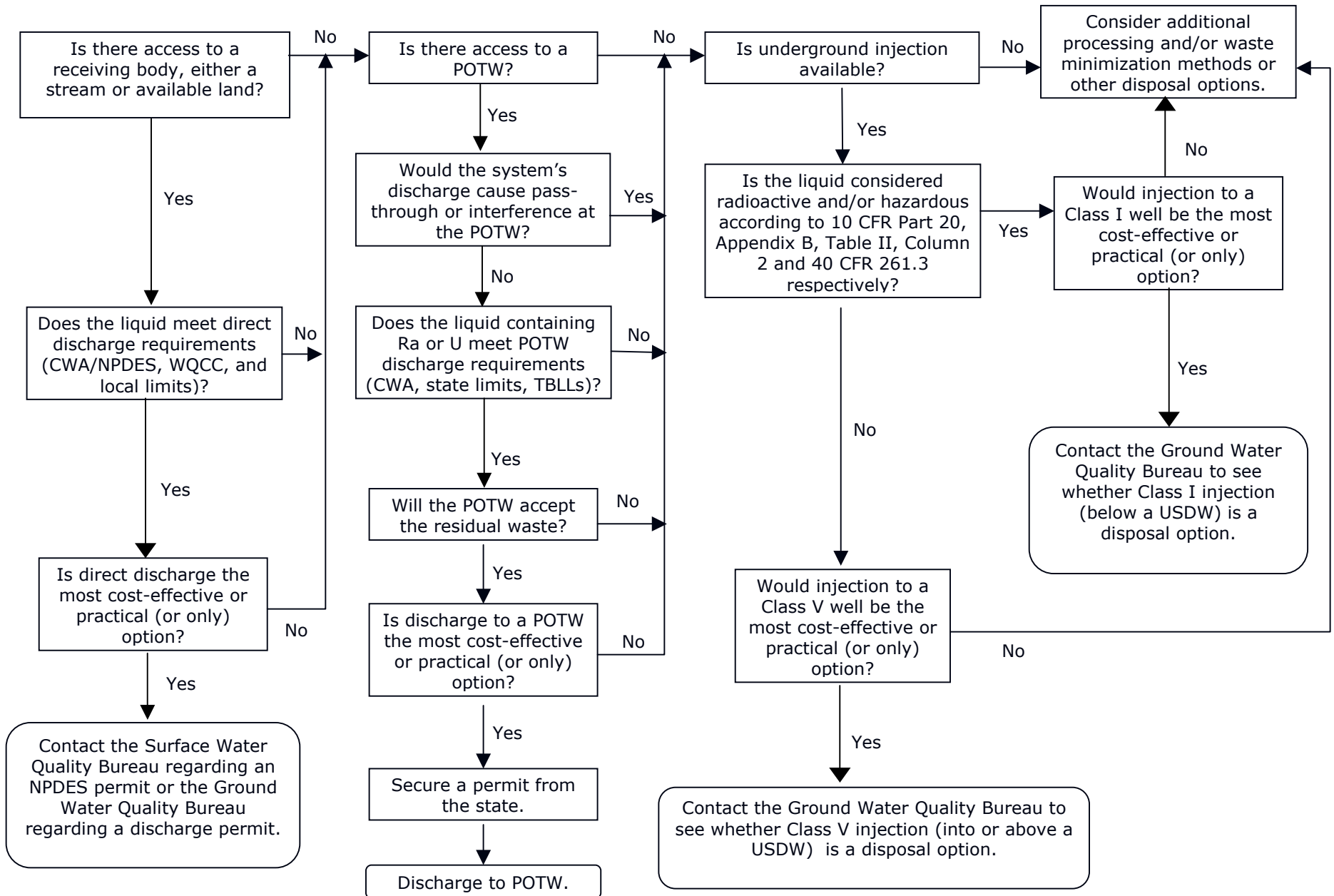
The following two pages contain reproductions of residual disposal flowcharts to help systems identify the proper location for the disposal of any wastes.



### Solids Residual Disposal



**Liquid Residuals Disposal**



## **Appendix I - Variance and Exemption Submittal Forms**

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**(To Be Added)**